CONFERENCE MANUAL

THE 8TH

NIT-NUU
BILATERAL ACADEMIC CONFERENCE

JULY 19-20,2025

ORGANIZED BY
NATIONAL INSTITUTE OF TECHNOLOGY, KOCHI COLLEGE
NATIONAL UNITED UNIVERSITY

SPONSORED BY
NISHIO RENT ALL CO., LTD.
HITACHI HIGH-TECH CORPORATION

レンタルって、未来だ。

ご存じですか？

実は、建設機械はレンタルが増えています。

近年もその市場は成長し、建設業界を支えています。

必要な時に必要なだけ利用できるレンタルは
地球環境にやさしいサステナブルなサービス。

西尾レントオールは最先端の ICT を駆使した建築 DX を
はじめ、イベント・展示会分野でもレンタル資材を
取り扱う総合レンタル業界のパイオニア。

■ 建設ＩＣＴ

道路･土木工事や建築･設備工事現場に必要な多種多様な建機をレンタルしています。
ICT 施工技術やメンテナンスのノウハウを持った人材も多数活躍しています。

■ ＧＸ

環境負荷の低減と建設現場の生産性向上を目指し、ショベルカーをはじめとした様々な種類の電動建機のレンタルだけではなく、NISHIO グループの総合力をいかした電動建機の開発もおこなっています。

■ 木造モジュール・大阪咲洲Ｒ＆Ｄ国際交流センター

展示・交流・研究開発の拠点である「大阪咲洲 R&D 国際交流センター」や、
国産材活用と持続性を追求した転用可能な木造モジュール「Morena（モリーナ）」
により、SDGs にも積極的に取り組んでいます。

■ グローバルキャンプ

次世代を担う技術者のグローバル化を目指した国際交流を NISHIO で実施。
高専生と世界の学生を繋ぐ場として、KOSEN Global Camp を全面協力しました。

西尾レントオールは国内外で約 400 拠点を構える NISHIO グループの一員です。NISHIO グループ
の持株会社「ニシオホールディングス株式会社」は東証プライム市場に上場しています。

総合レンタル業のパイオニア
西尾レントオール株式会社

HITACHI

変化の激しい時代。
この星のいたるところで、身近な暮らしの中で、
私たちはさまざまな課題に直面している。
その課題を解決するためには
課題の本質を正しく知ることが重要だ。
知ることは、世界や未来を変えるスタートライン。

日立ハイテクは「知る力」で、
社会やお客さまが直面する課題の本質を、
広く、深く、正しく把握する。
そして真に必要な解決策を提供し続ける。

持続可能な地球環境、
健康で安全安心な暮らし、
科学と産業の持続的発展の実現をめざして。

知る力で、
世界を、未来を変えていく
日立ハイテク

ナノテクノロジー ソリューション

半導体デバイスの製造、検査・計測のソリューションを提供することで未来を、ともに創り、ともに変えていく

エッチング装置、計測装置・検査装置、半導体製造・計測・検査ソリューション

ヘルスケア ソリューション

「医療従事者とともに患者さんに笑顔を」「がんを恐れることのない社会の実現」をめざし、ヘルスケア・イノベーション創生に挑戦し続ける

生化学・免疫分析装置、検体検査自動化システム、キャピラリー電気泳動シーケンサー、粒子線治療システム、X線治療システム、臨床検査システム

コアテクノロジー ソリューション

技術をコアにした「知る」力で、社会課題を解決していく

電子顕微鏡(SEM・TEM・FIB)、光度計・蛍光X線分析装置、熱分析装置、液体クロマトグラフ

産業・社会インフラ ソリューション

社会潮流・顧客課題を起点とし、産業分野における次の柱事業を創生・スケーリングをめざす

通信インフラ、電池ライフサイクル、検査・測定装置、デジタル、半導体関連、モビリティ、環境・エネルギー

株式会社 日立ハイテク
東京都港区虎ノ門一丁目17番1号 虎ノ門ヒルズ ビジネスタワー

【日立ハイテクWebサイトはこちら】

Contents

Welcome Speech
By Dr. Tadaomi Eguchi

Distinguished Guests, Ladies and Gentlemen,

It is both a great honor and a sincere pleasure to welcome you to the 8th NIT-NUU Bilateral Academic Conference 2025 (NNBAC 2025), held here in Kochi, Japan. On behalf of the National Institute of Technology, Kochi College, and in close partnership with our esteemed co-organizer, the National United University of Taiwan, I extend my heartfelt gratitude to all participants for joining us at this prestigious gathering.

This conference serves as a valuable international platform for faculty members, researchers, and students from NIT, NUU, and our partner institutions to share their research outcomes, exchange ideas, and foster collaboration. We are delighted to welcome such a distinguished group of scholars and students from overseas and beyond. Your presence underscores the importance of international academic cooperation and our shared dedication to advancing knowledge, innovation, and mutual understanding.

This year's conference theme reflects our collective vision to address both emerging challenges and promising opportunities in our respective fields. With over 100 oral and poster presentations scheduled across the two-day program, we anticipate stimulating discussions, insightful presentations, and fruitful exchanges that will inspire future academic endeavors and long-lasting partnerships.

I would like to express my deepest appreciation to all speakers and participants who have traveled from near and far to be with us. Special thanks are due to our organizing committee, sponsors, and staff, whose dedication and tireless efforts have made this conference possible.

We are also profoundly grateful to our special sponsors—Hitachi High-Tech Corporation and Nishio Rent All Co., Ltd.—for their generous support in promoting industry-academia collaboration, which lies at the heart of this event.

I encourage you all to take full advantage of this opportunity not only to learn and share but also to connect with one another. It is through such dialogues and collaborations that we build bridges and grow together as a global academic community.

Once again, welcome to NNBAC 2025. I wish you a productive, enriching, and enjoyable conference.
Thank you.

江口忠臣

Tadaomi Eguchi
President
National Institute of Technology, Kochi College, Japan

Welcome Speech
By Nakashima Hideharu, Ph.D

It is with great pleasure that we announce the 8th NIT-NUU Bilateral Academic Conference 2025, to be held as a collaborative event between National Institute of Technology (NIT) and National United University (NUU).

The first conference was held in 2017 with the aim of promoting research and academic exchanges between the two institutions. Since then, it has been held alternately in Japan and Taiwan each year. After a period of online conferences due to the impact of COVID-19, in-person meetings resumed in 2023. This year, we are delighted to welcome all NUU members to National Institute of Technology (KOSEN), Kochi College — the host institution, surrounded by abundant nature and rich history.

As society continues to globalize and social environments and industrial structures transform, we at "KOSEN" are required to cultivate highly skilled engineers capable of solving various challenges of new era through technology. To achieve this, advanced and globalized research activities are essential, and research exchanges with excellent universities are indispensable. For over a decade, KOSEN and National United University have maintained a friendly partnership, and this conference is one of the great results of such a relationship.

We recognize that this conference provides a valuable opportunity for research exchange for both faculty members and students of the two institutions. I had the honor of participating in the 7th conference held last year at National United University in Miaoli, Taiwan, for the first time. Witnessing the active exchange of ideas among many faculty members and students, I came to deeply understand the significance and importance of this conference. Taking this opportunity, I sincerely hope for the further development of a strong partnership between our two institutions, in addition to continued exchange among faculty and students.

We would like to express my deepest respect for the significant efforts of all those involved in organizing such a wonderful conference and sincerely wish that this event will be meaningful for all participants.

We look forward to meeting you in Kochi in July 2025!

Nakashima Hideharu, Ph.D.
Senior Executive Director
National Institute of Technology (KOSEN), JAPAN

KOSEN
国立高等専門学校機構

Conference Information

- **Origin of the Conference**

  On April 25, 2012, National United University (NUU), together with four other Taiwanese institutions—National Taipei University of Technology, National Kaohsiung First University of Science and Technology, Cheng Shiu University, and Chung Chou University of Science and Technology—entered into an Academic Exchange Agreement with the National Institute of Technology (NIT), Japan, representing a consortium of 51 Colleges.

  Since then, NUU has actively fostered academic interaction with several NIT (KOSEN) colleges, including Kisarazu College, Ube College, Tsuyama College, Anan College, Niihama College, Kochi College, Kagawa College, Tokuyama College, Matsue College, Hakodate College, and Kagoshima College. These collaborations have encompassed student exchange programs, internship opportunities, and visiting scholar initiatives.

  Through these programs, students from both NUU and KOSEN have had the opportunity to broaden their perspectives and deepen their understanding of diverse cultures. Moving forward, the partnership aims to enhance and expand research collaboration among faculty members and students. In pursuit of this goal, the co-organization of a biennial international conference serves as a vital platform for sharing research findings and cultivating long-term academic partnerships.

- **Purpose of the Conference**

  The purposes of the conference are: (1) to offer a platform for faculties and students to exchange research ideas and experiences; (2) to increase the opportunities for faculties and students to publish research results and discussion; (3) to expand faculties' and students' professional field of vision; (4) to create and develop research collaborations among faculties; and (5) to strengthen the relationship between NUU and NIT.

- **Theme of the Conference- Sustainable Development**

  The themes of the conference include:

  (1) Linguistics, Language Education, and Culture
  (2) Management
  (3) Mechanical and Energy Engineering
  (4) Chemistry and Biochemistry, Materials Science
  (5) Computer Science and Information Engineering
  (6) Electronic and Electrical Engineering
  (7) Architecture, Civil and Environmental Engineering
  (8) Industrial Design

- **Duration of Presentation Time**

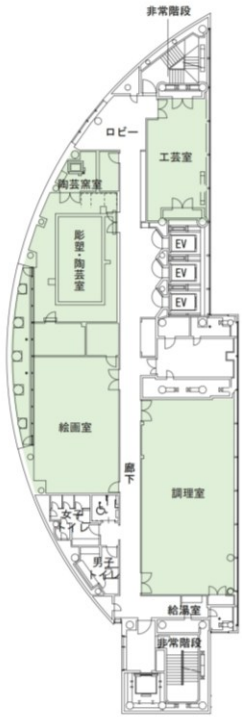
  (1) Keynote Speech: 40 minutes (including 10 minutes for Q&A)
  (2) Oral Presentations: 15 minutes (including 3 minutes for Q&A)
  (3) Poster Presentations: 15:30–16:30 on July 19

Venue

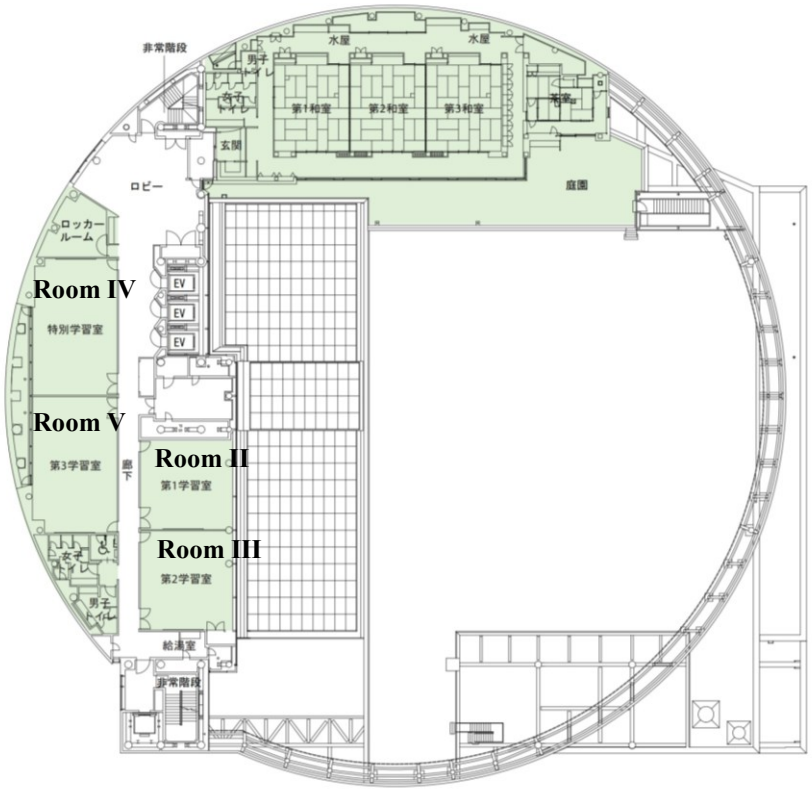
Kochi City Culture Plaza Cul-Port https://www.bunkaplaza.or.jp/

Floor Map

11th Floor



10th Floor



9th Floor

Committees

1. Conference Chairman

Tadaomi Eguchi	President of National Institute of Technology, Kochi College, Japan
Ti-Kuang Hou	President of National United University, Taiwan

2. Organizing Committee

Tadaomi Eguchi	President of National Institute of Technology, Kochi College, Japan
Ti-Kuang Hou	President of National United University, Taiwan
Hideharu Nakashima	Senior Executive Director of National Institute of Technology, Kosen, Japan
David Grant	Director of International Exchange Office, NIT, Kochi College, Japan
Gain Dennis	Vice-Director of International Exchange Office, NIT, Kochi College, Japan
Shoji Okada	Vice-Director of International Exchange Office, NIT,
Tzu-Hsuan Chiang	Director of Research and Development, National United University, Taiwan
Fu-Chieh Hsu	Chief of Division of International Affairs, National United University, Taiwan

3. Peer Review Committee

Chien-Yuan HAN	Department of Electro Optical Engineering, National United University, Taiwan
Gui-Ling, Zhuang	Department of Architecture, National United University, Taiwan
Fan-Bean, Wu	Department of Materials Science and Engineering, National United University, Taiwan
Tung-Fei Tsai-Lin	Department of Business Management, National United University, Taiwan
Tzu-Chieh, Chou	Department of Electrical Engineering, National United University, Taiwan
Yin-Hung, Lai	Department of Chemical Engineering, National United University, Taiwan
Takuo Fujita	Department of Social Design Engineering, NIT, Kochi College, Japan
Masahiro Yasukawa	Department of Social Design Engineering, NIT, Kochi College, Japan
Masato Ohsumi	Department of Social Design Engineering, NIT, Kochi College, Japan
Ryoichi Yanagawa	Department of Civil Engineering, NIT, Kagawa College, Japan
Satoko Hamamoto	Department of Social Design Engineering, NIT, Kochi College, Japan
Shogo Tendo	Department of Social Design Engineering, NIT, Kochi College, Japan
Shoji Okada	Department of Social Design Engineering, NIT, Kochi College, Japan

The 8th NIT-NUU Bilateral Academic Conference

Saturday, July 19th, 2025

National Institute of Technology, Kochi College

Time	Activities			
12:30-13:00	Registration			
13:00-13:30	Welcome and Opening Ceremony **(Large Lecture Hall on the 11th Floor)** Prof. Tadaomi EGUCHI - President of NIT-Kochi, Japan Prof. Hideharu NAKASHIMA - Director of NIT, Kosen, Japan Prof. Ti-Kuang Hou - President of NUU, Taiwan Moderator: Prof. David Grant (NIT-Kochi)			
	Group Photo			
13:30-13:40	Break			
	Room I (Music room I on the 11th Floor)	Room II (Study room I on the 9th Floor)	Room III (Study room II on the 9th Floor)	Room IV (Special study room on the 9th Floor)
	Session 1 06_Management	Session 2 04_Electronic and Electrical Engineering	Session 3 05_Architecture, Civil and Environmental Engineering	Session 4 02_Chemistry and Biochemistry, Materials Science
13:40-15:10	Moderator: Prof. Fu-Chieh Hsu (NUU) Prof. Takuo Fujita (NIT-Kochi)	Moderator: Prof. Tzu-Chieh Chou (NUU) Prof. Yosuke Takubo (NIT-Niihama)	Moderator: Prof. Jung-Jen Tsai (NUU) Prof. Ryoichi Yanagawa (NIT-Kagawa)	Moderator: Prof. Fan-Bean WU (NUU) Prof. Masato Ohsumi (NIT-Kochi)
13:40-13:55	**S01-01** Yu-Yun Yu, Yu-Hsuan Lu, Hsiang-Heng Chen, Jia-Lin Chuang (NUU)	**S02-01** Wan-Ting Huang (NUU)	**S03-01** Naoki Hayashi (NIT-Kagawa)	**S04-01** Masahiro Yasukawa (NIT-Kochi)
13:55-14:10	**S01-02** Tung-Fei Tsai-Lin (NUU)	**S02-02** Yamato Ono (KIT-Kagawa)	**S03-02** Haruki Takahashi (NIT-Kochi)	**S04-02** Renta Goto (NIT-Niihama)
14:10-14:25	**S01-03** LIU,YU CHIN (NUU)	**S02-03** Kazuki ANDO (KIT-Niihama)	**S03-03** Yu-Hsiang Huang (NUU)	**S04-03** Koki Ikeda (NIT-Ube)
14:25-14:40	**S01-04** Lusi Susanti (Andalas University)	**S02-04** Chien-Yuan Han (NUU)	**S03-04** Gouki Tsuda (NIT-Kochi)	**S04-04** Yin-Hung Lai (NUU)
14:40-14:55	**S01-05** Pin-Tsen Lin, Hsin-Yen Li (NUU)	**S02-05** Zhen-Yun Chen (NUU)	**S03-05** Ryutaro Abe (NIT-Kagawa)	**S04-05** Sakdinan Wongsricha (NIT-Anan)
14:55-15:10	**S01-06** Iwan Sukarno (Pertamina University)	**S02-06** Kokone Michikura (NIT-Kochi)	**S03-06** Gui-Ling Zhuang (NUU)	
15:10-15:20	Break			
15:30-16:30	Poster Session & Nishio Rent All Exhibition **(Large Lecture Hall on the 11th Floor)**			
16:30-16:40	Break			

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National Institute of Technology, Kochi College

15:30-16:30	Poster Presentation Title	Presenter (Affiliation)
P-01	Residual Stress Measurement of Copper Thin Film on Polymer Substrate by Sputtering Method	Hiroto Fujita (NIT-Niihama)
P-02	Residual Stress Change in Aluminum Alloy Material by FSW with Mechanical Loading	Rui Murakami, Tatsuya Matsue (NIT-Niihama)
P-03	Palladium-Catalyzed Nucleophilic Substitution of Benzyl Carbonates	Koushin Kubota, Masato Ohsumi (NIT-Kochi)
P-04	Effect of Substituent Position in Salicylideneaniline-Metal Complexes on Antimicrobial Property	Arisa Niinobe (NIT-Niihama)
P-05	Investigation of UV Absorption Properties and Biodegradability of Cyclic Diketone Compound without Aromatic Ring Structures	Kokoro Ishikawa (NIT-Niihama)
P-06	Exploration of Functional Constituents of “Sansha” (Bombyx Faces) Extract: Effect of Ultraviolet Light on Antimicrobial Properties	Mai Narimatsu (NIT-Niihama)
P-07	Photochlomic and fluorescent properties of thienylvinylthizazole derivative having methyl group	Shuwa Kondo (NIT-Niihama)
P-08	Effects of Spin-Orbit Interaction on MnAs-Monolayer in GaAs(110)	Souta Ishida (NIT-Anan)
P-09	Interdiffusion and impurity coefficients of Zr and Hf of Be-ta solid solution in Ti	Oshita Akiko (NIT-Niihama)
P-10	Proposal for Utilization of Volatile Data in Factory Large-scale Machines.	Takayuki Yamada (NIT-Kochi)
P-11	Trial of Automatic Driving by Road Sign Recognition using JetRacer.	Takayuki Yamada (NIT-Kochi)
P-12	Proposal for Children's Handwritten Character Recognition using CNN.	Takayuki Yamada (NIT-Kochi)
P-13	A basic research of aqua getter made by precast concrete based on analysis of experimental data of laboratory tests	Osawa Ayaka (NIT-Kagawa)
P-14	Effects of Large-Scale Flooding on Ayu Spawning Grounds in the Shimanto River	Koki Shimada (NIT-Kochi)
P-15	Development and Field Application of a Smartphone-Based River Turbidity Measurement Method	Hiro Ogasawara (NIT-Kochi)
P-16	Aiming to improve efficiency at construction sites with the power of ICT	Haruto Inoue, Haruto Kawatake, Juto Takemura (NIT-Kochi)
P-17	An Investigation into the Service Quality and Customer Satisfaction of Taiwan High-Speed Rail	Liu, Yu Chin (NUU)
P-18	Connecting, Expanding: Ube KOSEN’s Global Power	Sanano Okawa, Mai Yasuda (NIT-Ube)
P-19	Religious Practice and Identity : A Discussion Based on Women's Participation in Miaoli County	Chen, Bo-Hao (NUU)
P-20	The Promotive Effects of Gamification Marketing on Cultural Identity and Travel Intention	Wen-Yu Sung (NUU)
P-21	A Study on Agritourism Experience Economy, Tourist Motivation, and Satisfaction: A Case of Young Farmers’ Businesses	Chien-Pei Lin (NUU)

The 8th NIT-NUU Bilateral Academic Conference

Saturday, July 19th, 2025

National Institute of Technology, Kochi College

Time	Activities			
	Room I (Music room I on the 11th Floor)	Room II (Study room I on the 9th Floor)	Room III (Study room II on the 9th Floor)	Room IV (Special study room on the 9th Floor)
	Session 5 03_Computer Science and Information Engineering	Session 6 04_Mechanical and Energy Engineering	Session 7 08_Linguistics, Language Education, and Culture	Session 8 02_Chemistry and Biochemistry, Materials Science
16:40-18:30	Moderator: Prof. Gen Chiaki (NIT-Kochi)	Moderator: Prof. Katsuhiro Suzuki (NIT-Niihama)	Moderator: Prof. Chun-Ying Wang (NUU) Prof. Manabu Hatamura (NIT-Ube)	Moderator: Prof. Yin-Hung Lai (NUU) Prof. Shogo Tendo (NIT-Kochi)
16:40-16:55	**S05-01** Jura Taniguchi (NIT-Kagawa)	**S06-01** Yuta Nanba (NIT-Tsuyama)	**S07-01** CHEN,BO-HAO (NUU)	**S08-01** Tz-Feng Lin (NUU)
16:55-17:10	**S05-02** kota sano (NIT-Kagawa)	**S06-02** Tzu-Chieh Chou (NUU)	**S07-02** Daisuke Nakano (NIT-Ohshima)	**S08-02** Tomoya Konishi (NIT-Anan)
17:10-17:25	**S05-03** Yuhi Shuno (NIT- Niihama)	**S06-03** Yudai Miyake (NIT-Niihama)	**S07-03** Shu-Fang Kao (NUU)	**S08-03** Shuya Yamamoto (NIT-Ube)
17:25-17:40	**S05-04** Takayuki Yamada (NIT-Kochi)	**S06-04** Hoang-Viet Nguyen (NUU)	**S07-04** Fuyuko Eguchi (NIT-Kochi)	**S08-04** Hibiki Kusakabe (NIT-Niihama)
17:40-17:55	**S05-05** Takayuki Yamada (NIT-Kochi)	**S06-05** Haruto Miyazaki (NIT-Niihama)	**S07-05** Yuzhen Jiang (NUU)	**S08-05** Shogo Tendo (NIT-Kochi)
17:55-18:10	**S05-06** Teruyuki Nagano (NIT- Matsue)	**S06-06** Cao Luong Tran (NUU)	**S07-06** Julien SAINTE (NIT-Kagawa)	
18:10-18:25	**S05-07** Miyamoto Sota (NIT- Matsue)	**S06-07** CHAN BING LIN (NUU)	**S07-07** Shan-Wei, Hu (NUU)	
18:25-19:00	Transportation: Move to The Crown Palais New Hankyu Kochi individually.			
19:00-21:00	Reception Moderator: Prof. David Grant (NIT-Kochi)			

The Crown Palais New Hankyu Kochi (ザ クラウンパレス 新阪急高知)
https://www.hankyu-hotel.com/hotel/hh/kouchishh/access

Access:
The location is approximately 1.3 km west of the conference venue along the tram line, near Kochi Castle and the Kochi Prefectural Office. If you are using the tram, it is convenient to board at 菜園場町"Saenba-cho" (the nearest stop to the venue) and get off at 高知城前"Kochi-jyo Mae" stop.

The 8th NIT-NUU Bilateral Academic Conference

Sunday, July 20th, 2025

National Institute of Technology, Kochi College

Time					
8:30-9:10	Keynote Speech Speech Title: Case Studies of Academic Collaboration between Nishio Rent All Co., Ltd., KOSEN, and Overseas Universities Speaker: Ryo Iwahara, Kosuke Uwai (Nishio Rent All Co., Ltd.) Moderator: Prof. Gain Dennis (NIT-Kochi)				
9:10-9:20	Break				
9:20-11:30	Room I (Music room I on the 11th Floor)	Room II (Study room I on the 9th Floor)	Room III (Study room II on the 9th Floor)	Room IV (Special study room on the 9th Floor)	Room V (Study room III on the 9th Floor)
	Session 9 06_Management	Session 10 04_Electronic and Electrical Engineering	Session 11 05_Architecture, Civil and Environmental Engineering 07_Industrial Design	Session 12 04_Mechanical and Energy Engineering	Session 13 08_Linguistics, Language Education, and Culture
	Moderator: Prof. Tung-Fei Tsai-Lin (NUU) Prof. Shulin Chen (NIT-Ube)	Moderator: Prof. Chien-Yuan Han (NUU) Prof. Hiroo Tarao (NIT-Kagawa)	Moderator: Prof. Gui-Ling Zhuang (NUU) Prof. Akemi EMOTO (NIT-Tokuyama)	Moderator: Prof. Tzu-Hsuan Chiang (NUU)	Moderator: Prof. Yoshihiro Noda (NIT-Niihama)
9:20-9:35	S09-01 Takuo FUJITA (NIT-Kochi)	S10-01 Yanakorn Srianant (NIT-Kagawa)	S11-01 YA-FEN, HUANG (NUU)	S12-01 Cheng-Hsiang Hsu (NUU)	S13-01 LI, CHONG-FU (NUU)
9:35-9:50	S09-02 Bo-Xin Song (NUU)	S10-02 Yan-Ting Hsieh (NUU)	S11-02 Shuya Okamoto (NIT-Kochi)	S12-02 Tzu-Shu Huang (NUU)	S13-02 Tseng, Sheng-Fu (NUU)
9:50-10:05	S09-03 Yi-Ting Lee (NUU)	S10-03 Akinari Onishi (NIT-Kagawa)	S11-03 Jung-Jen Tsai, Ping-Yin Wang (NUU)	S12-03 Takemura Kazuki (NIT-Kochi)	S13-03 Kenyu Morisada (NIT-Niihama)
10:05-10:20	S09-04 Lee, Pin-Yen (NUU)	S10-04 Aoi Kubota (NIT-Niihama)	S11-04 Ren Ueta (NIT-Kagawa)	S12-04 Tseng,Yu.Ru. (NUU)	S13-04 Eguchi Yuto (NIT-Ube)
10:20-10:35	S09-05 Chia-Ching Mao, Wei-Cheng Lin, Jian-Ming Lai, Ke-Yun Lin (NUU)	S10-05 Hao-Xian Lu (NUU)	S11-05 Chun-Cheng Su (NUU)	S12-05 Taichi Iio (NIT-Niihama)	S13-05 Chunying Wang (NUU)
10:35-10:50		S10-06 Sasuke Kagawa (NIT-Kagawa)	S11-06 Akemi EMOTO (NIT-Tokuyama)	S12-06 Tian-Lin Hsu (NUU)	S13-06 Yu-Jie Chen (NUU)
10:50-11:05		S10-07 Zhi-Xuan Liao (NUU)		S12-07 Shuya Yamamoto (NIT-Ube)	S13-07 Jo-Han, Yen (NUU)
11:05-11:20				S12-08 Cheng-Hsiang Chou (NUU)	
11:20-11:35				S12-09 Subaru Kawazu (NIT-Niihama)	
11:40-12:00	Closing Ceremony **(Large Lecture Hall on the 11th Floor)** Prof. Tadaomi EGUCHI - President of NIT-Kochi, Japan Prof. Ti-Kuang Hou - President of NUU, Taiwan Moderator: Prof. Gain Denis (NIT-Kochi)				

Conference Chairman

Tadaomi Eguchi,

President,
National Institute of Technology (NIT), Kochi College, Japan

Career Summary
After working as a research engineer at Sumitomo Rubber Industries, Ltd., Dr. Eguchi held academic positions including Research Associate and Lecturer at National Institute of Technology, Akashi College, and Visiting Researcher at Ehime University. He was later appointed Associate Professor at both Akashi and Gunma Colleges, followed by promotion to Professor and then Vice President at Akashi College. Since 2023, he has been serving as President of Kochi College.

Academic Degrees
- **Doctor of Engineering**, Ehime University, 2005
- **Associate Degree in Engineering**, National Institute of Technology, Akashi College, 1986

Research Fields
- Civil Engineering
- Construction Management
- Construction Machinery
- Terramechanics

Professional Affiliations
- Japan Society of Civil Engineers (JSCE)
- Japanese Society for Engineering Education
- Japanese Geotechnical Society
- International Society for Terrain-Vehicle Systems (ISTVS)

Current Major Committee Role
- Vice Chair, Wear Countermeasure Committee, Kansai Branch, Japan Construction Machinery and Construction Association (JCMA)

Awards
- Best Session Paper Award, 15th International Conference of the ISTVS (2005)
- Academic Contribution Award, Hyogo Prefecture Distinguished Service Award (2023)

Other Social Contributions
- Honorary Volleyball Referee, Japan Volleyball Association
- Volleyball Coach Level 1, Japan Sports Association

Conference Chairman

Name: Hou, Ti-Kuang
Date of Birth: 1968
Current Position: President, National United University

Educational Background

Ph.D., Power Mechanical Engineering, National Tsing Hua University (June 2003)
M.S., Power Mechanical Engineering, National Tsing Hua University (June 1993)
B.S., Mechanical Engineering, Chung Yuan Christian University (June 1991)

Academic and Administrative Experience

- National United University, Department of Mechanical Engineering: Assistant Professor, Associate Professor, Professor, and Department Chair
- National United University, College of Science and Engineering: Acting Dean
- National United University: Dean of Student Affairs, Vice President

Academic Publications and Research Achievements

- Over 40 international journal papers published in journals such as J. Micromechanics & Microengineering, J. MEMS, and IEEE Electron Device Letters.
- More than 20 international conference papers presented in the US, Europe, Japan, Australia, and Taiwan.
- Over 40 domestic conference papers.
- Holder of 6 patents in Taiwan and the United States.

Academic and Social Contributions

- Recipient of the National Science and Technology Council's Distinguished Talent Award (2011–2013)
- Recipient of the Excellent Mentor Award, National United University (2019)
- Recipient of the Service Contribution Award, Chinese Society of Mechanical Engineers (2023)

Areas of Expertise

- MEMS and nanostructures
- Medical image processing
- Automation and robotics
- University governance and higher education policy

Summary

Professor Hou has a strong foundation in both engineering practice and academic research. He has long been dedicated to the promotion of higher education, university administration, and interdisciplinary research. With practical experience in department governance, student affairs, and industry-academia collaboration, he is committed to fostering innovation, stability, and care in institutional development. He aims to deepen the university's unique strengths, promote internationalization, and connect with regional industries to create shared value for students, faculty, and society.

Keynote speaker

Ryo Iwahara

Mechanic, Presenter,

Shikoku Machine Center, Nishio Rent All Co., Ltd. Japan
ryou.iwahara@nishio-rent.co.jp

Education

-Bachelor of Arts in Thai Language and Culture for Foreigners, Mae Fah Luang University, Thailand

-Diploma, Department of Mechanical Engineering, National Institute of Technology, Kagawa College, Japan

Experience

-Mechanic, Nishio Rent All Co., Ltd. (2024-present)

Honor

-First Class Honors, Bachelor of Arts in Thai Language and Culture for Foreigners Mae fah luang University, Thailand

International Academic Activity

-Ryo Iwahara, “Language Strategies in Japanese Restaurant Advertisements in Thailand” The 1st National Academic Conference on Teaching Thai to Foreigners, Khon Kaen University, Thailand.

Information about Nishio Rent All Co., Ltd.

It is a great pleasure for us to support the 8th NIT-NUU Bilateral Academic Conference 2025 as a sponsor. Nishio Rent All is a comprehensive rental company that specializes in the rental and development of a wide range of products, including construction equipment and event supplies. Since beginning our rental operations in 1965, we have proudly contributed to society as a pioneer in the rental industry.
Furthermore, over the past several years, we have collaborated with several National Institutes of Technology (NITs / KOSEN) through joint research projects, Global Camp, and sponsorship of solar car races—offering students valuable opportunities for hands-on learning. We also provide opportunities for them to explore advanced construction machinery equipped with cutting-edge technology.

Moderator of Session 1

- **Dr. Fu-Chieh Hsu**

Associate Professor
Department of Cultural Tourism
National United University**, Taiwan/Japan**
E-mail: fchsu@nuu.edu.tw

Professional Profile

Dr. Hsu is a tourism and hospitality scholar specializing in food tourism, cultural heritage, and consumer behavior. With over a decade of academic experience in Taiwan and Macao, his research explores the intersection of tourism, emotion, and social cognition. He has published extensively in high-impact SSCI/SCI journals and actively engages in interdisciplinary projects linking tourism with digital technology, AI, and sustainability.

Education

Ph.D. in Tourism Management, The University of Queensland, Australia

Research Achievements

Dr. Hsu has authored over 20 peer-reviewed SSCI/SCI journal articles. His works appear in Annals of Tourism Research, Journal of Hospitality and Tourism Management, British Food Journal, and International Journal of Tourism Research, many as first or corresponding author.

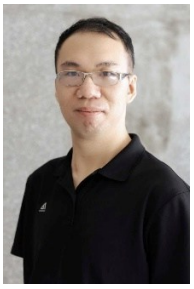
Academic Service

- Editorial Board Member, Journal of Vacation Marketing (SSCI)
- Reviewer for SSCI journals including IJCHM, JHTR, BFJ, JHTM, etc.

Moderator of Session 2

- **Dr. Chou Tzu Chieh**

Assistant Professor
Department of Electrical Engineering
National United University, Taiwan
E-mail: tcchou@nuu.edu.tw



Chou Tzu Chieh was born in Taichung, Taiwan, in 1992. He received the B.S. degree in Electronic and Computer Engineering from the National Taiwan University of Science and Technology(NTUST), Taipei, Taiwan, in 2014. He received the Ph.D. degree in Electrical Engineering from the National Tsing Hua University(NTHU), Hsinchu, Taiwan, in 2020. From 2020 to 2023, he was a Research and Development(R&D) Substitute Services in the National Chung-Shan Institute of Science and Technology(NCSIST), Taoyuan, Taiwan. His past researchs included power converter design and motor-driven systems integration. He is currently an Assistant Professor in National United University(NUU), Department of Electrical Engineering, Miaoli, Taiwan. His research interests currently focus on renewable energy applications, DC-DC converters, DC-AC inverters, motor drive control and DSP-based micro- controllers.

Moderator of Session 3

- **Dr. Jung-Jen TSAI**

Assistant Professor
Department of Architecture
National United University, Taiwan
E-mail: normantsai@nuu.edu.tw

EDUCATION:

Ph.D. in Architecture

The University of Edinburgh, Edinburgh, Scotland

Dissertation title : “the Metaphors of the Nation : the Architectural Programme of the KMT under Chiang Kai-shek’s rule in Post-war Taiwan”

WORK EXPERIENCE:

Section Chief, Energy Management Section in General Affairs Office.

Section Chief, Public Affairs Section and Alumni Services Section in Office of Secretariat.

RESEARCH INTERESTS:

Western Architectural History, Modern Architectural History, The Theories And Critics on Contemporary Architecture, and the Architecture History of Taiwan.

PUBLICATIONS:

Working in Progress : “Japanese Colonial Shinto Shrines in Taiwan”, Locus publisher.

Moderator of Session 4

- **Dr. Fan-Bean Wu**

Professor,
Department of Materials Science and Engineering,
Director,
Glass & Optical Fiber Materials Research Center,
National United University, Taiwan.
E-mail: fbwu@nuu.edu.tw

Prof. Fan-Bean Wu is currently a professor in Dept. Materials Science and Engineering and the director of Glass and Optical Fiber Materials Research Center in National United University in Taiwan. He received his Bachelor/Master/Ph.D degrees in Dept. Materials Science and Engineering, National Tsing Hua University in Taiwan in 1996/1999/2002, respectively. He started the academic career in Dept. Materials Science and Engineering in National United University in 2006 and served as the Dean of the Office of Research and Development from Aug. 2021 to July 2024. His research interests focus on Surface Treatments, Vacuum and Coatings Technologies, Protective Layers, Plasma Techniques, Atmospheric Pressure Plasma, Low Temperature Specialty Glass, and Glass Processes. The major topics in his lab recently are nanostructure layer, multilayer films, protective nitride, refractory nitride coatings, low temperature glass, glass fabrication, atmospheric pressure plasma surface treatment, and electroplaing. He has been elected as Executive Committee Member in Taiwan Association of Coatings and Thin Films since 2019 and serves as organizer in International Conferences of Metallurgical Coatings and Thin Films ICMCTF and International Thin Films Conference TACT. He published 50+ papers, including journal articles, book chapters, patents, and technical reports. Over 10 keynote and invited talks in domestic and international conferences about surface coatings and specialty glass applications were delivered. Over 10 awards, including silver and bronze international invention medals, university social responsibility USR model prize, outstanding service, outstanding teaching, excellent industrial-academia collaboration, and best paper and posters, were collected in his career due to his dedication in related research fields and academia.

Prof. Fan-Bean Wu welcomes all kinds of collaboration, including various research topics, internship and exchange of students, industry-academia technology transfer, lectures and courses. He is open to cooperate with people who is interested in related fields. Contact: fbwu@nuu.edu.tw

Moderator of Session 7

Chunying Wang PhD

Associate Professor
Language Centre
National United University, Taiwan
E-mail: cwang01@nuu.edu.tw
Research interests：linguistics, language education, bilingual teaching, metaphors, Multi-grade instruction

Education Background
PhD in Language in Education, UCL Institute of Education, UK

Work Experience

- Assistant Professor, Language Centre, National United University, Taiwan (Aug 2023 ~ Jan 2025)
- Assistant Professor, Language Teaching and Learning Centre, Chinese Culture University, Taiwan (Feb 2022 ~ Jul 2023)
- Assistant Professor, Department of Applied Foreign Languages, Lunghwa University of Science and Technology, Taiwan (Aug 2018 ~ Jan 2022)

Awards

- Dissertation Fellowships for ROC Students Abroad (Europe region), Chiang Ching-kuo Foundation for International Scholarly Exchange
- 2012 The International Student Exchange Support Programme (Institute of Education-Waseda University SS Exchange Scholarship)
- 2010 Government Scholarship to Study Abroad, Ministry of Education, ROC
- An Honorary Member of the Phi Tau Phi Scholastic Honor Society of the Republic of China

Moderator of Session 8

Dr. Yin-Hung Lai

Associate Professor
Department of Chemical Engineering,
National United University, Taiwan
E-mail: laiyh@nuu.edu.tw

Education:

2012 Ph. D. in Chemistry (physical chemistry) National Tsing Hua University, Taiwan

2006 B. S. in Biomechatronics Engineering, National Taiwan University, Taiwan

Professional Experience:

2018-2020 Postdoc, Chemistry and Applied Biosciences, ETH Zürich, Switzerland

2016-2018 Postdoc, Chemistry, Stanford University, USA

2014-2015 Postdoc, Genomics Research Center, Academia Sinica, Taiwan

Area of expertise and research:

mass spectrometry instrumentation & method development and its applications in bioanalytical & environmental sciences

Selected publications:

1. Yin, H., Zheng, L.-Q.,* Fang, W., **Lai, Y.-H.**, Porenta, N., Goubert, G., Zhang, H., Su, H.-S., Ren, B., Richardson, J. O.,* Li, J.-F.,* and Zenobi, R.,* Nanometre-scale spectroscopic visualization of catalytic sites during a hydrogenation reaction on a Pd/Au bimetallic catalyst. *Nat. Catal.* **3**, 834-842 (2020)
2. Chang, H.-W.,* Dong, C.-L., Chen, Y.-H., Xu, Y.-Z., Huang, T.-C., Chen, S.-C., Liu, F.-J., **Lai, Y.-H.**,* Tsai, Y.-C.,* Extended Graphite Supported Flower-like MnO_2 as Bifunctional Materials for Supercapacitors and Glucose Sensing. *Nanomaterials*, **11**, 2881 (2021)
3. Martínez-Jarquín, S.,† Begley, A.,† **Lai, Y.-H.,** Bartolomeo, G. L., Pruška, A., Zenobi, R.,* Aptapaper ─ An Aptamer-Functionalized Glass Fiber Paper Platform for Rapid Upconcentration and Detection of Small Molecules. *Anal. Chem.*, **94**, 5651-5657 (2022)
4. **Lai, Y.-H.,*** Wang, Y.-S.,* Advances in High-Resolution Mass Spectrometry Techniques for Analysis of High Mass-to-Charge Ions. *Mass Spectrom. Rev.*, **42**, 2426-2445 (2023)
5. **Lai, Y.-H.,*** Leung, W., Chang, P.-H., Zhou, W.-X., Wang, Y.-S.,* Structural identification of carbohydrate isomers using ambient infrared-assisted dissociation. *Anal. Chim. Acta,* **1264**, 341307 (2023)
6. Cao, J.-L.,† Guo, J.-H.,† Leung, W.,† Liu, Y.-T., Tsai, I-L., Huang, S.-L., Wang, Y.-S., **Lai, Y.-H.,*** Do phenolic contents relate to their *in-vitro* cytotoxicity against colorectal cancer cell lines from *Calvatia lilacina* (puffball mushroom)? *Food Biosci.*, **66**, 106193 (2025)
7. Su, P.-J., Shen, C.-J.,† Leung, W.,† Chen, M.-H., **Lai, Y.-H.,*** Quantitative Native Speciation of ppb-level Metals in Semiconductor-manufacturing-used Strong Acids and a Base. *Talanta* **291**, 127819 (2025)

Moderator of Session 9

Dr. Tung-Fei Tsai- Lin

Associate Professor
Department of Business Management
Director, Center for the Development of Teaching and Learning, Office of Academic Affairs
National United University, Taiwan
E-mail: tftsailin@nuu.edu.tw

Tung-Fei Tsai-Lin is an associate professor of the Department of Business Management at the National United University in Taiwan. He obtained his doctoral degree in Technology Management at National Tsing-Hua University in Taiwan 2015. From 2012 to 2013, He has been a visiting scholar at the University of Bw Munich in Germany. His research interests cover IP management, patent bibliometrics, academic entrepreneurship, open innovation, and business strategy and sustainable innovation. His research has been published in Technnovation, Minerva, Sage Open, Journal of Organizational Change Management, Asia-Pacific Business Review, Journal of Technology Management (in Chinese), Industry and Management Forum (in Chinese), and Journal of Management & Systems (in Chinese).

Moderator of Session 10

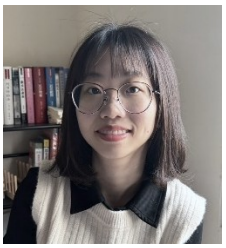
Curriculum Vitae

Name	韓建遠 (Han. Chien-Yuan)
Occupation	教授兼資訊長，國立聯合大學光電工程學系所 Dean, Office of Information Technology. Professor, Department of Electro-Optical Engineering, National United University
Education	博士學位，國立交通大學光電工程研究所 Ph.D. The Institute of Electro-Optical Engineering. National Chiao-Tung University, Taiwan 2001 - 2006 碩士學位，國立陽明大學醫學生物技術研究所 M.S. Department of Biotechnology and Laboratory Science in Medicine. National Yang-Ming University, Taiwan 1997 - 1999 學士學位，輔仁大學生物學系 B.S. Department of Biology, Fu-Jen Catholic University, Taiwan, 1993 - 1997
Experience	助理教授 Assistant professor National United University (2007~2013) 教務處課務組組長 Division Director, Curriculum Division, Office Of Academic Affairs, , National United University 副教授 Associate Professor, National United University (2013~2020) 兼系主任 Department Chair (2012~2022) 教授 Professor, National United University, 2020~present 資訊長(2022.08~2027.07.31)/國立聯合大學資訊處 Dean, Office of Information Technology, NUU 學務長(2024.08.01~2025.1.31)/國立聯合大學學務處 Dean, Office of Student Affairs, NUU
Contact Info	360 苗栗市南勢里聯大二號, cyhan@nuu.edu.tw, cyhan@gm.nuu.edu.tw (Office) +886-37-382565, 2 Lien-Da Rd., Nan-Shih-Li, Miaoli City 360, Taiwan.
Research Interests	・Phase shift Interferometry ・Imaging Ellipsometry ・Optical Polarimetric Modalities for Biomedical Research ・Mueller Matrix Microscopy
Honor	-口頭報告論文獎佳作, Conferences on photonics and communications，光電與通訊工程應用研討會 2020 . -日本東京創新天才國際發明展獲得金牌, Gold Genius Award, World Genius Convention & Education Expo Tokyo 2018
Academic and Social Service	國際期刊客座編輯 Guest editor Surface and Coatings Technology. (2013, 2015) 國際期刊審查委員, Reviewer. Optics Express, Applied Optics, Japanese Journal of Applied Physics, Optics and Lasers in Engineering, etc.
Honory International Activity (Selected)	Member of OSA

Moderator of Session 11

- **Dr. Zhuang Gui Ling**

Assistant Professor
Department of Architecture
National United University, Taiwan
E-mail: glingzhuang@nuu.edu.tw



Summary
Experienced architectural researcher with over 3 years of work focused on sustainable design and parametric design. Skilled in the circular economy, lifecycle assessment, and cross-disciplinary collaboration. Committed to integrating computational design with environmental performance to drive innovative, resource-efficient solutions.

Education

- PhD, National Taiwan University of Science and Technology, Department of Architecture, 2021-2024
- Master, Tunghai University, Department of Architecture, 2020-2021

Work experience

- Assistant Professor, Department of Architecture, NUU
- Engineer, Urban Development Bureau, Taoyuan City Government
- Research Assistant, Department of Architecture, NTUST
- DGNB Consultant
- ROC's architect's license

Research Interests

Sustainable built environment、Circular economic、Circular design thinking、Architectural Design

References

Zhuang, G.-L., Shih, S.-G., Wagiri, F., 2023. Circular economy and sustainable development goals: Exploring the potentials of reusable modular components in circular economy business model. Journal of Cleaner Production 414, 137503.
Zhuang, G.-L., Shih, S.-G., 2023. An Educational Game for Circular Economy Unit Reuse. ARCHITECTURE SCIENCE.
Lin, V.Y.C., Lin, J.Y., Shih, S.G., **Zhuang, G.L.**, Tan, D.H., 2023. On the Math-inspired Sustainable Skyscraper Design. Nexus Network Journal 25, 87–94.

Curriculum Vitae

Dr. Tzu-Hsuan Chiang

Director of Research and Development
Department of Energy Engineering of
Professor

National United University, Taiwan

E-mail: thchiang@nuu.edu.tw

Eduction

National Yang Ming Chiao Tung University, PhD., Sep. 2002- Jul. 2006.

Professional Experience

- Associate Professor, National United University, Aug. 2009 – Jul. 2015
- Visiting Scholar, University of Tokyo, Jul. 2015 – Jun. 2016
- Professor, National United University, Aug. 2015 – Present
- Director, Institutional Research Office, National United University, Aug. 2024 – Feb. 2025
- Director, Research and Development Office, National United University, Feb. 2025 – Present

Research Expertise

Prof. Chiang's research focuses on the development of high-performance electrocatalysts for the oxygen reduction reaction (ORR), hydrogen evolution reaction (HER), and oxygen evolution reaction (OER), which are critical for hydrogen fuel cells and water electrolysis. She specializes in designing cost-effective, durable materials for alkaline, acidic, and seawater electrolysis, aiming to enhance efficiency in hydrogen production. Her studies on Schiff base chelating ligands for non-precious metal composite electrodes have significantly improved electrocatalytic stability and activity. Additionally, she is involved in scaling up large-area alkaline electrolyzer modules, ensuring practical applications for industrial hydrogen production. Her interdisciplinary approach combines materials science, electrochemistry, and engineering, making her a leading researcher in next-generation sustainable energy solutions.

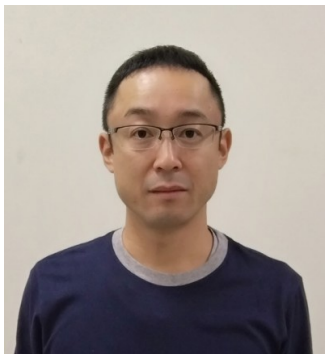
Moderator of Session 1

Curriculum Vitae (Takuo Fujita)

Name	Takuo Fujita	
Occupation	Associate Professor of Department of Social Design Engineering, National Institute of Technology, Kochi College	
Education	National Institute of Technology, Kochi College (1985)	
Experience	Associate Professor; Department of Social Design Engineering, National Institute of Technology, Kochi College, from 2024. Assistant Professor; Department of Social Design Engineering, National Institute of Technology, Kochi College, 2017-2024. Manager; NEC Display Solutions, Ltd., 2012-2016 Conducted design reviews and supplier quality management audits for display solution products. Provided guidance and support to enhance supplier quality management practices. Manager; Account Quality Management dept., TPV Electronics Fujian Co. Ltd., 2012-2013 Supervised and provided guidance on quality and production management at an ODM supplier's manufacturing facility for displays. Deputy Manager; NPG Display Ltd. Taiwan Branch, 1996-2007 Managed the development of display monitors and supervised reliability testing and regulatory certification processes. Provided technical guidance and oversight on development and evaluation procedures. DQA Engineer; NEC Home Electronics Ltd., 1985-1995 Conducted product evaluations and reliability testing for personal computers and displays. Developed and established testing standards for product quality and performance.	
Contact Info	tfujita@kochi-ct.ac.jp (Office) +81-88-864-5686	
Research Interests	Carrier Development Education, Practice-based Education for Social Implementation, Digital Signage Solution	
Skills	- Carrier Guidance and Education - Quality Assurance and Reliability Engineering - Supplier Quality Management & Auditing - Display Product Development - Cross-cultural Project Leadership - ISO/IEC Standards, Regulatory Compliance - Fluent in Japanese; Business-level English and basic Chinese	
Certifications	- Certified Career Consultant (National License, Japan) - Certified Career Development Advisor (CDA), Japan Career Development Association (JCDA), [2025]	

Moderator of Session 2

Curriculum Vitae (Yosuke Takubo)

Name	Yosuke Takubo	
Occupation	Associate Professor of Department of Electrical Engineering and Information Science, National Institute of Technology, Niihama College Associate Researcher, High Energy Accelerator Research Organization (KEK) (2024-)	
Education	Osaka University, PhD (2006), MS (2003), and BS (2001)	
Experience	Associate Professor; National Institute of Technology, Niihama College, Department of Electrical Engineering and Information Science, from 2024. Research Associate; High Energy Accelerator Research Organization (KEK), Institute of Particle and Nuclear Studies, 2011-2024. Assistant Professor; Tohoku University, Department of Physics, 2007-2010.	
Contact Info	y.takubo@niihama-nct.ac.jp (Office) +81-897-37-7700	
Research Interests	High energy physics, Quantum physics, Statistical linguistics	
Honor	- Breakthrough Prize in Fundamental Physics, For the fundamental discovery and exploration of neutrino oscillations, revealing a new frontier beyond, and possibly far beyond, the Standard Model of particle physics, Fundamental Physics Prize Foundation (2015) - The 2016 ATLAS Outstanding Achievement Award (2016) - Breakthrough Prize in Fundamental Physics, CERN's Large Hadron Collider (LHC) – ATLAS, CMS, ALICE and LHCb, Fundamental Physics Prize Foundation(2025)	
Academic and Social Service	-Translator of ancient documents stored at Zentoku-ji temple in Toyama prefecture -Member of the historical societies of Niihama and Komatsu towns in Ehime prefecture	
Honory International Activity (Selected)		
Research Gate:	https://www.researchgate.net/profile/Yosuke-Takubo	

Moderator of Session 3

Curriculum Vitae (Ryoichi Yanagawa)

Name	Ryoichi Yanagawa
Occupation	Professor, Department of Civil Engineering, National Institute of Technology, Kagawa College Visiting Associate Professor, Osaka Metropolitan University (2014-)
Education	Osaka City University, PhD (2005), and ME (2001) Kagoshima University, BE (1999)
Experience	Professor; National Institute of Technology, Kagawa College [NITKC], Department of Civil Engineering, from 2025. [About the research topics, please see the related website] Associate Professor; NITKC, Dept. of Civil Engineering, 2017-2025. Lecturer; NITKC, Dept. of Civil Engineering, 2016-2017. Assistant Professor; Iwate University, Research Center for Regional Disaster Management [RCRDM], 2012-2016. Tsunami [Great East Japan Earthquake] analysis using GIS Human disaster risk assessment against the earthquake and secondary disasters Disaster management drills for school institutions Analyst; Chuden CTI Co., Ltd., Dept. of Engineering [Private Company], 2005-2012. 2004-2006: Osaka Bay, Investigation of the impact on marine organisms due to water discharge from thermal power plants, and the effect of countermeasures 2005-2008: Malaysia, Technology transfer of marine environment numerical models, CENSIS 2005-2007: Malaysia, investigation of countermeasure effects for river mouth burial problem 2007: Malaysia, Development of eutrophication numerical model for lake 2007-2008: Amagasaki water-channel, Hyogo, Japan, Development of hydrodynamics & water quality model, and environmental restoration studies: Increase seawater exchange, Create tidal flat, Microbubble generation, Install vegetation shelf or environmentally friendly seawall, etc.. 2008-2009: UAE, Prediction of coastal water quality due to creat the artificial islands 2008-2010: Saudi Arabia, Development of flow, water quality, ecosystem and bioaccumulation models, and technology transfer around an oil refinery plant. 2011-2012: Ise Bay, Methodological study on the control of diatom red tide plankton using a numerical flow model
Contact Info	yanagawa-r@t.kagawa-nct.ac.jp (Office) +81-87-869-3922
Research Interests	Coastal Disaster Management, Coastal Ecosystem Research Skill: Numerial Modeling, Programming (Fortran, Ruby, VBA, PHP, C++, Python, etc..), Field Survey, Data Acquisition, Water Analysis, GIS, UAV
Academic and Social Service	-Member of the technical review committee of the Japan Water Agency -Member of the Committee for reviewing changes to the Kagawa Prefectural Coastal Conservation Master Plan -Editorial board member of the Japanese Society of Multiphase Flow
Related Website:	https://www.researchgate.net/profile/Ryoichi-Yanagawa [Research Gate] https://research.kosen-k.go.jp/plugin/rmaps/details/4/132/yanagawa-r [NIT Research Info. Portal]

Moderator of Session 4

Curriculum Vitae (Masato Ohsumi)

Name	Masato Ohsumi	
Occupation	Associate Professor of Department of Social Design Engineering, National Institute of Technology, Kochi College	
Education	Kochi University of Technology, PhD (2018) Kyushu University, ME (2007)	
Experience	April 2020 – Present Associate Professor, Department of Social Design Engineering, National Institute of Technology, Kochi College April 2016 – March 2020 Assistant Professor, Department of Social Design Engineering, National Institute of Technology, Kochi College April 2010 – March 2016 Assistant Professor, Department of Materials Science and Engineering, National Institute of Technology, Kochi College	
Contact Info	ohsumi@ms.kochi-ct.ac.jp	
Research Interests	Organic Synthetic Chemistry	
Honor	Faculty Award for Excellence, National Institute of Technology, Kochi College (2024) Poster Award, “Palladium-Catalyzed Cross-Coupling of Benzyl Compounds with Boronic Acid,” The 23rd National College of Technology Symposium (2018) Best Presentation Award, “Development of Thermal Insulation Material Using Coconut Fiber to Reuse Agricultural Industrial Waste,” ICEE 2017 (2017)	
Academic and Social Service	Educational Secretary, Kochi Chemical Society	

Moderator of Session 5

Curriculum Vitae (Gen Chiaki)

Name	Gen Chiaki	
Occupation	National Institute of Technology, Kochi College Department of Social Design Engineering, Associate Professor	
Education	The University of Tokyo, PhD (2016) The University of Tokyo, Master of Science (2013) The University of Tokyo, BA (2010)	
Experience	Associate Professor, Department of Social Design Engineering, National Institute of Technology, Kochi College (2025-present). Assistant Professor, Department of Social Design Engineering, National Institute of Technology, Kochi College (2023-2024).	
Contact Info	chiaki@kochi-ct.ac.jp (Office) +81-88-864-5564	
Research Interests	Cosmology, Numerical astrophysics, Star and galaxy formation	
Academic and Social Service	-Member of the Astronomical Society of Japan -Member of Rironkon -Member of Japan Society for Simulation Technology	
Research Map	https://researchmap.jp/gen_chiaki	

Moderator of Session 6

Curriculum Vitae (Katsuhiro Suzuki)

Name	Katsuhiro Suzuki	
Occupation	Assistant professor, Lecturer of Department of Mechanical Engineering, National Institute of Technology, Niihama College	
Education	The University of Electro-communications, PhD (2014), ME (2011), and BE (2009)	
Experience	Assistant professor, Lecture, Department of Mechanical Engineering, National Institute of Technology, Niihama College, from 2024 Assistant professor, Department of Mechanical Engineering, National Institute of Technology, Niihama College, 2023-2024 Assistant professor, The Division of Materials and Manufacturing Science, Osaka University 2019-2023	
Contact Info	Ka.Suzuki@niihama.kosen-ac.jp (office) +81-897-37-7742	
Research Interests	Condensed matter physics, First-principles calculation, Computational material design, photo-luminescence, electronic transport.	
Honor		
Academic and Social Service	-Member of the Japan Society of Physics (JPS). -Member of the Japan Society of Applied Physics (JSAP). -Member of the Japan Institute of Metals and Materials. (JIMM).	
Honory International Activity (Selected)	.	
Research Gate:		

Moderator of Session 7

Curriculum Vitae (Manabu Hatamura)

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Experience	Professor; Department of General Education, National Institute of Technology, Ube College, from 2014. Associate Professor; National Institute of Technology, Ube College, Department of General Education 2003-2013. Lectuer; National Institute of Technology, Ube College, Department of General Education 1997-2002. Administrative Assistant; Hiroshima University, Department of Literature, Chinese Literature Laboratory,1996.	
Contact Info	hatamura@ube-k.ac.jp (Office) +81-836-35-7660	
Research Interests	Classical Chinese Literature (Tang Dynasty Literature etc.), Chinese Language Education, Communication Education	
Honor	- National Institute of Technology Chairman's Award for Excellence in Educational Practice in Classical Chinese (2008) -National Institute of Technology Chairman's Encouragement Award for Research Contribution to Education and Student Activities (2008) -National Institute of Technology Best Presentation Award in the Field of Educational Research (2011) -National Institute of Technology Best Paper Award in KOSEN Education (2013) National Institute of Technology Faculty Award for Excellence in Creative Japanese -Language Education and International Engagement (2014) -National Institute of Technology President's Award for Excellence in Globalization and International Collaboration (2023)	
Academic and Social Service	-Executive Committee Member, Chinese Language and Chinese Language Education Research Association, National Institute of Technology (KOSEN) -Advisory Committee Member, Ube Senior High School Management Council -Committee Member, Ube Future Co-Creation Platform Planning and Management Council -Member, International Education and Research Division, Headquarters for International Strategy Promotion, National Institute of Technology (KOSEN)	
Honory International Activity (Selected)	-Keynote Speaker, *"A New Model of Chinese Language Instruction through Collaboration among Japan's KOSEN Colleges",* The 14th International Conference on Classical and Modern Literature, 2023, Hosted by the Department of Applied Chinese, Wenzao Ursuline University of Languages (Taiwan)	
Research Gate:		

Moderator of Session 8

Curriculum Vitae (Shogo Tendo)

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Honor	- Best Poster Prize, The 33rd Symposium on Chemical Kinetics and Dynamics (2017) - Best Student Presentation Award, The 14th Nano Bio Info Chemistry Symposium (2017) - Best Poster Prize, The 34th Symposium on Chemical Kinetics and Dynamics (2018) - Student Award, The 15th Nano Bio Info Chemistry Symposium (2018)	
Academic and Social Service	-Member of the Japan Society for Molecular Science -Member of the Japan Society for Synchrotron Radiation Research (JSR) -Lecturer of the 29th Youngsters' Science Festival at Hiroshima	
researchmap:	https://researchmap.jp/shogo_tendo	

Moderator of Session 9

Curriculum Vitae (Shulin Chen)

Name	Shulin Chen	
Occupation	Assistant Professor of Department of Business Administration, National Institute of Technology, Ube College	
Education	Kobe University, PhD (2025)	
Experience	Assistant Professor; Department of Business Administration, National Institute of Technology, Ube College, from 2025. .	
Contact Info	cshulin@ube-k.ac.jp (Office) +81-836-35-5028	
Research Interests	IASB; IFRS ; China; political power; social network analysis; organizational legitimacy	
Honor	-	
Academic and Social Service	-Member of European Accounting Association -Member of Japanese Association for International Accounting Studies -Member of Japan Accounting Association	
Major Papers	- Chen, S. (2024). Emerging Chinese status in international accounting standard setting: A social network analysis of the International Accounting Standards Board. *Accounting in Europe*, 21(3), 273–298. https://doi.org/10.1080/17449480.2024.2308831 . - Chen, S. (2025). Review of the IASB's legitimacy based on Suchman's typology. *Journal of Management and Governance*, 2025, 1-23. https://doi.org/10.1007/s10997-025-09742-2	
Research Gate:	https://researchmap.jp/chen.shulin	

Curriculum Vitae (Hiroo Tarao)

Hiroo Tarao received B.S., M.S., and Dr. degrees in electrical engineering from The University of Tokushima, Japan, in 1994, 1996, and 1999, respectively. In 1999, he joined the Department of Electrical Engineering, Takamatsu National College of Technology as an Assistant Professor. He is currently an Associate Professor at the Department of Electrical and Computer Engineering, National Institute of Technology, Kagawa College, Japan.

His current research interests are in electromagnetic environmental problems from power-frequency to intermediate frequency, and the interaction of electromagnetic fields with biological systems. Also, he has engaged in the research of computational electromagnetics in biology and medical applications. He is a member of IEE Japan.

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Moderator of Session 11

Curriculum Vitae (Akemi EMOTO)

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Education	Toyohashi University of Technology, Dr. Eng., M. Eng., and B National Institute of Technology, Kure College	
Experience	Associate Professor; National Institute of Technology, Tokuyama College, Department of Civil Engineering and Architecture, from 2019. Lecturer; National Institute of Technology, Fukui College, Department of Civil Engineering, 2013-2018. Assistant Professor; National Institute of Technology, Fukui College, Department of Civil Engineering, 2008-2012. Cooperating associate professor; Toyohashi University of Technology, Department of Architecture and Civil Engineering, 2017-2018 Cooperating lecturer; Toyohashi University of Technology, Department of Architecture and Civil Engineering, Global Faculty Development Program, City University of New York (USA) and University of Science Malaysia (Malaysia), 2016-2017.	
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Academic and Social Service	-Certificate of Appreciation awarded by Kudamatsu City; Advisor to Koigahama Park Inclusive Renewal Project (2025) -Member of the Architectural Institute of Japan (AIJ) -Member of the City Planning Institute of Japan -School Disaster Prevention Advisor, Fukui Prefecture and Yamaguchi Prefecture -Supporter of foreigners in times of disaster -Japan Bosaisi	
Social Committee Services Activity (Selected)	-Chairman, Kudamatsu City Landscape Council (2021-) -Member of the Examination Committee for the Project to Promote the Preservation of Traditional Buildings in Fukui Prefecture (2009-) -Advisor to Kudamatsu City Koigahama Green Park Improvement Project (2023-2024) -Vice-Chairman, Koigahama Green Park Improvement Project Proposal Review Committee, Kudamatsu City (2023) -Member of Kudamatsu Municipal Land Appropriateness Planning Council (2022-2023) -Member, Iwakuni City Landscape Council (2021-) -Chairman, Shunan Municipal Land Appropriateness Plan Expert Committee (2020) -Technical Program Committee member and session chair of the International Symposium on Advances Technology Education (2019) -Chairman, Echizen Town Landscape Planning Committee, 2018-2019. -Member of Sabae City Community Development Fund Council, 2011-2018. -Member of Echizen City Landscape Council, 2008-2018.	
Research Gate:	https://researchmap.jp/read0142185	

Curriculum Vitae (Yoshihiro NODA)

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Education
Graduate School of Letters, Department of Chinese and Indian Intellectual History, Hiroshima University (Master of Arts,1992)

Experience
1996 National Institute of Technology (KOSEN), Niihama College lecturer
2002-2003 MEXT Overseas Researcher
(Southeast University, Nanjing, People's Republic of China)
2005 National Institute of Technology (KOSEN), Niihama College Associate Professor
2015 National Institute of Technology (KOSEN), Niihama College Professor

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Japanese Confucianism in the Early Modern and Modern Period
Chinese Language Education

S01-01

Silent Struggles at the Bottom: Emotional Exhaustion and Job Satisfaction among the Part-Time Workforce.

Yu-Yun Yu[1+], Yu-Hsuan Lu[1+], Hsiang-Heng Chen[1+], Jia-Lin Chuang[1+*], Hsiao-Ling Chen[2]

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2 Assistant Professor, Department of Business Management, National United University, Miaoli, Taiwan
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As economic growth slows, Taiwan is experiencing a shift in its labor force structure, with an increasing number of workers opting for part-time jobs alongside their primary employment. Many grassroots jobs are characterized by low entry barriers, flexible working hours, and immediate income, making them a common choice for university students, recent graduates, and middle-aged or older individuals who have retired from full-time employment. However, the burdens associated with these jobs — such as long working hours, emotional labor, significant physical effort—are often perceived as the silent struggles of grassroots workers. Although these challenges are frequently regarded as a necessary evil, these workers demonstrate remarkable resilience in accepting them. This study focuses on part-time workers as the research subjects and employs a questionnaire survey method to collect data. It aims to explore how emotional exhaustion impacts job satisfaction, whether there are differences in working hours and demographic variables, and whether the work atmosphere can serve as a moderating factor through cross-level analysis. Ultimately, based on the results of the statistical analysis, this study will provide insights into the part-time labor market and offer practical management suggestions for related industrial organizations.

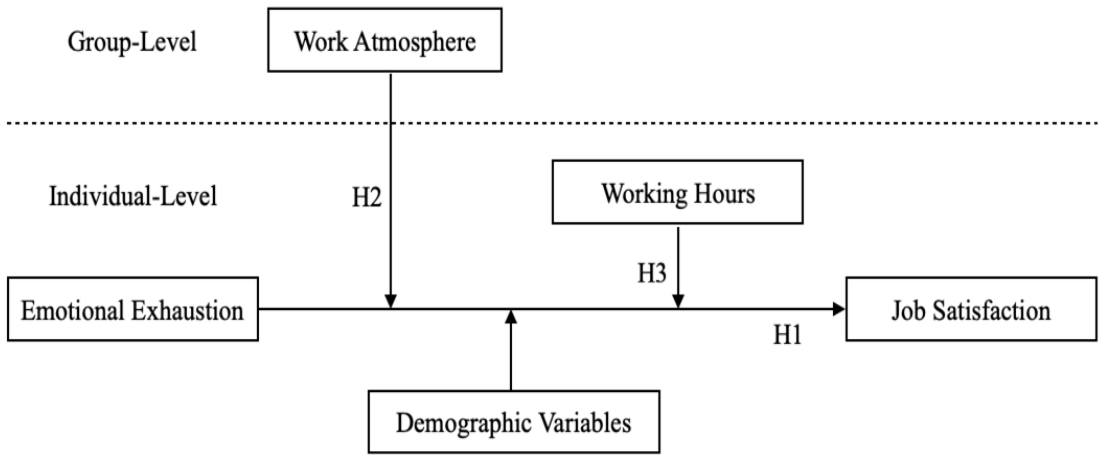

Figure1: Research Framework

Keywords: Emotional Exhaustion, Job Satisfaction, Work Atmosphere, Working Hours

***** In light of the extensive number of references, they are not included in this section.

S01-02

Navigating Multiple Transformations: How Dynamic Capabilities and Absorptive Capacity Shape Innovation Outcomes in High-Tech Firms

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In an era of rapid market change and intensifying competition, firms must pursue multiple transformations, including digital transition, green transition, and technological upgrading, to maintain competitive advantage. Successfully navigating these multiple transformations requires robust dynamic capabilities - sensing, seizing, and reconfiguring capabilities - that enable firms to respond quickly to environmental changes and foster innovation. Equally critical is the firm's absorptive capacity, which determines its ability to identify, assimilate, and apply external knowledge, ultimately influencing knowledge transformation and innovation outcomes. Building on these two theoretical foundations, this study investigates how dynamic capabilities and absorptive capacity jointly shape firms' innovation outcomes under conditions of multiple transitions.

Using a panel dataset of 178 publicly listed high-tech firms in Taiwan, this study analyses 141,000 patent filings from 2002 to 2023, combined with firm-level business data. The firm's domain, digital, and green technologies are identified based on patent classifications, and dynamic capabilities and absorptive capacity are proxied by time-series proxies. A longitudinal dataset covering 2008 to 2021 was constructed for empirical analysis.

The results show that firms' new knowledge-sensing capabilities significantly increase knowledge-seizing activities and that potential absorptive capacity (PAC) positively moderates this relationship. Furthermore, knowledge seizing in a firm's domain and digital and green knowledge significantly enhances the development of new technologies. Realized absorptive capacity (RAC) exhibits a dual moderating effect: it weakens the positive relationship between core knowledge seizing and core technology development, while it strengthens the relationship between green knowledge seizing and green technology innovation. Finally, knowledge seizing drives combinative innovation outcomes. RAC negatively moderates the relationship between digital knowledge seizing and digital combinative innovation but positively moderates the relationship between green knowledge seizing and green combinative innovation. Overall, this study highlights the critical role of dynamic capabilities and absorptive capacity in enabling firms to orchestrate multiple transformations and sustain innovation resilience successfully.

Keywords: Multiple Transitions, Dynamic Capabilities, Absorptive Capacity, and Combinative Innovation

S01-03

Business Model Analysis of the Woodcarving Industry

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Technical capabilities are key indicators of social productivity, and craftsmanship determines the level of production and manufacturing across different historical periods. Based on Alexander Osterwalder's Business Model Canvas, this study analyzes the woodcarving industry from four perspectives: (1) demand-oriented aspects: target customer segments, customer relationships, and distribution channels; (2) supply-oriented aspects: key partnerships, key activities, and key resources; (3) value-oriented aspects: the core value propositions; and (4) financial-oriented aspects: cost structures and revenue streams. In addition, this study explores consumer behavior and research methodologies.

Utilizing the Business Model Canvas framework, this research investigates the current operations, development trends, and consumer behavior within the woodcarving industry, with particular attention to the challenges and strategies involved in transitioning from manufacturing to research and design. The study evaluates the current state of Taiwan's woodcarving industry, identifies areas for improvement, analyzes factors influencing consumer purchasing behavior, and offers strategic recommendations for industry development.

The findings reveal that, with technological advancements, companies within the arts and crafts sector increasingly leverage cultural and creative innovation to highlight the cultural value of their products. By integrating elements of Chinese culture into brand identity, these companies reposition themselves in the market and enhance brand influence. Consumer surveys indicate that both branding and craftsmanship significantly strengthen purchasing power, and that purchasing intentions vary significantly across different genders, age groups, education levels, and disposable income brackets. Based on these findings, the study proposes trends and strategic suggestions for the future development of the woodcarving industry.

Keywords: Cultural and Creative Industries, Woodcarving Industry, Business Model, Consumer Behavior

S01-04

Navigating Global Megatrends in Indonesian Higher Education

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Indonesian higher education stands at a critical juncture, where the impact of global megatrends necessitates strategic adaptation and forward-thinking policies. Several key global forces – including globalization, rapid urbanization, demographic shifts, changing labor markets, technological advancements, and climate change – significantly shape the direction of Indonesian higher education. [1]These megatrends exacerbate existing weaknesses in the Indonesian higher education system. Indonesian higher education grapples with low participation, uneven infrastructure, limited STEAM, and faculty shortages. Vocational education suffers from industry misalignment, while research lacks collaboration and innovation. [2]Indonesia's global competitiveness indicators lag, compounded by teacher shortages and suboptimal training. Addressing these systemic issues in access, quality, relevance, and governance is crucial for Indonesia to thrive in a rapidly evolving world.

This paper aims to explore how Indonesian higher education can respond to global megatrends by analyzing their implications and proposing strategic approaches. Drawing on data from the [3]National Socioeconomic Survey (Susenas) of the Central Agency on Statistics (BPS) and the [4]Ministry of Education's Higher Education Data Repository (PDDikti), this study highlights programs designed to improve education quality, relevance, and impact. Recognizing low societal participation in quality higher education, Indonesia's strategic roadmap targets infrastructural inequities, underdeveloped STEAM disciplines, and educator shortages. To address these issues Indonesia aims to boost access, infrastructure, and STEAM-based learning. Strengthening educators and governance are also key.

Indonesia's vocational education strategy aims to boost graduate productivity, competitiveness, and skills. Key goals for 2045 include 75% employment in relevant fields and 66.37% within a year of graduation. This involves enhancing services through stronger industry partnerships, upgrading infrastructure to meet industry standards, refining curriculum with flexible entry/exit options, and improving teacher capabilities, ultimately preparing graduates for successful careers.

Ultimately, strategic reforms are vital for Indonesian higher education to adapt to global changes. By addressing systemic weaknesses and prioritizing innovation, Indonesia can empower its higher education system to fuel national progress and ensure a prosperous future.

Keywords: Global mega trends, Indonesian higher education, transformation, challenges, strategic adaptation

[1] Ringkasan Eksekutif. Peta Jalan Pendidikan Indonesia Tahun 2025-2045. Kementerian PPN/Bapenas (2025).
[2] Human Development Report 2021, World Bank 2012-2020, WIPO 2022, WEF 2019.
[3] Susenas, BPS, from different years.
[4] PDDikti, Mendiktisaintek 2005-2022.

S01-05

Impact of Stress-Resistance on Work Behavior: The Moderating Role of Lying-Flat

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In recent years, the impact of stress-resistance on work attitude has attracted growing interest in the fields of organizational studies and career development, particularly within the domain of human resource management. Lying-Flat, which is a movement of an extreme choice to live simply and give up the image of overwork and consumerism. However, stress-resistance indicates the personal perception of the individual facing stress, and deciding how to deal with stress. In other words, an individual may choose to actively engage with challenging job tasks, known as job crafting, or passively avoid or neglect jobs. In line with this trend, this study examined the relationship between individual stress-resistance and work behavior, besides exploring the mechanism of Lying-Flat.

The study focuses on general industrial workers, using structured survey questionnaires to assess participants' stress-resistance and work-related behaviors. Data collected from 261 samples, and the results showed that "stress-resistance" has a significantly positive impact on job crafting, but significantly negative impacts on job neglect. Besides, Lying-Flat plays a moderating role in the relationship between stress-resistance and job crafting. For individuals with low Lying-Flat, stress-resistance can enhance their job crafting. On the other hand, there is no moderating effect on stress-resistance and job neglect. Based on these results, we suggested that (1) the organization would evaluate the personality of job candidates during the selection process; (2) the employer could notice the individual's value of lying flat during the trial period; (3) create an organizational culture that is full of challenges and provide incentive.

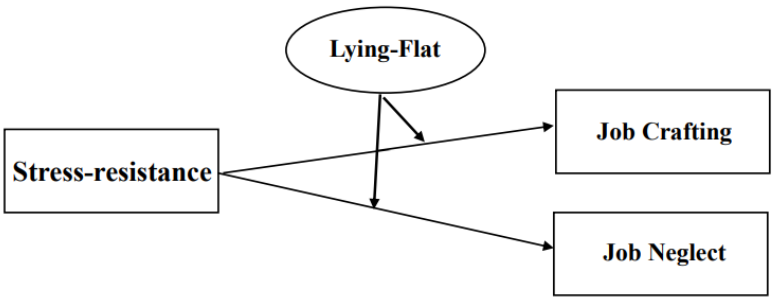

Figure1: Simple model for our academic research

Zhang, Z., & Li, K. (2023). So you choose to "Lie Flat?""Sang-ness," affective economies, and the "Lying Flat" movement. *Quarterly Journal of Speech*, *109*(1), 48-69.
Rusbult, C. E., Farrell, D., Rogers, G., & Mainous III, A. G. (1988). Impact of exchange variables on exit, voice, loyalty, and neglect: An integrative model of responses to declining job satisfaction. *Academy of Management journal*, *31*(3), 599-627.

S01-06

Future Challenges of Indonesia's Logistics Sector and the Role of Universities

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Abstract

Indonesia which consists of more than 17,000 islands, has created complex logistics challenges across its territories. The distribution of goods in Indonesia encounters significant geographical barriers, uneven infrastructure development, and high inter-island transportation dependency. Logistics costs in Indonesia remain relatively high, ranging from 14% to 23% of the Gross Domestic Product (GDP), significantly higher than neighboring ASEAN countries such as Malaysia, Thailand, and Vietnam (Rizka & Budiarto, 2022). The demand for efficient, responsive, and sustainable logistics services has intensified, while industry players are being challenged to implement digital technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), blockchain, and big data analytics in logistics operations (Handayani et al., 2021). Therefore, higher education institutions are viewed as critical players in equipping professionals with necessary digital skills, conducting applied research, and serving as innovative hubs for the logistics sector.

This study aims to identify the key challenges of Indonesia's logistics sector in the future and to evaluate the strategic role of higher education institutions in supporting the transformation of the national logistics sector through education, applied research, and multi-stakeholder collaboration. The methodology applied is a qualitative descriptive analysis based on a literature review of official government reports, logistics policy documents, and peer-reviewed articles published between 2019 and 2023 from national and international logistics sources.

The findings indicate that Indonesia's future logistics challenges include the high disparity of logistics costs between regions (Rizka & Budiarto, 2022), the readiness of human resources in embracing logistics 4.0 digitalization (Handayani et al., 2021), and the increasing demand for environmentally friendly logistics operations (Yuliasih & Yamin, 2020). Universities are crucial in developing qualified professionals, conducting applied research on multimodal transport systems, and fostering logistics digitalization and sustainable supply chain initiatives. In addition, universities serve as strategic drivers in fostering national collaboration through training programs, academic forums, and joint research partnerships with government and logistics industry stakeholders. This study recommends increasing synergy between academia, industry, and government to enhance the adaptability and competitiveness of Indonesia's logistics ecosystem in the global era.

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Rizka, D., & Budiarto, R. (2022). The development of Indonesia's national logistics system in supporting economic growth. Journal of Logistics and Supply Chain Management, 11(2), 45-56. https://doi.org/10.2139/jlscm.2022.002

Handayani, P. W., et al. (2021). Digital transformation in logistics: a framework and future research agenda. International Journal of Logistics Research and Applications, 24(3), 261-282. https://doi.org/10.1080/13675567.2020.1826428

Yuliasih, I., & Yamin, M. (2020). Green logistics challenges in Indonesia: a conceptual review. Journal of Sustainable Logistics, 5(1), 33-41. https://doi.org/10.1016/jsl.2020.05.00

S02-01

Research on Thermal Runaway Reaction of Lithium Titanate Batteries

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With the intensification of the global energy crisis and environmental pollution, countries around the world are actively seeking ways to reduce carbon emissions. These efforts have led to increasing demands for battery safety. Lithium-titanate batteries, known for their high safety, are a new type of lithium-ion battery. In this study, Toshiba SCiB™ and HUAHUI Energy 26650 batteries were selected. The batteries were charged and discharged to different states of charge (30%, 50%, and 100% SOC) and subjected to thermal hazard tests. Based on the experimental data, the thermal hazard characteristics of lithium-titanate batteries under high-temperature conditions were analyzed and discussed.

According to the results, the Toshiba SCiB™ battery exhibited relatively mild thermal runaway behavior at lower SOC levels, with both 30% and 50% SOC showing T_{max} values below 250°C, indicating moderate thermal hazards. However, at 100% SOC, significant thermal runaway occurred with a T_{max} of 281.6°C, suggesting a more severe thermal hazard accompanied by a potential risk of self-ignition and fire. In contrast, the HUAHUI Energy 26650 battery displayed notable thermal reactions even at 30% SOC, with a T_{max} of 255.8°C, revealing considerable risk even under low charge conditions. When fully charged (100% SOC), the T_{max} soared to 408°C, reflecting an extremely severe thermal runaway state with a high likelihood of explosion or large-scale combustion.

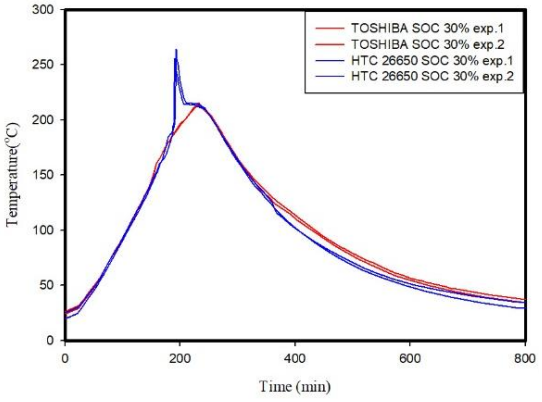

Fig. 1: 30% SOC temperature versus time

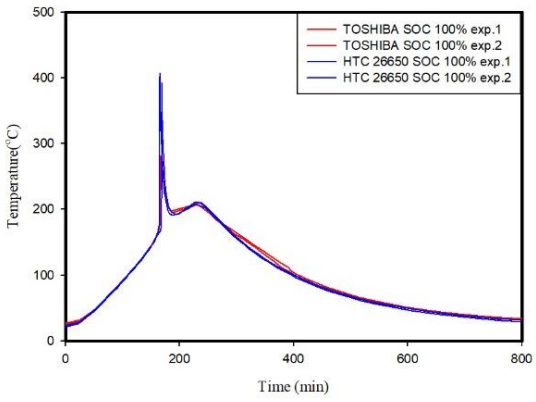

Fig. 2: 100% SOC temperature versus time

Keywords: Lithium titanate battery, closed heating test, thermal runaway, thermal stability, state of charge

S02-02

Fabrication of Position Sensitive Detectors Using ZnO and Ga-Doped SnO_2 Thin Films

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The PSD developed in this research uses ZnO and Ga-doped SnO_2 (GTO), a wide-gap semiconductor material, to achieve high transparency and sensitivity in the ultraviolet region, features not found in conventional PSDs. In particular, by taking advantage of the excellent transparency and the high UV sensitivity of ZnO and GTO, a sensor structure that responds selectively only to UV light while maintaining high transmittance in the visible light range has become possible.

The device structure is a translucent PSD with Al-doped ZnO bonded to GTO and ZnO, an n-type semiconductor. As shown in Figure 1, clean rectification characteristics are obtained in the dark state. In addition, a photocurrent is generated under ultraviolet light (340 nm wavelength) irradiation. The PSD device characteristics were confirmed to vary with distance from the output voltage, as shown in Figure 2. In the presentation, we will discuss the spectral response characteristics and other properties.

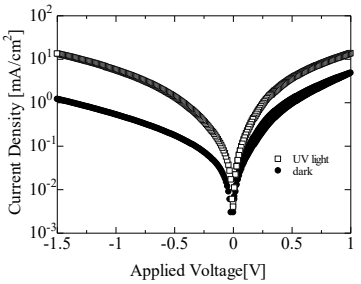

Fig. 1. I–V characteristics under dark and 340 nm UV light (0.45mW/cm^2).

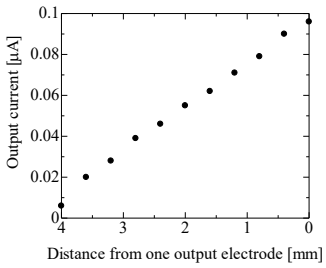

Fig. 2. Position Detection Characteristics of the PSD with 4mm distance output electrodes

[1] I. Takimoto, H. Kajii, R. Takahashi, A. Nagakawa, T. Miyazaki, K. Kanazawa, H. Murakami, S. Fujita and T. Morimune. physica status solidi (a). 220, 24, 2300141 (2023)

S02-03

Development of a Diagnostic Device for Detecting Internal Defects in Wood Using Vibration Measurement

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Wood is widely used in modern Japanese architecture. But wood can cause internal cracks that weaken its structural strength because its high moisture content requires drying.

This study aims to enable simple and highly accurate diagnosis of internal cracks in wood at forest sites by developing a portable measurement device by a non-destructive testing method based on wood vibration measurement and applying a neural network to the diagnosis of internal cracks, overcoming the limitations of conventional methods such as X-ray inspection, moisture measurement, and visual observation.

A schematic diagram of the measurement device is shown in Figure 1. In the measurements, vibrations were generated by lightly tapping near a piezoelectric element using one of four hammers. These vibrations were detected by the piezoelectric element and recorded on a computer. The test specimens were 80 Hinoki logs (100 mm in diameter, 250 mm in height), divided into four groups of 20 with center holes of 0 mm, 15 mm, 30 mm, and 50 mm. Table 3 presents a portion of the experimental data, showing the average logarithmic damping ratios for each hole size using Hammers No.2 and No.3. Although the results were not ideal due to limitations in data processing, a trend was observed where larger holes tended to show higher damping values. Although not shown in a figure, FFT-based frequency analysis revealed peaks at 0.8–1.2 kHz for 0 mm and 15 mm holes, 2.0–2.5 kHz for 30 mm, and 1.2–1.8 kHz for 50 mm. These findings suggest that large holes can be detected.

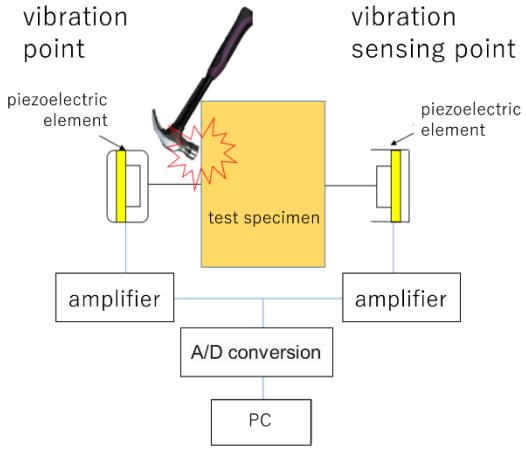

Fig. 1: Schematic representation of the experiment

Table 1: Logarithmic decrement for each hole

hole diameter [mm]	hammar② average logarithmic decrement	hammar③ average logarithmic decrement
0	0.1416	0.0914
15	0.1025	0.0852
30	0.1421	0.0882
50	0.1104	0.1602

Keyword: Vibration measurement, Neural network

S02-04

Development and Application of a UAV-Based Multispectral Polarimetric Optical Imaging System

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Polarization is a fundamental optical phenomenon that offers complementary information to intensity-based imaging, enabling more comprehensive characterization of material properties and structural features [1]. This study presents the development of a multispectral polarization imaging system mounted on an unmanned aerial vehicle (UAV) [2], designed for real-time, wide-area outdoor detection of plant nutrient conditions and material classification. The system integrates a polarization camera and multiple bandpass filters mounted on a motorized rotating holder, enabling spectral switching via a high-precision stepper motor. A custom electronic control unit and 4G LTE module allow remote operation through a mobile ground station application.

The system computes Stokes vectors from captured images to derive key polarization parameters, including the Degree of Linear Polarization (DoLP) and Angle of Polarization (AoP). By incorporating multi-angle flight strategies, the system enhances the accuracy of both plant nutrient analysis and material recognition. To validate the system's performance [3], UAV-based remote sensing experiments were conducted, targeting metallic object detection and plant/soil nutrient evaluation. The results demonstrate that metallic materials exhibit distinct polarization signatures across varying spectral bands and viewing angles, while polarization spectral features observed in plant and soil samples provide valuable indicators of nutrient status. These findings confirm the system's versatility and effectiveness across diverse applications.

Through the integration of automated hardware, wireless control interfaces, and advanced polarization image processing, the proposed UAV-mounted multispectral polarization imaging system presents a highly efficient, flexible, and scalable solution for remote sensing, with strong potential for deployment in environmental monitoring, plant health diagnostics, search and rescue operations, and infrastructure inspection.

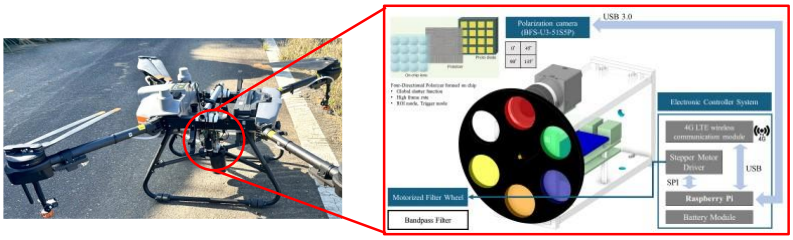

Fig.1: UAV-based multispectral polarization imaging system.

Keywords: Polarimetric Imaging, Remote Sensing, Unmanned Aerial Vehicle (UAV), Multispectral

[1] Wolff L B. (1990) Polarization-based material classification from specular reflection. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 12(11):1059-1071.

[2] Colomina I, Molina P. (2014). Unmanned aerial systems for photogrammetry and remote sensing: A review. *ISPRS Journal of Photogrammetry and Remote Sensing*, Volume 92, Pages 79-97.

[3] XIONG Zhihang, LIAO Ran, ZENG Yaguang, et al. (2020). Rapid identification of metal debris in complicated scenes by using polarization imaging (Invited). *Infrared and Laser Engineering*, 49(6):18-23.

S02-05

Development of a Controllable Circular diattenuation Optical System by Using a Mach-Zehnder Interferometer

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Optical circular polarization-where the electric field of a light wave rotates in a helix as it propagates-plays a crucial role across both fundamental science and a wide array of technologies [1,2]. Its distinctive properties arise from carrying spin angular momentum, interacting selectively with chiral structures, and enabling control over light–matter interactions that linear polarization alone cannot achieve [3]. This study proposes an optical circular diattenuation system based on the configuration of Mach-Zehnder interferometer capable of tuning the ratio between left-handed and right-handed circular polarization of the light. Fig. 1 reveals the optical configuration of the system, at the incoming and outgoing of the interferometer, two liquid crystal variable retarders (LCVRs) were installed that changed the linear polarized light into circular polarized and vice versa. The interferometer contains two polarizing beam splitters (PBS), two mirrors and two rotating half-wave plates (HWPs). By rotating the two HWPs at specific relative angle, the outgoing beam of the interferometer shows different proportions of left and right-handed circular polarizations. So as to verify the interferometer can be regarded as an optical circular diattenuator, the Mueller matrix of the interferometer system under the condition of different azimuths of two half-wave plates were demonstrated. The experimental results indicate that when the half-wave plate is adjusted to different angles, the system's modulation signal exhibits corresponding changes, thereby validating the feasibility of this architecture, as shown in Fig. 2.

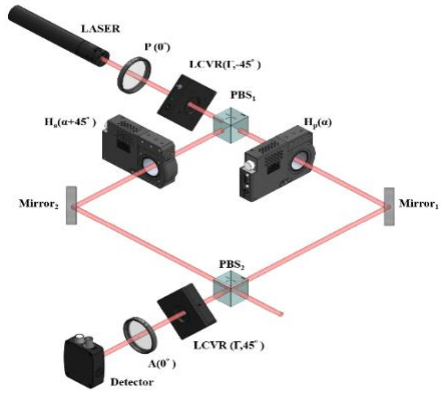

Fig. 1: Circular diattenuation optical system installation

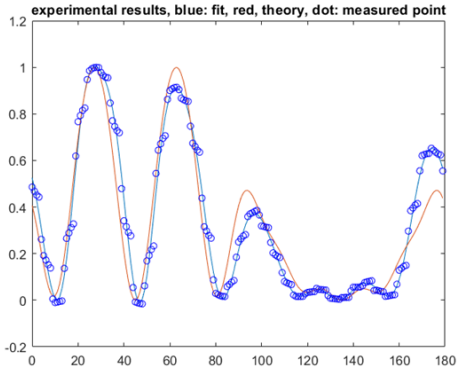

Fig. 2: Experimental results.

Keywords: circularly polarized light, adjustable attenuation, polarization control

[1] Basiri, Ali, et al. "Nature-inspired chiral metasurfaces for circular polarization detection and full-Stokes polarimetric measurements." Light: Science & Applications 8.1 2019): 78.
[2] Flñrez, Samuel Ángel Jaramillo. "Circular polarization and availability in free space optics FSO) communication systems." 2010 IEEE Latin-American Conference on Communications. IEEE, 2010.
[3] Zhang, Pengfei, et al. "Imaging single chiral nanoparticles in turbid media using circular-polarization optical coherence microscopy." Scientific reports 4.1 2014): 4979.

S02-06

Effects of Additional Gases on the Negative Ions Generated by Atmospheric Pressure Helium Plasmas: Implications for RNS Formation

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It has become clear that reactive oxygen and nitrogen species (RONS) produced by atmospheric pressure plasmas play important roles in plasma medical applications. RONS are effective in cancer treatment and sterilizing microbes. The type and concentration of RONS produced in plasma are reported to depend on the composition of the carrier gas [1]. In this study, a small amount of nitrogen or oxygen was added to helium, and the effects of the additional gases on the negative ions produced by plasmas were investigated using mass spectrometry. This study aims to investigate how the addition of nitrogen or oxygen affects the formation of negative ions in helium plasma.

The plasma generator used in this study is shown in Fig.1. A quartz glass tube was used with two electrodes of copper tape wrapped outside of the tube. Bipolar pulse high voltages were applied to the electrode to produce plasma jets. Helium was used as the carrier gas, and its flow rate was set to 3.0 slm. Experiments were conducted with He/N_2 and He/O_2. The mass spectrum of the negative ions were measured using an atmospheric pressure ionization mass spectrometer (API-MS) [2].

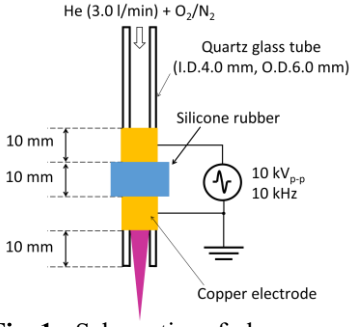

Fig. 1: Schematics of plasma generator

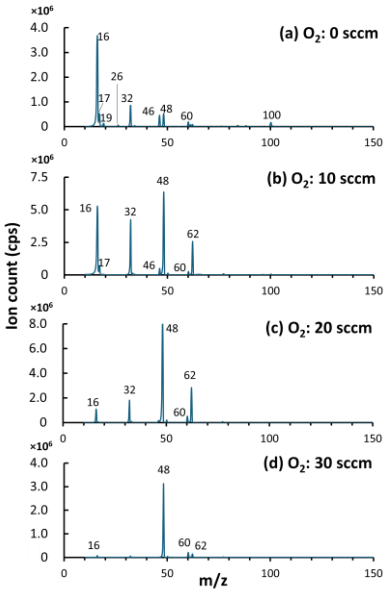

Fig. 2: Mass spectra of negative ions generated by helium plasma jets at different O_2 flow rates

Fig.2 shows the change in negative ion mass spectra when the flow rate of oxygen added to helium varied. Oxygen-derived ions such as O^- (m/z 16), O_2^- (m/z 32) and O_3^- (m/z 48) dominated the spectrum by the addition of oxygen.

Nitrogen-derived ion of NO_3^- (m/z 62) was also observed especially with 10 and 20 sccm of O_2. However, NO_3^- was hardly detected in case of adding nitrogen. The results of this study show that the addition of nitrogen cannot produce enough amount of RNS (NO, NO_2 and NO_3), but the addition of oxygen is necessary to promote RNS formation.

Keywords: atmospheric pressure plasma, mass spectrometry, reactive species

[1] Khaled Lotfy, (2020). The impact of the carrier gas composition of non-thermal atmospheric pressure plasma jet for bacteria sterilization. *AIP advances 10,* 015303; doi:10.1063/1.5099923

[2] Kenkichi Nagato, (2017). Measurement of ionic species in atmospheric pressure plasma by mass spectrometry, *Journal of Plasma and Fusion Research,* 93, 236-239 (in Japanese)

S03-01

Evaluation of channel width effects on reproducing infinite width overflow in the experimental channel

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This study investigates the usage of the experimental data obtained from both wide and narrow experimental channel width. When the infinite width overflow condition is reproduced by an experimental channel, there is a concern about the wall friction effect. Although there are walls on both sides in the laboratory experiment and its effect should be considered, we can ignore it in the real. In fact, the previous study has shown that when reproducing the tsunami that acts on a ground structure, the real situation can't be reproduced because there isn't enough channel width against the ground structure model widths. [1] This suggests the limits of tsunami analysis in the experimental channel.

Following these backgrounds, the purpose of this study is to investigate how the flow velocity distribution changes when the same flow rate per unit width is generated under multiple channel width conditions.

A movable PVC wall was installed to change the channel width. There are four patterns of channel width: 20, 30, 40, and 50 cm. Additionally, the same flow rate per unit width (with approximate discharges of 0.002, 0.005, 0.008, and 0.011 m³/s) was generated for each experimental case. The flow velocity distribution was checked for each pattern. The reference case was set with a channel width of 40 cm. The velocities measured at each channel width were compared to the velocities measured in the reference case.

In these conditions, the distance from the wall with velocity gradient was found to extend approximately 7.5 cm away from the wall in either cases (Fig. 1). From this result, it was estimated that the experimental results would be unaffected by the wall effect if the building model was placed at least 7.5 cm away from the wall in the case of experimental channel with different widths.

The difference in finite channel widths has some effect on the reproduction of the infinite-width flow condition. In order to clarify the flow pattern with structures of infinite width, further experiments will be conducted.

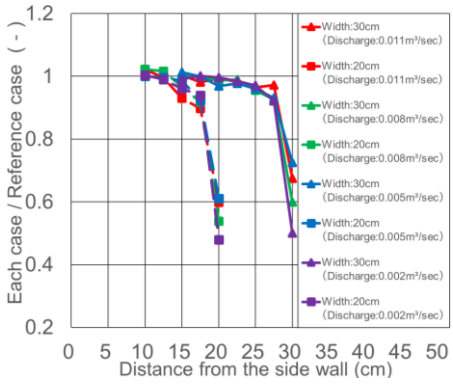

Fig. 1: Dimensionless flow velocity distribution.

Keywords: channel width[1], boundary layer[2], flow velocity distribution[3]

[1] Tsuyoshi IKEYA, Yoshihiro IWATA, *et. al.*(2017). INFLUENCE OF EXPERIMENTAL CHANNEL WIDTH ON TSUNAMI FORCE ACTING ON LAND STRUCTURES IN HYDRAULIC MODEL TEST, J. JSCE, Vol. 73, No. 2, I_901-I_906, in press.

S03-02

Visualization of flow velocity distribution using PIV analysis with a drone

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In recent years, the increasing risk of flood damage due to frequent localized heavy rainfall in urban areas has highlighted the importance of understanding detailed river flow patterns. Flow velocity measurement using image analysis allows for non-contact, wide-area, and instantaneous visualization of surface velocity distributions, making it particularly effective under harsh conditions such as during floods. In this study, we applied geometric correction and Particle Image Velocimetry (PIV) analysis to drone-captured surface imagery of the Mnobe River to visualize surface flow velocity distributions. The results clearly showed a trend of higher velocities in the central part of the river channel and lower velocities near the banks. By combining analysis results from multiple observation points, a comprehensive surface velocity distribution map of a wide area was successfully created. These findings demonstrate that PIV analysis using drones enables rapid and highly accurate flow measurements compared to fixed cameras, and thus is a practical and effective method.

Keywords: Particle Image Velocimetry, Monobe River, drone

[1]Atsuhiro Yorozuya .(2024). development and application of the method for measuring the spatial distribution of the water surface and the velocity in actual rivers. Journal of the Japan society of Civil Enginner

S03-03

Numerical Simulation of Positive Pressure Ventilation for Smoke Control in High-Rise Buildings Abstracts for NNBAC2025

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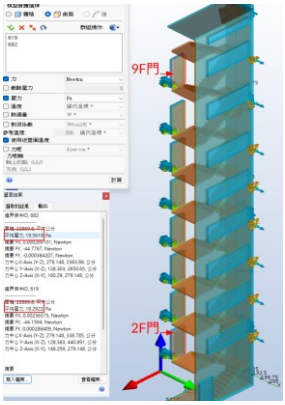
High-rise building fires often cause severe casualties due to smoke spread, with smoke inhalation being a primary cause of death. This study focuses on designing positive pressure ventilation (PPV) systems for stairwells to enhance fire safety and ensure smoke-free evacuation routes. Using Autodesk CFD with the k-epsilon turbulence model, the study simulates a 9-story building (30.6 m tall) to investigate the effects of air supply configurations, fan placements, and door-opening conditions on smoke control. Results show that insufficient stairwell pressure allows smoke to infiltrate via the stack effect, while adequate PPV maintains positive pressure, preventing smoke ingress and expelling it from fire floors. A multi-fan strategy stabilizes pressure without hindering door operation. Simulations confirm that adjusting fan flow rates (e.g., 300–330 CMM, 20–25 Pa) achieves target pressures (>12.5 Pa) in critical floors (e.g., 2nd and 9th). mechanical air curtains (air doors)—devices that blow a controlled stream of air across stairwell entrances—may help mitigate pressure loss during door openings. The findings validate PPV's feasibility for high-rise fire safety, offering practical guidance for architects and engineers to optimize ventilation designs, minimize fire risks, and enhance evacuation safety. Future research could explore varied building types and fire scenarios to refine sustainable safety strategies.



Fit 1: Simulation

	9F	8F	7F	6F	5F	4F	3F	2F	1F
install 3F 7F open 1F 150Pa	107.379	108.257	108.253	98.3696	93.7411	91.8969	80.7563	42.3484	6.67546
install 3F 7F open 1F 200Pa	142.7	143.927	143.723	130.431	123.982	121.497	106.561	55.8153	8.83103
install 3F 7F open 1F 4F 150Pa	71.4904	72.2211	68.9205	37.8312	15.4472	0	20.7868	10.6201	1.61013
install 3F 7F open 1F 4F 200Pa	92.4524	93.2316	89.2184	48.8865	20.076	0	27.9998	14.1505	2.17415
install 5F 9F open 1F 150Pa	118.417	112.39	108.255	105.88	95.7839	63.6453	40.457	22.1338	3.45213
install 5F 9F open 1F 200Pa	158.017	149.491	143.581	140.704	126.531	83.404	53.3088	29.1486	4.58853
install 5F 9F open1F 4F 150Pa	109.253	100.926	94.1985	89.8053	71.5589	4.31681	3.15329	1.78133	0.276681
install 5F 9F open1F 4F 200Pa	145.43	134.305	125.301	119.974	95.5647	5.78527	4.23503	2.36365	0.373386
Install air door(20Pa)									
install 5F 9F open 1F 150Pa	118.457	113.901	109.701	105.917	102.074	87.5087	64.0643	46.4023	13.9037
install 5F 9F open 1F 200Pa	156.281	149.566	143.724	138.014	132.306	112.252	79.6174	55.0996	15.4611
install 5F 9F open1F 4F 150Pa	104.999	94.3362	84.5132	75.1226	65.8243	7.31334	16.0583	13.554	4.19289
install 5F 9F open1F 4F 200Pa	147.7	131.754	115.335	98.4397	82.103	9.43158	22.5047	15.2454	3.91785
install 5F 9F open 1F 200Pa airdoor 50Pa	155.693	148.712	142.394	136.319	130.201	108.876	73.9441	46.8089	9.05478
install 5F 9F open 1F 4F 200Pa airdoor 50Pa	135.059	121.898	109.589	96.4683	84.8299	9.85953	19.4652	14.5136	4.11442
all door open airdoor 50Pa 150Pa	7.073	5.33359	2.66728	10.9318	5.40765	1.80831	0.270619	7.89377	23.3329
all door open airdoor 50Pa 200Pa	9.02243	8.23853	3.13787	5.15314	5.83851	2.80179	1.59713	8.34276	24.3839

Table 1: experimental data

Keywords: Positive Pressure Ventilation[1], High-Rise Buildings[2], Fire Safety[3],Computational Fluid Dynamics[4],Smoke Control[5]

[1] Man Li , Zihe Gao , Jie Ji , Kaiyuan Li (2018). Title of articleModeling of positive pressure ventilation to prevent smoke spreading in sprinklered high-rise buildings.*Fire Safety Journal*. *Vol 95, January 2018,* Pages 87-100.

[2] Chen, S. Y.(2013). *Smart green building on the Tropic of Cancer - Lantan Jingyuan*. Taipei: Architecture and Building Research Institute, Ministry of the Interior.Pages 97-10.

S03-04

Modification effect of silicate-based surface impregnation work by supplying various calcium auxiliary solutions to neutralized mortar

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There have been reported cases where the modification effect was not obtained when silicate-based surface impregnation materials were applied to mortar that was neutralized and lacked Ca $(OH)_2$.

In this study, we examine the modification effect of silicate-based surface impregnation work after supplying various calcium auxiliary solutions to neutralized test specimens.

The test specimens were neutralized from 28 days old, and the surface impregnation materials were applied at 56 days old. After the curing period, Vickers hardness tests and saltwater immersion tests were performed.

The results of the Vickers hardness test are shown in Figure 1. In the specimens supplied with calcium auxiliary solution, the Vickers hardness increased in the carbonation region, as in previous studies. The distribution of total chloride ion concentration in the pre-carbonated mortar is shown in Figure 2. In all specimens, the total chloride ion concentration tends to decrease in the carbonation region and beyond for those supplied with calcium auxiliary solutions compared to the control specimen.

When various calcium auxiliary solutions were applied to pre-neutralized mortar before the application of surface impregnation materials, the Vickers hardness and Cl^- penetration prevention properties improved.

Keywords: Silicate surface impregnation material[1], neutralization[2], calcium[3]

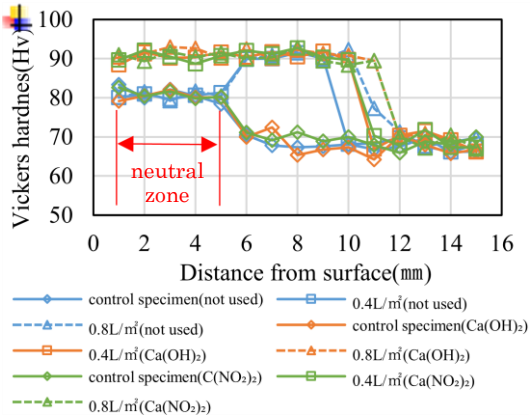

Fig. 1: Vickers hardness distribution.

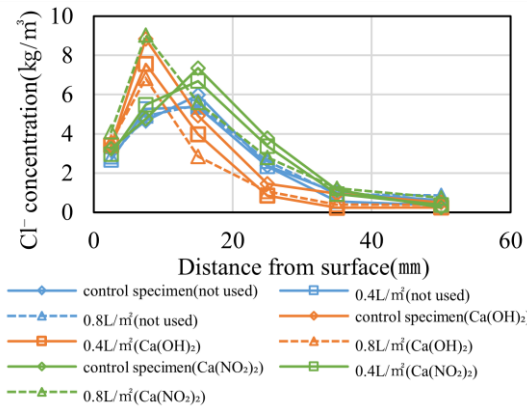

Fig. 2: Cl^- concentration distribution.

S03-05

Experimental study on the placement of portable blocks to improve flow conditions downstream of a weir

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Background In many downstream of weirs, issues such as riverbed scouring caused by increased water flow, and insufficient water depth required for the movement of aquatic animals such as salmon, have become problems. There is a demand for methods to improve flow conditions that are cost-effective and easy to apply.

Objective This study aims to develop a method for improving flow conditions by placing cost-effective portable blocks downstream of weirs. The study experimentally examines the effective arrangement of these blocks.

Methods A 1/10-scale weir model of the experimental site was installed in a tilted open channel experimental apparatus. The arrangement positions and the number of portable blocks required to appropriately increase downstream water depth were investigated. Additionally, the effects of the proposed portable block arrangement on the flow conditions downstream of the weir were analyzed through water depth and flow velocity distributions.

Results and Discussion Laboratory experiments indicate that the installation position shown in **Fig. 1** is the most effective for increasing water depth. The water depth distribution indicated that the water depth downstream of the weir under normal flow conditions was 9 cm, which does not satisfy the 10 cm depth required for upstream salmon migration. However, the installation of portable blocks increased the downstream water depth, fulfilling the depth requirements for salmon migration. From the flow velocity distribution, the flow velocity downstream of the weir during normal flow generally decreased. Notably, the flow velocity on the sides of the blocks, presumed as migration pathways, decreased, suggesting that the movement environment for aquatic animals such as salmon could be improved. During increased water flow, the flow velocity near the riverbed also decreased. This result indicates that the main flow has shifted from the vicinity of the riverbed toward the water surface. This shift effectively prevents riverbed erosion, suggesting that it contributes to the mitigation of riverbed scouring.

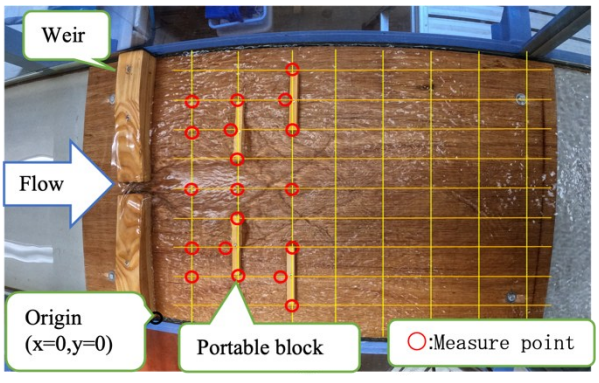

Fig. 1: Experimental equipment

Keywords: River crossing structures, Improvement of flow conditions, water depth

S03-06

Simulation Game Design for the Development of Modular Reusable Units in Circular Economy Strategies

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In the construction industry, the circular economy business model is gaining attention as a strategy for achieving sustainable development goals amid the increasing demand for sustainable industries. However, the process of cyclical utilization is dynamic, complex, and lengthy, marked by multiple uncertain changes. The evolution of modular architectural design, coupled with advancements in computer science and technology, introduces a novel research method emphasizing dynamic management concepts — educational game [1]. The game provides a fresh method for researchers and students to contemplate issues within the construction industry chain, enabling discussions about complex industrial cycle processes in a simplified setting and integrating potentially transformative teaching methods into the classroom.

To establish a conducive environment for a circular economy business model, this study investigates the circular process framework in the industrial system. It achieves this by creating a simplified model in virtual (Fig.1). And employing an initial scope definition and environmental prototype decision-making. This study elucidates the role of game-based learning in enhancing the feasibility of teaching, particularly within the context of circular economy education. It begins by examining the application of modular design principles within the game design framework, emphasizing the potential of reusable units to foster sustainable thinking. The research adopts a participatory approach, involving students in both the learning process and game testing phases. Incorporating modular, reusable elements in game-based learning can enhance engagement, conceptual understanding, and promote systems thinking aligned with circular economy strategies. Furthermore, a model database is constructed from the simplified model for reuse. By leveraging the creation of game learning tools, the study establishes the theoretical foundation of a circular economy for modular unit reuse. This model becomes a conceptual tool for promoting sustainable development in architecture.

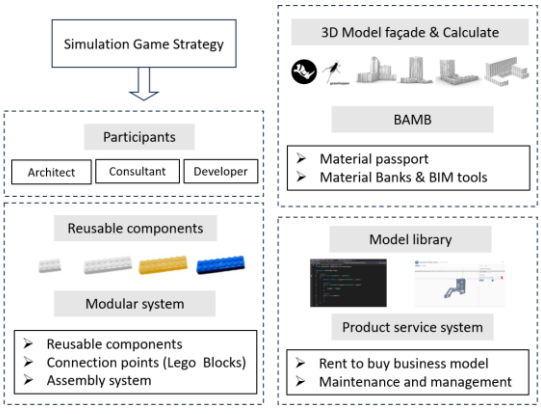

Fig. 1: Sample figure for abstract preparation.

Keywords: Game[1], Sustainable development [2], Modular unit [3] Building materials bank [4], Circular economy education [5]

[1] Peters, V., Vissers, G., & Heijne, G. (1998). The Validity of Games. *Simulation & Gaming*, *29*(1), 20–30. https://doi.org/10.1177/1046878198291003

S04-01

Preparation of electroconductive Nb- or Ta-doped α-Fe_2O_3 ceramics

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α-Fe_2O_3 (hematite) having a corundum-type structure becomes an n-type semiconductor when the material is doped with tetravalent metallic elements Ti, Zr, Sn [1–3]. The high-temperature thermoelectric properties were reported for α-$Fe_{2-x}M_xO_3$ (M=Ti, Sn) ceramics [3] and the figure of merit of 4.28×10^{-5} K^{-1} at 973K was reported for the $Fe_{1.94}Ti_{0.06}O_3$ ceramic [3]. It is worth expanding the research subject into α-Fe_2O_3 doped with pentavalent metallic elements to explore higher figure of merit. In this study, α-Fe_2O_3 ceramics doped with pentavalent metallic element of Nb or Ta are prepared, and the solubility range of Nb or Ta for α-Fe_2O_3 and the doping effect on the electrical conductivity at room temperature are revealed.

To prepare α-$Fe_{2-x}M_xO_3$ (M=Nb, Ta; x=0.00 – 0.15) ceramics, powder reagents of α-Fe_2O_3, Nb_2O_5, Ta_2O_5 (purity ≥ 99.9%) were weighed stoichiometrically and mixed with a small amount of ethanol in an agate mortar. The mixed powder was molded into a cylinder and fired at 1673 K for 1h in air-flow. Powder X-ray diffraction (XRD) patterns were measured for the fired bodies to identify the phases and estimate the lattice parameters of the corundum-type $Fe_{2-x}M_xO_3$. The electrical conductivity was measured at room temperature for the ceramics by direct-current four-probe method.

The corundum-type single phase has been obtained for the $Fe_{2-x}Nb_xO_3$ ceramics with x=0.00 – 0.05 and for the $Fe_{2-x}Ta_xO_3$ ceramics with x=0.00 – 0.04, respectively. Above these x values, secondary phases of $FeNbO_4$ and $FeTaO_4$ have been formed, respectively. It has been revealed that the lattice parameters a and c of the corundum-type structure increase almost linearly with increasing x in the both single phase regions, indicating that Nb and Ta are doped successively into the α-Fe_2O_3. It has also been revealed that the electrical conductivity at room temperature increases by about three-digits due to Nb or Ta doping with x = 0.01. Therefore, the pentavalent metallic element of Nb or Ta acts as an electron donor for α-Fe_2O_3 and the Nb- or Ta-doped α-Fe_2O_3 is a good candidate oxide to investigate the thermoelectric properties.

Keywords: Ceramics [1], α-Fe_2O_3 [2], Corundum [3], Doping [4], Electrical conductivity [5]

Acknowledgments: This work was supported by JSPS KAKENHI Grant Number JP24K08090.

[1] A. Tawfik, M. M. Barakat, M. A. Ahmed (1990), High semiconductivity of Ti-doped Fe_2O_3, *Interceram*, *39*, 40 – 41.

[2] D. Benjelloun, J. P. Bonnet, J. P. Doumerc, J. C. Launay, M. Onillon (1988), Anisotropy in the electrical properties of zirconium doped α-Fe_2O_3 single crystals, *Mater. Chem. Phys.*, *20*, 1 – 12.

[3] H. Muta, K. Kurosaki, M. Uno, S. Yamanaka (2002), Thermoelectric properties of Ti- and Sn-doped α-Fe_2O_3, *J. Alloys Compd., 335*, 200 – 202.

S04-02

Investigation of Conditions for Drug Membrane Fabrication in Pulsed Drug Release Device

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1. Introduction

In conventional drugs, the drug concentration reaches a maximum at a certain time, and then the drug concentration remains for a long time due to single stage. This creates a risk of resistance to the drug and makes the drug less effective. We propose a “pulse-type release device,” which consists of two layers of a barrier membrane and a drug membrane, and by adjusting the release of the drug in stages, we propose a drug device with no drug resistance.

In this study, lysozyme was added to the drug membrane as a model drug, and drug membranes were fabricated with various composition ratios in order to immobilize the drug.

2. Experimental

DMA and MMA were used as the main structure of the drug membrane, DVB was used as a cross-linker, and AIBN was used as an initiator, and various composition ratios were used to fabricate the drug membrane. Lysozyme was added at 0.5 wt% of the total weight during preparation, and polymerization was carried out in a water bath at a 2 of 80℃. The release ratio of lysozyme in both water and citric acid solution was examined to see if lysozyme was immobilized on the membrane, and this was used as an indication of immobilization.

3. Results and Discussion

We attempted to immobilize lysozyme, which is hydrophilic, by increasing the ratio of DMA, which has hydrophilic groups, from 72/28 and 65/35, which are the ratios of MMA/DMA that have been found in previous studies to be most likely to be used successfully in film formation. We also increased the concentration of DVB, a cross-linker, which we expected would increase the mesh structure and thus facilitate the immobilization of lysozyme in the mesh. The results suggest that a larger percentage of DMA and a higher concentration of DVB may reduce the release ratio of lysozyme. Therefore, lysozyme may be immobilized in membranes with a harder membrane structure and higher hydrophilicity.

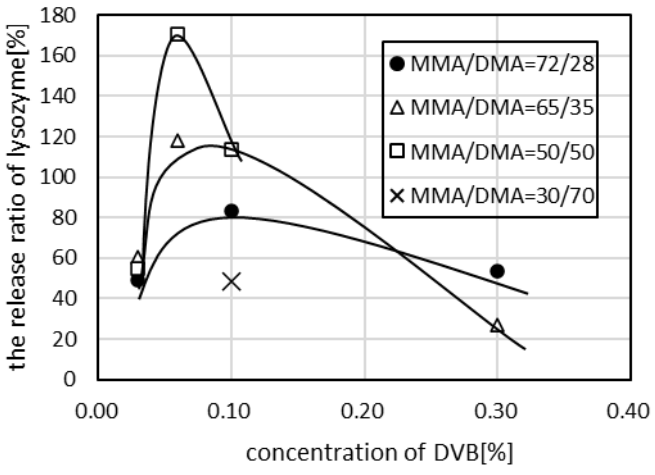

Fig.1 Effect of drug membrane fabrication conditions on release ratio

S04-03

Hydrogen Sulfide Production and Lithium Sulfide Synthesis Using Sulfate-Reducing Bacteria

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1. Introduction

Food waste is typically treated by anaerobic digestion, but sulfate ions present in the waste can lead to hydrogen sulfide (H_2S) generation by sulfate-reducing bacteria (SRB), which interferes with methanogenesis [1]. This study aims to utilize SRB to produce ~10% H_2S and apply the gas to synthesize lithium sulfide (Li_2S), a potential all-solid-state battery material, using a fluidized-bed reactor.

2. Methods

2.1 Cultivation of Sulfate-Reducing Bacteria

SRB were cultured in a 15 L reactor using sludge from a wastewater plant. Simulated food waste was tested under two conditions: without additive (Reactor A) and with sodium lactate (Reactor B). Sulfate salts were added, and temperature was maintained at 37°C. Generated gas was collected and analyzed for H_2S concentration.

2.2 Lithium Sulfide Synthesis

A fluidized-bed reactor was used to synthesize Li_2S by reacting lithium hydroxide with H_2S (90%) generated from ferrous sulfate and dilute sulfuric acid. Particle sizes of LiOH (90–250 μm) were separated, and reactions were performed at 150°C under nitrogen.

3. Results and Discussion

3.1 H_2S Production

H_2S concentrations reached 9.6% in Reactor A and 11.0% in Reactor B, achieving the target level. However, gas levels fluctuated, suggesting further optimization is needed.

3.2 Lithium Sulfide Yield

Li_2S was successfully synthesized (Table1). The highest yield (64.7%) was achieved using 90–100 μm LiOH particles, while other sizes showed lower efficiency (15–25%).

Table 1. Lithium Sulfide Synthesis Results by Particle Size

Particle Size [μm]	Li_2S [%]	Li_2CO_3 [%]	LiOH [%]
180–250	15.2	0.00	84.8
150–180	24.3	13.4	63.3
125–150	13.6	0.00	87.4
100–125	15.7	0.00	84.2
90–100	**64.7**	**0.00**	**36.5**

4. Conclusion

This study confirmed the potential of SRB-based H_2S production for food waste treatment and Li_2S synthesis. While ~10% H_2S was achieved, process stability needs improvement. Particle size strongly influenced Li_2S yield, highlighting the need for further optimization.

KeyWords: Hydrogen sulfide, Sulfate-reducing bacteria, Lithium sulfide

[1] J.Suh, M.Fukui, T.Yamagishi, Y.Urushigawa, T.Mori. (1993) Changes in Substrate Metabolism by Sulfidogens and Methanogens with Increasing Sulfate Load in Anaerobic Sludge, Journal of Japan Society of Water Environment, Vol 16, No.9, pp.645-651

S04-04

Quantitative Native Speciation of ppb-level Metals in Semiconductor-manufacturing-used Solvents

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ABSTRACT

The presence of metal species in solvents significantly affects production yields in the semiconductor industry, especially as the dimensions of integrated circuits continue to shrink. Therefore, it is crucial to control metal concentrations in solvents to levels as low as a few parts per billion (ppb) during fabrication processes. Effective purification methods are essential for removing various levels of contamination, and understanding the speciation of metals is key to achieving efficient purification. Conventional methods for the speciation of solution-phase metals include ion chromatography (IC) and ultraviolet-visible (UV-Vis) absorption spectroscopy. However, these techniques have limitations; for example, IC can inadvertently alter species during the elution process, while the need for high-purity parts per million (ppm) concentrations of metals in UV-Vis absorption spectroscopy can obscure the speciation of trace mixed samples. In this study, we present a quantitative speciation method for metals in their native states within strong acids and bases, utilizing breakthrough curve (BTC) theory alongside inductively coupled plasma-mass spectrometry (ICP-MS). Sodium, potassium, magnesium, calcium, iron, and copper serve as model systems for our investigations. The combination of BTC and ICP-MS provides insights into the species present and their respective abundances. Our findings indicate that breakthrough time (t_{BT}) is primarily influenced by the charge states and binding selectivity of the metal species, as well as the concentrations of competing binding species. In cases where the product of the adsorption equilibrium constant (K) and the concentrations of a species at equilibrium (C) is significantly less than one ($KC << 1$), t_{BT} becomes a critical metric for assessing metal species at trace levels. Using sodium (I) and magnesium (II) as representative examples, we found that t_{BT} is accelerated by factors of 5 and 25, respectively, when the concentration of the competing binding species ($[H]^+$ in this study) is increased five-fold. Additionally, we observed distinct species transformations for iron and copper, as indicated by altered t_{BT} in choline hydroxide solutions. Anionic iron complexes and neutral copper particles were inferred, supported by ion exchange and UV-Vis absorption spectroscopy measurements. Furthermore, the copper particles, potentially identified as $Cu(OH)_2$ or CuO, exhibited a size distribution ranging from 200 to 400 nm, with a peak at 300 nm, as characterized using particle analyzers. The advantages of the BTC theory-facilitated native quantitative speciation are expected to enhance informed decision-making for optimizing purification processes within the semiconductor industry.

Keywords: Native speciation; Breakthrough curve (BTC); Trace metal; Species transformation; Ion-exchange resin; Inductively coupled plasma-mass spectrometry (ICP-MS)

Reference:
Su, P.-J., Shen, C.-J.,† Leung, W.,† Chen, M.-H., **Lai, Y.-H.,*** Quantitative Native Speciation of ppb-level Metals in Semiconductor-manufacturing-used Strong Acids and a Base. *Talanta* **291**, 127819 (2025)

S04-05

Combustion Synthesis of MTA Cement and Effect of Fuel Ratio on Particle Shape

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Mineral trioxide aggregate (MTA) cement was developed for dental treatment material in 1990s, which has tricalcium silicate ($3CaO \cdot SiO_2$, C3S) as a main component[1]. To use MTA cement for dental treatment, it is required that the particle size is 50-10,000 nm and the shape is spherical [2,3]. In this study, we prepared spherical nano-sized C3S cement using combustion synthesis.

We prepared cement precursors by freeze drying an aqueous solution composed of silica sol (particle size: 450 nm) as the SiO_2 source, $Ca(NO_3)_2 \cdot 4H_2O$ as the CaO source and polyvinylpyrrolidone (PVP) as a fuel in combustion synthesis with various PVP/Ca ratio. The cement precursors were heated at 10°C/min up to 500°C for the combustion of Ca $(NO_3)_2$ and PVP, then calcined again at 1000°C to form C3S cement.

Powder XRD pattens show that C3S cement was obtained by post-calcination with the highest diffraction peak of C3S cement in a PVP/Ca ratio of 1 (Fig. 1). Figure 2 shows FE-SEM micrographs of the samples prepared in different PVP/Ca ratio. The samples were post-calcinated at 1000°C. Spherical grains of C3S cement were obtained using combustion synthesis with PVP/Ca ratio over 1. As a result, it was found that combustion synthesis obtains fine C3S cement for dental treatment, after calcination at 1000°C in a PVP/Ca ratio of 1.

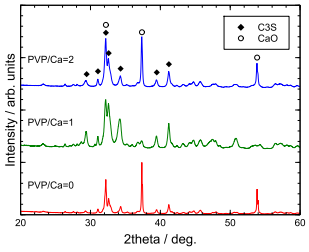

Fig. 1: Powder XRD patterns of samples in various PVP/Ca ratio.

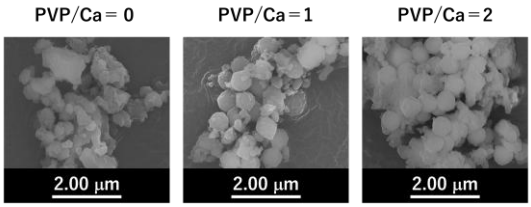

Fig. 2: FE-SEM micrographs of samples in various PVP/Ca ratio.

Keywords: MTA Cement, Combustion Synthesis, Polyvinylpyrrolidone

[1] O. Takashi, H. Linlin, S. Yoshimi, Y. Kunihiko, J Endod 33 (2012) 3–13.

[2] S. Sakamoto, K. Kimoto, T. Nakatsuka, US10307344B2, 2019.

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S05-01

Proposal of Defect Determination Method Using code2vec for Software Reliability Improvement

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Software reliability is required in various fields such as system control and medical IoT. Early detection and fixing defects are important issues for reducing effort and improving quality[1]. Although machine learning is often used to determine defects in the modern era, it has the problem of increasing computational cost and requiring a huge amount of training data when applied to real-time defect detection and large-scale projects. To solve these problems, this thesis proposes a method, as shown in Fig. 1 that divides source code into method units, generates vectors using code2vec[2], and uses the generated vectors as input to a neural network. To detect defects, we collect data before and after modification of code classified as bug labels from open-source projects on GitHub. From the collected data, a training dataset was created to determine the presence of defects by generating vectors using code2vec. The effectiveness of the proposed method was verified by training the created dataset using multiple models such as LSTM and CNN and verifying the accuracy. It was confirmed that the model with the maximum accuracy can detect defects with an accuracy of about 60%.

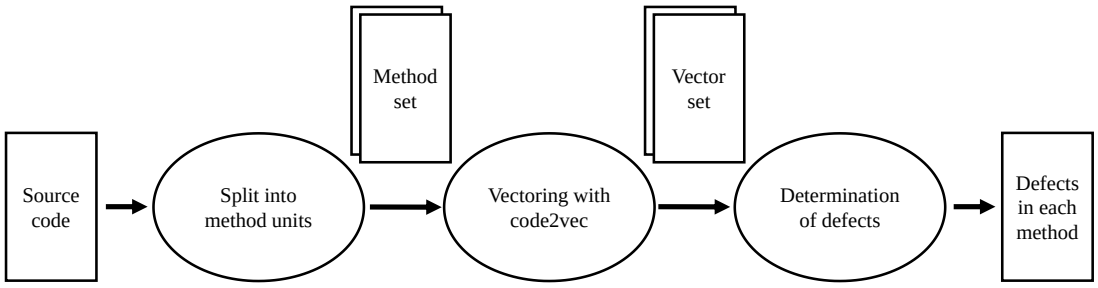

Fig. 1: Source code vectorization system configuration

Keywords: code vectorization, defect detection, machine learning, open-source data

[1] Kenjiro Asada (2008). “Causes of Quality Defects and Countermeasures in Software Development,” Master's Thesis, Kobe University, pp.26-27 (in Japanese).

[2] Uri Alon, Meital Zilberstein, Omer Levy, Eran Yahav (2019). “Code2vec:Learning Distributed Representations of Code,” Proceedings of the ACM on Programming Languages, Vol. 3, No. 40, pp.1-29.

S05-02

A Proposal for an Oversampling Method Using Causal Inference

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Recent technology advancements (e.g., AI, IoT) have underscored data science's importance. However, class imbalance remains a major issue in low-probability event data. Imbalanced datasets hinder machine learning performance, especially for minority classes, as models often overfit majority data, leading to biased learning.

In this study introduces an oversampling technique that utilizes causal inference method [1] to address this issue. Firstly, we estimate the average treatment effect using causal inference. Secondly, we apply the estimated effect to the majority class data. This approach aims to create diverse synthetic samples for the minority class, thereby improving class balance (Fig. 1).

To evaluate the effectiveness of the proposed method, we compare its performance with SMOTE by constructing binary classification models using LOO cross-validation as the evaluation metric. The average model accuracy across test data was used as the benchmark. Experimental results showed an approximate 5% increase in classification accuracy, though statistical significance was not achieved.

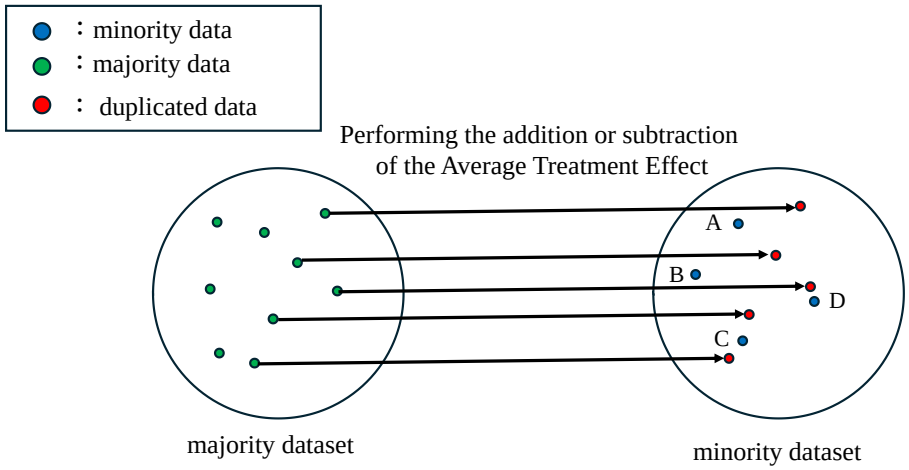

Fig. 1: Overview of proposed method

Keywords: average treatment effects, diverse synthetic samples, imbalanced datasets

[1] D.B.Rubin and G.W.Imbens, (2015) “Causal Inference for Statistics, Social, and Biomedical Sciences : An introduction,” Cambridge University Press.

S05-03

Research on Machine Failure Detection Technology in Factories

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In recent years, while labor-saving and automation have been promoted in factories, the number of machines managed per worker is increasing, potentially leading to a greater burden. Troubleshooting machine failures requires skilled technicians' experience, but their aging and the difficulty of skill transfer have become major issues. This study proposes a method to streamline machine fault detection to address these challenges.

Specifically, a supervised learning-based artificial intelligence (AI) model is developed using only normal sound data to automatically classify normal and abnormal machine sounds. The Wavelet transform is applied for feature extraction and visualization to clarify the time-frequency characteristics of machine sounds (Fig.1). These visualized outputs are used as input data to enhance anomaly detection performance. The publicly available DCASE2024 Challenge Task 2 dataset [1], containing real-world industrial machine sounds, is used for training. This method replaces manual inspection with AI-based classification, enabling the detection of subtle anomalies without relying on empirical knowledge. The ultimate goal is to reduce operator workload and support the resolution of skill transfer issues.

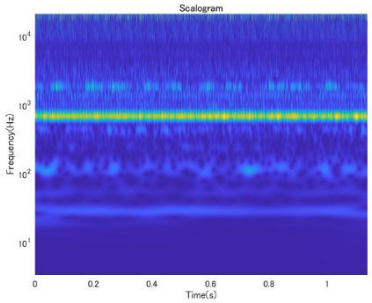

Fig. 1: Output result with wavelet transform

Keywords: machine learning, AI

[1] K. Toyoda, K. Nakamura, Y. Koizumi, K. Imoto, S. Tanabe, and N. Kawaguchi, "DCASE 2024 Challenge Task 2: Unsupervised anomalous sound detection for machine condition monitoring under domain-shifted conditions," in Proc. Detection and Classification of Acoustic Scenes and Events (DCASE) Workshop 2024.

S05-04

Instructions for Preparing Camera-Ready Abstracts for NNBAC2025 (Paper Title：Proposal of Method for Speeding Up Path Routing in Basic SPN Cipher.)

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There are two types of cryptography that are essential in modern society. One is secret key cryptography and the other is public key cryptography. Block ciphers, which are classified as secret key cryptography, are used for a variety of purposes, including email, file encryption, and VPNs. These block ciphers employ a structure in which the same round function is repeated in order to make the implementation cost efficient. And there are two types of block ciphers: the SPN structure represented by AES and the Feistel structure used in DES. Well-known cryptanalysis methods for this block cipher include linear and differential cryptanalysis.

To success these cryptanalyses, it is necessary to determine the encryption and decryption paths and calculate their probabilities. The Basic SPN cipher is a simple block cipher that takes a 16-bit input block and processes the block using four iterations of an elementary operation.[1] For linear cryptanalysis of Basic SPN cipher, we proposed earlier on the derivation of a linear approximation formula using path finding in the linear cryptanalysis method [2], where path finding is used to compute linear probabilities. Specifically, we showed how to find the maximum linear probability by path finding and derive its linear approximation formula. In the path finding, we take advantage of the sparse structure feature that there are many zeros in the deviation table. In this method, when multiplying the probabilities at each stage by piling up-lemma, the result of multiplying by 0 is 0. As a result, unnecessary search can be terminated in the middle of the path routing search, but it is time consuming to search the entire path routing.

Therefore, in this paper, we propose a method to make the route search faster than the previous method. Specifically, by creating a deviation table that excludes 0 in advance, the selection of routes is made more efficient. Furthermore, by selecting deviations based on the magnitude of the deviation values in the deviation table by weighted random extraction, routes with large deviations can be searched with priority. These ingenuities not only increase speed but also efficiency. Applying this method to an efficient secret key identification method in the differential cryptanalysis for Basic SPN cipher.[3] We were able to complete the route search within a finite time, faster than previous method.

Keywords: Basic SPN cipher, Linear, Differential, Cryptanalysis, Path routing

[1] Howard M.Heys1. (2002). *A tutorial on linear and differential crypt- analysis*, Cryptologia, Vol.26, Iss:3, pp189-221

[2] Takayuki Yamada. (2024). *Derivation of Linear Approximation using Path Planning in Linear Cryptanalysis to Basic-SPN*, Proceedings of the 86th National Convention of IPS, Vol.2024, No.1, pp481-482

[3] Yuuna Yoshimatsu, Takayuki Yamada. (2025). *Efficient Private Key Identification Method in Differential*

Cryptanalysis for Basic SPN cipher. Proceedings of the 87th National Convention of IPS. (forthcoming)

S05-05

A Study of Computational Complexity Reduction in Cryptanalysis for Enigma using SNLP.

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The Enigma, which means mystery in Greek, is a rotor-based mechanical encryption device used by the former German military in World War II.[1] The Enigma allows for a myriad of conversions by changing the selection of rotors, the order of the selected rotors, the initial position of the rotors, ring settings, reflector selection, and plug board wiring. The sheer number of ciphertext patterns produced by the Enigma made it difficult for the science and technology of the time to estimate all the initial settings that would be the secret key by a brute-force search. An alphabet of plaintext never enciphers to itself. Alan Turing was able to cryptanalysis the Enigma by using known cribs (portions of known plain texts) to narrow down the Enigma settings by Bombe [2], but it is not realistic to perform a brute-force search without any effort, because it would take an enormous amount of time even using a modern computer.

In this paper, we show that plugboard wiring is the element that critically increases the computational complexity based on the calculation of the number of combinations of each element, and we reduce the computational complexity by dividing it into encryption by plugboard wiring and before that. Specifically, since encryption by plugboard wiring corresponds to a maximum of 13 pairs of substitutions, if the settings other than plugboard wiring are correct, either plain text itself or substitutions of plain text are obtained, and the letters of the language used should appear.

Therefore, we used Statistical Natural Language Processing (SNLP), such as the index of coincidence [3] and fastText[4]. The index of coincidence is a linguistic statistic that evaluates the distribution of letters in a sentence, and since substitution is just the replacement of letters, plain text and substitution have the same index of coincidence. On the other hand, fastText is a natural language processing library developed by Meta (formerly Facebook) that uses a learning model based on shallow neural networks to output 157 language discriminations and their accuracy. Using these, settings other than plugboard wiring are decoded on a trial basis by brute-force search. Then, the match index of the decoded sentences is calculated and tested using statistics, and furthermore, fastText is used to sort out only the decoded sentences with accuracy above a set threshold that is determined to be the language used.

Finally, the time-consuming process of solving the plugboard settings is reduced by using substitution cipher techniques, such as letter frequency, bigrams and trigrams to reduce the overall computational complexity.

Keywords: Enigma, Plug board, Substitution, SNLP

[1] Enigma Machine, CIA (Central Intelligence Agency)
https://www.cia.gov/legacy/museum/artifact/enigma-machine/
[2] Neil SIGMON and Rick KLIMA, (2017), *The Turing Bombe and its Role in Breaking Enigma*, ATCM 2017, Invited Papers, No7
[3] William F. Friedman, *The Index of coincidence and Its Applications in Cryptanalysis*, (1996), Aegean Park Press
[4] Meta, TOOLS, FastText
https://ai.meta.com/tools/fasttext/

S05-06

Development of Script Generation Tools in the Development of Cluster Worlds

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With the advancement of VR technology, virtual space construction has become increasingly prevalent; however, building interactive environments still requires technical expertise, particularly in scripting for object control. To address this challenge, Ogawa developed a support tool for building virtual environments[1], and Inoue expanded this tool[2], enabling even inexperienced users to easily place interactive objects.

Nonetheless, scripting an essential aspect of virtual space development remains difficult due to its technical nature. This study aims to make scripting accessible to beginners by developing and evaluating a script generation tool called Jcreate. The tool allows users to generate JavaScript scripts for object control in the metaverse platform *Cluster* by selecting predefined actions and conditions without writing code manually. To evaluate its effectiveness, two experiments were conducted a controlled experiment comparing script creation time with and without Jcreate (Fig.1), and a user evaluation during an actual VR world development class (Fig.2). The results demonstrate that Jcreate significantly reduces script creation time and is highly effective in enabling beginners to work with scripts.

In conclusion, Jcreate lowers the technical barrier to scripting in VR world development of Cluster and enables novice developers to create and use scripts.

Fig. 1: Using Jcreate in an experiment

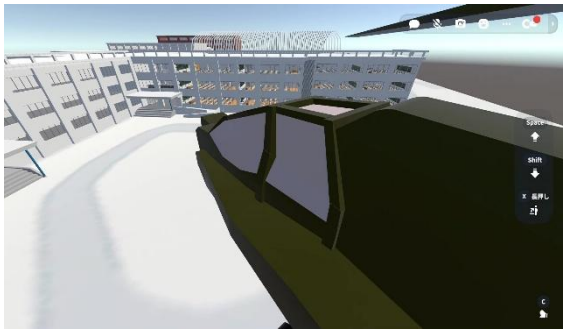

Fig. 2: A vehicle in Cluster with scripts created by Jcreate

Keywords: VR, cluster, education

[1] Naoki Ogawa (2022), Development of a Virtual Space Construction Support Tool, FY2021 National Institute of Technology, Matsue College Collection of research papers (in Japanese)

[2] Mami Inoue, Tsuyoshi Hashimoto (2024), Expansion of Virtual Space Construction Support Tools, The 7th NIT-NUU Bilateral Academic Conference 2024, pp.130, Miaoli, Taiwan

S05-07

Performance evaluation of AI using DreamerV3 in an FPS environment

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Recent advancements in game AI have enabled agents to outperform professional players in increasingly complex environments. Among these, first-person shooter (FPS) games are particularly valuable for AI research due to their high demands on real-time decision-making, spatial recognition, and strategic behavior—factors that closely resemble real-world robotic applications. In this study, we investigate the effectiveness of DreamerV3, a world model-based reinforcement learning algorithm, in training an AI agent for FPS tasks. Using DeepMind Lab, a 3D game platform developed by DeepMind, we constructed a free-for-all combat scenario where agents must defeat enemies to gain points within a time limit. The agent was trained for over 3 million steps and tested against enemies of varying difficulty. Its performance was evaluated by comparing scores with human players grouped by FPS experience (beginner, intermediate, advanced). Results showed that DreamerV3 outperformed advanced players against weaker enemies, while struggling significantly against stronger ones. Behavioral analysis revealed that while the agent learned efficient strategies in simple settings, it failed to respond properly to enemy presence in complex scenes [1] and often misidentified visual effects as enemies [2]. These findings highlight both the potential and current limitations of world model-based agents in FPS environments, and suggest future improvements through mixed-difficulty training, better visual processing, and reward function refinement.

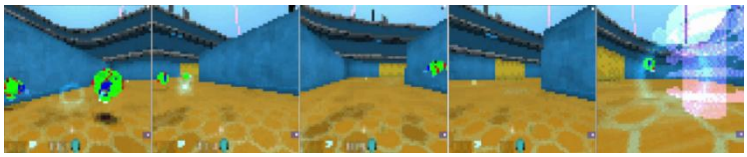

Fig. 1: A sequence of frames showing the agent failing to target an enemy. The frames are arranged chronologically from left to right.

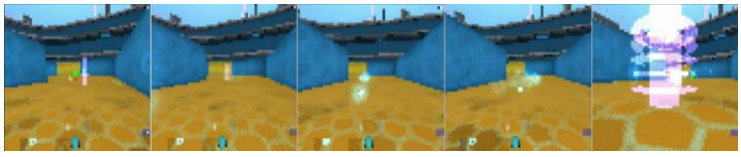

Fig. 2 : Scene against Enemy where the agent mistakes effects for enemies. The frames are arranged chronologically from left to right.

Keywords: FPS, reinforcement learning, World Model, DreamerV3

[1] Hafner, Danijar, et al. (2023) "Mastering Diverse Domains through World Models." *arXiv preprint* arXiv:2301.04104.

[2] Ha, David, Jürgen Schmidhuber, et al. (2018). "World Models." *arXiv preprint* arXiv:1803.10122.

S06-01

A Challenge in Wall Deformation Detection Using Particle Image Velocimetry Yuta NANBA[1+], Kazunori HOSOTANI[2]

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1. Introduction

Currently, in many municipalities in our country, predicting the lifespan and streamlining the inspection of aging infrastructure have become urgent tasks. Additionally, rapid inspections in dangerous locations, such as drainage channels or retaining walls at risk of collapse, require safer and simpler inspection methods in addition to existing survey techniques. This study proposes a unique detecting method for large deformed area on wall surfaces using a monocular camera and Particle Image Velocimetry (PIV) to extract such areas from videos taken while moving and capturing diagonal angles.

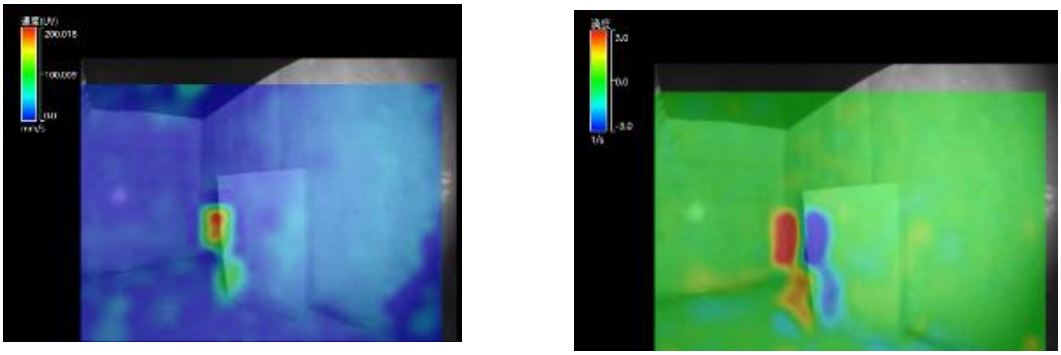
2. Experimental Method

A camera and light are mounted on a mobile robot, and the robot is driven through a field modeled to simulate a drainage channel, capturing video during movement. The camera is installed at a 45-degree angle relative to the wall surface, performing diagonal capture while the robot moves.

PIV analysis is performed on the captured images to obtain motion vector data [1]. In areas with deformations, velocity changes occur due to the principle of motion parallax. Vector computations are applied to analyze the velocity distribution, enabling the detection of surface irregularities. Instead of measuring the depth direction distance, the features of the wall surface shape can be understood using velocity contour maps and 3D plots.

3. Experimental Results

The results of the PIV analysis using the drainage channel field are shown in Fig. 4. The changes in velocity and rotation values in the deformed area indicate that areas with large block steps are detected.



(a) velocity (b) curl

Fig. 4: Deformed areas detected using curl analysis based on PIV data

[1]Hosotani, K., Simple Shape Detection of Wall Steps on Computer Graphics Based on Particle Image Velocimetry (PIV), *Proc. JSME annual Conference on Robotics and Mechatronics*, 2A1-B04, 2024.

S06-02

INDUCTOR-SWITCH SHARED HIGH VOLTAGE-GAIN, LOW INPUT-CURRENT RIPPLE DC-DC CONVERTER

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As the modern energy structure continues to evolve, the rapid advancement of renewable energy technologies has created a growing need for high-efficiency, high-gain DC-DC converters, especially in decentralized power generation applications like photovoltaic systems. The two-switch high-gain boost converter in [1] improves voltage gain but could further reduce switch count. In [2], ultra-high gain is achieved with one switch, but the use of many inductors increases EMI challenges.

This abstract proposes a novel converter design that achieves high performance and high gain by utilizing a switch and coupled inductor sharing structure, which greatly improves circuit integration. The proposed architecture shown in Fig. 1 combines an input-output inductor-coupled Ćuk converter with a multi-level boost converter. It ensures low switching voltage stress even under high voltage gain conditions, minimizes input inductor current ripple, and suppresses electromagnetic interference. The complete voltage conversion formula can be individually derived from the two sub-topologies and subsequently combined.

Fig. 2 shows the feasibility of the proposed converter through PSIM simulation for a 200 W output power. It can be observed that this topology is capable of achieving a high voltage gain conversion.

This work proposes a high-gain DC-DC converter with low switching stress and improved integration, verified by simulation at 200 W output power.

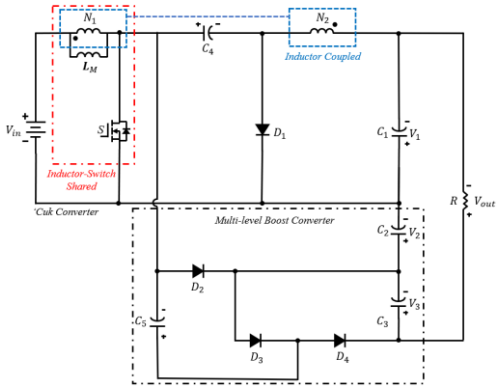

Fig. 1: Inductor-switch shared high voltage-gain DC-DC boost converter.

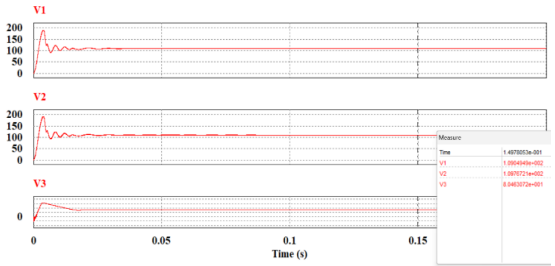

Fig. 2: Voltage across output capacitors C_1, C_2, and C_3 under an input voltage of 30 V.

Keywords: Inductor-Switch Shared, High Voltage Gain, Low Input-Current Ripple.

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S06-03

Performance evaluation of two small axial-flow fans in series

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1. Introduction

In recent years, small axial-flow fans are often used as devices to cool electronic equipment such as personal computers. When installing a fan inside a PC, the performance of the fan will be reduced due to the influence of the numerous electronic components installed inside the PC, so there is a need to improve the fan by adding or enhancing the fan to cool the inside of the PC. One solution is to install two fans in series. By installing two fans in series, the static pressure of the fans can be increased and the airflow can be sent farther. In this study, we used experiments and analysis to investigate the changes in the P-Q curve when two fans are installed in series in a small space inside a PC, and identified the fan spacing that provides the best performance.

2 .Experimental and analytical methods

The experiment is conducted using a double chamber system based on JIS standards (AMCA STANDARD 210-16). The test fan is a 40 mm square small axial-flow fan rated speed 6200 rpm). The test fans are installed in series, with distance intervals of 5 mm, 10 mm, and 15 mm.

For the analysis, a 3D-CAD model with different fan spacing is created, and analysis software (ANSYS Fluent) is used. Then, P-Q curves are created from the experimental and analytical results, and the fan performance is discussed.

3. Discussion

The performance evaluation is based on the maximum static pressure in the P-Q curve of the analytical and experimental results. Figure 1 shows the experimental results. The results are compared when there is a single fan and when the spacing between the two fans is 5 mm, 10 mm, and 15 mm. Note that only the experimental results are shown here. From Figure 1, the static pressure is highest when the fan spacing is narrow, 5 mm, and the maximum static pressure is about 1.4 times higher than that of a single fan.

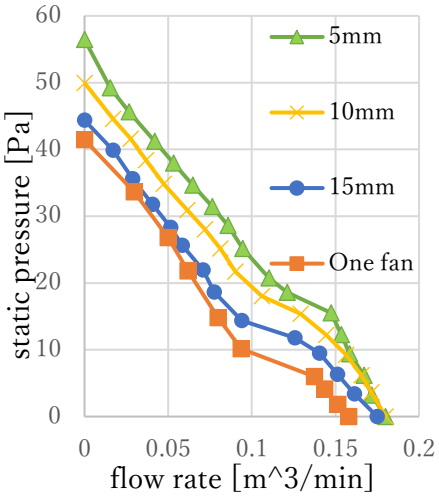

Fig.1: P-Q curve by experiment

Keywords: Axial-flow fan, P-Q curve, Fans installed in series

S06-04

Surface Plasmon Resonance Coupler-Based Detection of miRNA_125 via Optical Parameter Analysis

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ABSTRACT

A novel technique is proposed for characterizing the optical properties of miRNA-125 by using a surface plasmon resonance coupler sensor. The feasibility of the proposed technique is performed by measuring effective parameters, namely the orientation angle of the fast axis of linear birefringence, the phase angle of linear birefringence, the orientation angle of dichroism, the optical rotation angle, circular dichroism, and linear dichroism of miRNA-125 aqueous solution. The results show that the orientation angle of the fast axis of linear birefringence and circular dichroism property varies linearly with the miRNA-125 concentration, with a 69.41 fmol/L limit of detection (LOD). This technique provides a potential method for miRNA-125 detection and its application for early cancer detection.

Keywords: miRNA-125, Surface plasmon resonance, effective parameters.

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[2] Q.H. Phan, Q.T. Dinh, Y.C. Pan, Y.T. Huang, Z.H. Hong, and T.S. Lu, "Decomposition Mueller matrix polarimetry for enhanced miRNA detection with antimonene-based surface plasmon resonance sensor and DNA-linked gold nanoparticle signal amplification, " *Talanta*, vol. 270, p.125611, 2024.
[3] Q.H. Phan, Q.T. Dinh, Y.C. Pan, Y.T. Huang, Z.H. Hong, and T.S. Lu, "Antimonene-based surface plasmon resonance with antibody S9. 6 signal amplification for miRNA detection, *" Optics & Laser Technology*, vol. 171, p.110452, 2024.

S06-05

Fabrication and Evaluation of Aluminum Alloy Joints by Friction Stir Welding

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1. Introduction

Friction stir welding (FSW) is classified as a solid phase welding. FSW is considered to be highly reliable because of its small metallurgical structure and minimal strength loss in the joint. In recent years, FSW has become the most popular joining method for Al-Cu-Mg aluminum alloys in the fields of transportation and aircraft. In previous studies, FSW joining technology has been developed using a general-purpose milling machine with low equipment cost. In this study, a butt FSW joining technique was developed and the residual stress changes in the FSW material due to mechanical loading were determined by in-situ measurements. In this study, the joining condition of members, stirring distribution in the cross section, and residual stress state were investigated for overlay joining of aluminum alloys using the FSW joining technique.

2. Experimental Methods

The base materials used for the joints were A2017 material (Al-Cu-Mg system: hereafter A20 material) and A5083 material (Al-Mg-Mn system: hereafter A50 material). A general-purpose milling machine was used for FSW joining, and the joining conditions were a shaft speed of 775 [rev/min] and a table feed rate of 70 [mm/min], with thermal assistance (initial temperature of 200°C or higher) provided by heating using a gas burner. Next, samples were cut out of the fabricated joint material using a wire-cut electric discharge machine. The samples were evaluated by cross-sectional observation using a scanning electron microscope, Vickers hardness test and X-ray diffraction method.

3. Experimental results and discussion

The Vickers hardness distribution at the joint of A20/A20 and A50/A50 materials was 80-150 Hv for A20/A20 and 60-100 Hv for A50/A50. In both cases, the center of the joint tended to be 10 to 30 Hv harder than the base metal portion. Furthermore, the center of the A50/A20 dissimilar metal joint material was almost the same hardness as the A2017 base metal. Figure 1 shows the stirring condition of the A50/A20 material. In the A50/A20 material, there are many mixing regions in the jointed area, indicating that stirring is sufficient. Figure 2 shows the residual stress distribution in the A50/A50 material. In the raw material, compressive stress is distributed on the surface and tensile stress is distributed in the interior. However, after joining, the overall residual stress tends to be compressive.

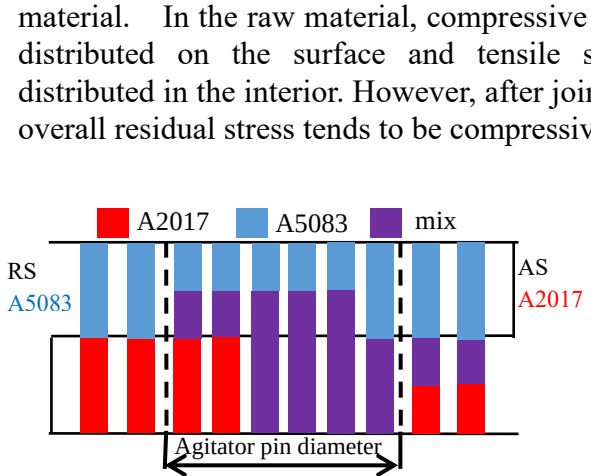

Fig.2 A50/A20 Mixing state

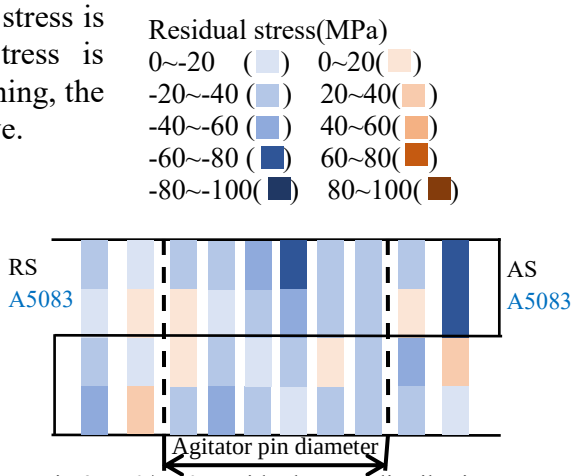

Fig.3 A50/A50 Residual stress distribution

S06-06

Optimized Format for all Types of Weather by Deep Learning-based Gramme Method for Unmanned Vehicle Control Signal Processing

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ABSTRACT

Nowadays, terms such as self-driving cars and artificial intelligence (AI) are frequently discussed and analyzed. In the near future, humans will gradually adapt to and further develop these technologies to support both work and daily life. Among these innovations, one of the most significantly developed applications will be in everyday transportation — particularly, automobiles. According to published sources, numerous methods are currently employed in autonomous vehicles to process signals and control vehicle operations on the road. These include GPS positioning, proximity sensors, Lidar and Radar sensors, and image recording devices such as cameras. Additionally, deep learning techniques are used to train vehicles based on existing data.

However, there are still many limitations due to factors such as geographical location, weather conditions, human behavior, and regional traffic safety regulations. These challenges pose considerable obstacles to the practical application of autonomous driving models. To address these issues, a method known as GRAMME has been introduced. This approach integrates all existing technologies into a cohesive, logically connected framework that is more practical and better suited for real-world applications. As a result, it offers a more promising outlook for the future of intelligent, flexible, and high-performance autonomous vehicles.

Keywords: Artificial intelligence[1] (AI)

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S06-07

Multi-View 3D Reconstruction with a Fixed Depth Camera: Trade-Off Between Sampling Density and Accuracy

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Three-dimensional (3D) reconstruction and inspection play a vital role in modern manufacturing automation, enabling precise measurement and quality control. Depth cameras such as the Intel RealSense D435i provide efficient and portable solutions for capturing spatial information. However, in fixed-camera configurations, challenges remain in achieving accurate and complete 3D reconstructions due to limited viewpoints and registration errors.

This study utilizes a fixed Intel RealSense D435i depth camera combined with a rotary platform to capture multiple point clouds of an object from varying angular positions. Each point cloud is transformed from the camera coordinate system to a unified world coordinate system using homogeneous transformation matrices that incorporate the camera's fixed pose and the object's rotation angle. The aligned point clouds are merged and compared to a reference CAD model in STL format. The mean registration error between the reconstructed point cloud and the CAD model is computed to assess reconstruction accuracy.

Results demonstrate that increasing the number of sampled views substantially reduces registration error initially. The error decreased from approximately 1.99 mm using 4 views to 1.58 mm at 36 views. Beyond 36 views, further improvements plateau, with the error reaching 1.46 mm at 360 views. These findings suggest that capturing 36 views at 10-degree intervals offers an optimal balance between accuracy and data acquisition efficiency in fixed-camera 3D reconstruction setups.

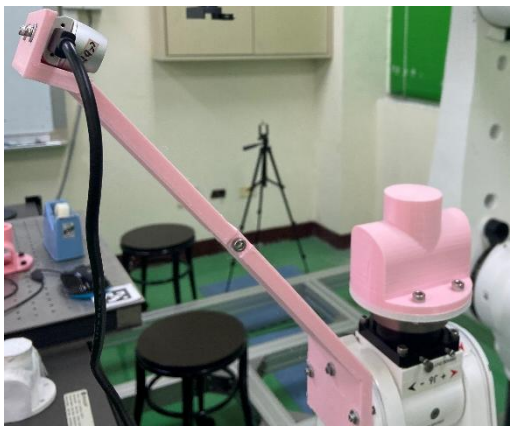

Fig. 1. Experimental Setup of the Depth Camera

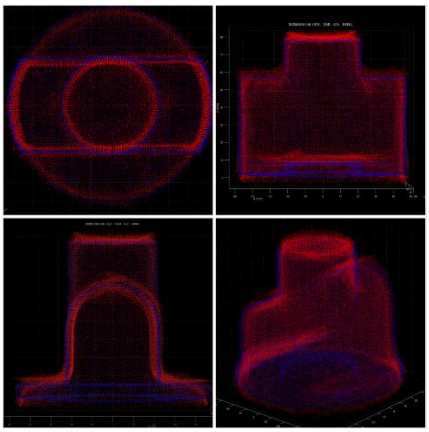

Fig. 2. Overlay of merged point cloud with CAD model

Keywords: depth camera, point cloud reconstruction, 3D scanning3

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S07-01

An Analysis of the Current Status and Empowerment of Female Environmental Protection Volunteers in Miaoli County

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Environmental protection can be seen as a spectrum—some individuals begin reducing carbon emissions by adopting a vegetarian diet, others by cutting down on plastic use, and still others by striving for a zero-waste lifestyle. There is no single superior approach or quantity when it comes to serving as a female environmental protection volunteer; the willingness to take the first step is itself an act of environmental friendliness.

According to General Recommendation No. 34 of the CEDAW Convention, structural environmental barriers faced by rural women should be addressed by providing access to education, employment, water and sanitation facilities, and enhancing their economic empowerment. In addition, Article 5 of the Convention emphasizes the elimination of gender-based biases and customary practices that assign hierarchical roles to women and men.

In this context, women in Miaoli County have increasingly participated in community public affairs through environmental volunteerism, and many have become local leaders. The number of female team leaders receiving “Outstanding Awards” has increased year by year.

This study adopts five theoretical frameworks—Needs Satisfaction Theory of Volunteering, Altruism Theory, Utility Theory, Human Capital Theory, and Exchange Theory—to analyze the motivations and participation of female environmental protection volunteers. A mixed-methods approach, including surveys and in-depth interviews, was employed to explore the current status and empowerment processes of female environmental volunteers across the 18 townships in Miaoli County. Based on the findings, this study proposes relevant recommendations.

Keywords: CEDAW Convention, Environmental Volunteer, Volunteering, Women's Empowerment in Environmental Action

S07-02

KOSEN Global Camp in Suo-Oshima
- Practical learning towards achieving the SDGs in an island environment -

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We believe that it would be effective toward the SDGs to establish a system that allows technical college students to take courses only in English, like international students taking the education, and to foster internationalism. This will help them acquire practical language skills and become human resources who can play an active role globally. To promote this, National Institute of Technology (KOSEN), Oshima College has implemented the "KOSEN Global Camp.

It was held from September 8 to 14, 2024, with a total of 30 participants (15 from Japan and 15 from overseas). It provided an opportunity to learn the importance of partnership when rowing the oars in accordance with the command in the cutter training, the importance of the marine environment by experiencing rescue activities in the rescue training using a water motorcycle, and the cooperative skills and practical communication by sharing meals and sleeping together for two days on the training ship "Oshima Maru". The students also had the opportunity to learn about cooperation and practical communication through a variety of other programs.

This program provided a valuable opportunity for the participating students to deepen their international knowledge. Fig. 1 shows the self-evaluation questionnaires of the participating students before and after the Camp. In addition, domestic students showed an interest in learning English, and their communication and teamwork skills seemed to have improved slightly.[1]

Fig.1: Pre-and post- Camp self-assessment (all students)

[1] Jongdoc Park (2024). *37 [Oshima] KOSEN Global Camp Initiative report.* Oshima College.

S07-03

Intergenerational Differences in Pharmacy Selection: An Empirical Analysis of Preferences Between Conventional and Chain Pharmacies Among Younger and Older Adults

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Taiwan's aging population and the impact of the COVID-19 pandemic (2020-2021) have increased demand for epidemic prevention products and health supplements. By 2023, the number of pharmacies in Taiwan reached 10,782, nearly matching the convenience store chains in the country (Ministry of Finance. R.O.C., 2024). In addition, the business models of pharmacies have diversified, and store designs have modernized, attracting greater consumer attention. The trend of chain pharmacy expansion has become increasingly evident. This study purpose is to understand the emergence of chain pharmacies and the coexistence of conventional pharmacies in Taiwan, and the factors related to the choice of pharmacies between the elderly and young people, in order to provide reference and suggestions for the future development direction of the role and management of pharmacies.

This research aims to identify and compare the factors influencing the selection between conventional and chain pharmacies among younger and older adults. The objects of this study are the 90 students of NUU in Taiwan. The semi-structural question is "What factors influence your decision to visit a conventional pharmacy versus a chain pharmacy?" The students completed the questionnaire and interview with an individual over the age of 50. The text data are through the systematic classification process of coding and identifying themes. Co-researcher is coordinated to review and check the concept of data as a requirement for rigor.

Among students, 82% prefer chain pharmacies, while 12% opt for conventional pharmacies. In contrast, 50% of older adults choose chain pharmacies, and 50% select conventional pharmacies. Factors influencing students' preference for chain pharmacies include proximity (53%), variety (50%), service attitude (30%), discount promotions (27%), and pharmacist expertise (23%). Factors influencing older adults' preference for conventional pharmacies include proximity (24%), pharmacists' familiarity with their personal health conditions (21%), and a sense of personal connection or warmth (18%). Factors influencing their preference for chain pharmacies include pharmacist expertise (29%), variety (29%), and proximity (24%). The study suggests that chain pharmacies should enhance their understanding of customers' health conditions and strive to create an environment characterized by warmth and personal connection.

Keywords: Conventional Pharmacies, Chain Pharmacies, Consumer Decision-Making

S07-04

Transitioning from Individual to Organizational Support for Students with Special Educational Needs at National Institute of Technology, Kochi College (NIT, Kochi): A Challenge Toward Creating a New School Culture

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At NIT, Kochi , support for students with special educational needs has until recently been built around classroom teachers, who collaborate with school counselors and school social workers. However, the quality and methods of support varied depending on the teacher, and there was insufficient accumulation of organizational knowledge and skills. Furthermore, in recent years, there has been an increasing number of students experiencing difficulties due to developmental disabilities and other challenges, making the establishment of a more systematic approach an urgent issue.

Under these circumstances, since December 2023, with the hiring of "Special Support Staff" (now known as "Ability Coordinator (specialist who facilitate the integration of diverse talents within school culture)"), NIT, Kochi has made progress in accumulating and systematizing support practices. As a result, the job responsibilities of "Ability Coordinator" have been clarified, extending beyond the previous role of Special Support Staff to explore comprehensive support approaches. Additionally, an organizational structure has been established to provide consistent support systematically.

Moreover, the achievements gained during this year-and-a-half process extend beyond enhancing organizational support. As the concept of the "social model of disability" has become more widely recognized in society due to recent advances in disability studies and first-person research, the difficulties faced by people with disabilities are being reframed as arising from social interactions. Indeed, the support practices have also undergone a process of opening up the school environment toward various abilities and possibilities, rather than merely "resolving the difficulties experienced by individuals." This report examines the series of reform processes and their outcomes at NIT, Kochi, positioning these initiatives as a challenge toward constructing a new school culture.

S07-05

The Two-Way Mirror Between Virtual Reality Exhibitions and Physical Exhibitions in Museums: A Case Study of the Taiwan Hakka Museum

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The rise of digitalization and globalization has made online virtual reality exhibitions an important channel for promoting cultural assets. The Taiwan Hakka Culture Museum has actively integrated virtual technologies alongside physical displays, reflecting the trend of digital-physical convergence. This study examines the complementary relationship between virtual and physical exhibitions, and explores their impact on cultural dissemination and visitor experience.

This study aims to explore the complementary or substitutive relationship between physical and online virtual reality exhibitions on the same theme, analyzing their impact on future exhibition formats and cultural dissemination. Using the Taiwan Hakka Museum as a case study, it investigates whether virtual exhibitions enhance audience interest in and attendance at physical exhibitions, and whether the two formats can offset each other's limitations to strengthen cultural presentation and improve visitor experiences. The findings will offer practical insights for museums integrating digital and physical exhibitions.

This study adopts four methods: participant observation, in-depth interviews, grounded theory, and questionnaire surveys to comprehensively collect data on the Taiwan Hakka Museum's digital strategies. Through observing on-site interactions, conducting interviews to understand needs and challenges, applying grounded theory to analyze the relationship between exhibitions and visitor behavior, and using surveys to quantify participation patterns and satisfaction, the study aims to explore the integrated effectiveness of online and physical exhibitions.

In response to digital trends, the Taiwan Hakka Museum has advanced the development of virtual exhibitions to complement and extend physical displays. By carefully distinguishing the content of each format, the museum aims to preserve visitor motivation for on-site visits. Curators are also encouraged to enhance their familiarity with digital exhibition methods, selecting appropriate themes to strengthen visitor immersion and optimize the integration of virtual and physical experiences.

This survey gathered data from 137 respondents, mainly young, highly educated individuals. Most of them visit museums out of interest in exhibition themes and value the sensory appeal of physical exhibitions. Online virtual exhibitions are also recognized for their educational value, interactivity, and ability to complement in-person visits. Overall, there is strong support for integrating online and physical formats. Key suggestions for online exhibitions include enhancing interactivity, enriching content, improving user experience, and increasing promotion.

S07-06

Toward Comprehensible Reform: Applying Input Theory to English Education in Japanese Higher Education

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Abstract

Despite ongoing reforms, Japan's English education system continues to struggle in fostering practical communicative competence, particularly in higher education. Students often complete secondary education without the proficiency needed for academic or global professional contexts, due in part to an overemphasis on output activities and insufficient exposure to meaningful English input. This paper examines the relevance of Input Theory—especially as proposed by Stephen Krashen [1]—for reforming college-level English instruction.

Institutional surveys and classroom observations at technical colleges reveal several persistent challenges: limited class hours, inadequate input-based instruction, [2] and a focus on productive skills before learners have built receptive competence. These issues are exacerbated by low institutional awareness of the foundational role of comprehensible input in second language acquisition.

To improve learner outcomes, we propose increasing input-rich learning through extensive listening and reading, expanding English class hours, and training instructors in input-oriented pedagogy. [3] These measures are designed to be achievable within the constraints of technical higher education institutions.

Prioritizing comprehensible input is essential for enabling students to develop real-world English proficiency. Aligning educational practice with established acquisition theory offers a viable path to more effective English education in Japan.

Keywords: Reform of English Education in Japan[1], English Language Teaching Research[2], Input Theory[3], Higher Education[4], Comprehensible Input[5]

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S07-07

Exploring the Influence of Sense of Place on Tourists' Place Attachment and Sustainable Behavior in Taipei ： The Moderating Role of Environmental Attitude

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This study investigates how tourists' sense of place influences their emotional attachment to Taipei and their sustainable behavioral intentions. Additionally, it examines how environmental attitude moderates the relationship between sense of place and place attachment. Taipei, as a destination, offers a distinctive blend of historical depth and modern urban culture—exemplified by areas such as Dadaocheng, ancient city gates, temples, and contemporary cityscapes—which collectively contribute to forming a unique sense of place for visitors.

While previous research has emphasized Taipei's physical tourism resources and marketing strategies, there remains a gap in understanding the psychological and emotional mechanisms through which tourists develop meaningful connections to the city and adopt sustainable behaviors. This study seeks to address this gap by employing the Stimulus-Organism-Response (S-O-R) theoretical framework. In this model, the sense of place functions as the external stimulus, the organism represents the internal emotional response (i.e., place attachment), and sustainable behavior serves as the resulting response. The research further introduces environmental attitude as a moderating variable that may enhance or weaken the pathway between stimulus and organism.

Empirical data will be collected using a structured questionnaire targeting individuals who have visited Taipei. Data analysis will be conducted via **Partial Least Squares Structural Equation Modeling (PLS-SEM) to test the hypothesized relationships. It is anticipated that sense of place will positively influence place attachment, which in turn will positively impact sustainable behavior. Furthermore, tourists with stronger environmental attitudes are expected to exhibit a more pronounced connection between sense of place and place attachment.

This research not only contributes to a theoretical understanding of tourist behavior but also offers practical insights for urban and cultural tourism development in Taipei. It highlights the importance of deepening tourists' experiential engagement, fostering emotional bonds with destinations—even during short visits—and promoting environmentally responsible behavior. The findings aim to assist tourism stakeholders in enhancing destination appeal, reinforcing sustainable practices, and increasing Taipei's global tourism competitiveness.

Keywords ： sense of place, place attachment, sustainable behavior, environmental attitude, S-O-R theory, urban tourism, Taipei

S08-01

Synthesis of Carbazole-Based Bifunctional Hole-Shuttle Interlayer

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In this study, a series of carbazole-based compounds were designed with two 4,4'-dimethoxy-diphenylamine (DPA) moieties and grafted with alkyl chain lengths from 1-bromobutane (C4), 1-bromodecane (C10), and 1-bromocetane(C16). The as-formed C4-DPA, C10-DPA, and C16-DPA structures were studied for the hole-shuttle interlayer of solar cells. According to the synthetic routes, 3,6-dibromocarbazole (1.39 g, 4.2 mmol) and K_2CO_3 (1.10 g, 8.0 mmol) were mixed together in a flask bottle containing 25 mL of DMF. After the excess addition of C4, C10, or C16 in 2ml, the solution color was oberved from transparent to pale yellow. It shows the protonation and substitution of the 3,6-dibromocarbazole molecular. The reaction temperature and time is 110°C and 16 hours, respectively. The crude product was extracted from ethyl acetate and deionized water in three times. Then, the target product C4-Br, C10-Br, and C16-Br was separated from column chromatography, resulting in a white powder with a yield of 90% above.

[1] Yuan-Yu Chiu, Shih-Hsuan Chen, Kun-Mu Lee, Tz-Feng Lin, Ming-Chung Wu. Side chain modulated carbazole-based bifunctional hole-shuttle interlayer simultaneously improves interfacial energy level alignment and defect passivation in high-efficiency perovskite solar cells. *Chemical Engineering Journal*, 2023, 477, 147208.

[2] Wen-Feng Lai, Yu-Chih Chiang, Jiun-How Yueh, Tz-Feng Lin, Jih-Hsin Liu, Ying-Nan Lai, Wen-Hsuan Lai, Wei-Chou Hsu, Chia-Yi Huang. Effect of Platinum Ribbons on Photoelectric Efficiencies of Dye-Sensitized Solar Cells. *Coatings*, 2023, 13, 705.

S08-02

Hydrothermal Synthesis of Spherical Er^{3+}-Doped β-$NaYF_4$ Nanophosphors

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Upconversion luminescent Er^{3+}-doped nanophosphors, which emit visible light when irradiated with near-infrared light [1], are expected to find applications in anti-counterfeiting inks and fluorescent bioimaging techniques. For practical use, the particle shape should be spherical, and the crystalline phase should be β-phase for excellent luminescence [2]. In the conventional soft solution process, spherical α-particles are prepared at room temperature, followed by a phase transition to β-particles by hydrothermal synthesis. However, the particles often grow into rod-shaped crystals [3].

To prevent this, oleic acid, which covers the particle surface to prevent crystal growth, is added as a capping agent, but the effect has been limited. In this study, we modified hydrothermal process of conventional one-pot method to synthesize spherical β-phase particles.

First, we prepared α-phase particles using soft process at room temperature. Next, we removed unreacted components in the solvent before hydrothermal process. The samples were characterized by powder X-ray diffraction (XRD), photoluminescence (PL) measurements, and scanning electron microscopy (FE-SEM). The results showed that we successfully obtained spherical β-phase $NaYF_4:Er^{3+}$ nanophosphors with comparable luminescence intensity to that of rod-shape β-phase nanophosphors prepared using conventional method.

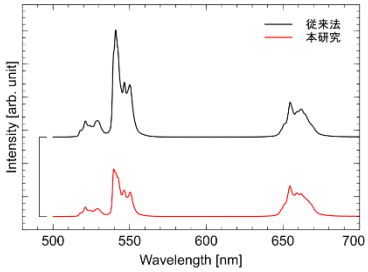

Fig. 1: Upconversion emission spectra of samples prepared using conventional (upper) and modified (lower) hydro-thermal synthesis (excited at 980 nm).

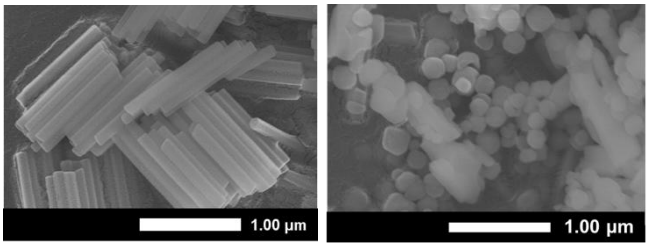

Fig. 2: FE-SEM micrographs of samples prepared using conventional (left) and modified (right) hydrothermal synthesis.

Keywords: upconversion emission, hydrothermal synthesis, nanophosphor

[1] S. Li et al., *Int. J. Nanomedicine* **15** (2020) 9431–9445.
[2] T. Konishi et al., *J. Mater. Sci: Mat. Electronics* **18** (2007) 183–186.
[3] R. Zhou et al, *Opt Mater. Express* **6** (2016) 1313 − 1320.

S08-03

Investigation of Microplastic Pollution in Coastal Areas of Yamaguchi Prefecture

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1. Introduction

Microplastics have been ingested by marine organisms such as sea turtles and seabirds, causing adverse health effects [1]. Yamaguchi Prefecture, surrounded by the Seto Inland Sea, Hibiki-nada, and the Sea of Japan, offers a diverse coastal environment. Our previous surveys revealed regional differences in microplastic pollution, with significant accumulation in the Nagato area. This study aims to analyze the number, weight, and composition of microplastics at 32 beaches in Yamaguchi Prefecture and to design a cyclone-type separator for robotic collection.

2. Methods

At each site, sand was collected from three 1 m² quadrats, and microplastics were separated using sieves (4.75 mm, 2.00 mm, 0.85 mm). The number and weight of particles were measured, and sand grain size distribution was assessed. For composition analysis, samples were treated with hydrogen peroxide and analyzed using FT-IR spectroscopy with ATR. A small cyclone-type separator was designed based on material properties and tested using sand mixed with known quantities of microplastics.

3. Results and Discussion

Microplastic accumulation was highest in the Nagato region and along the Sea of Japan coast (Fig.1). FT-IR analysis showed polypropylene was the most common polymer (16.8%). Expanded polystyrene was notably abundant in Tabe (30%), likely due to fragmentation from wave action. The cyclone separator effectively discharged sand but failed to separate microplastics, indicating insufficient suction power and the need for design improvements.

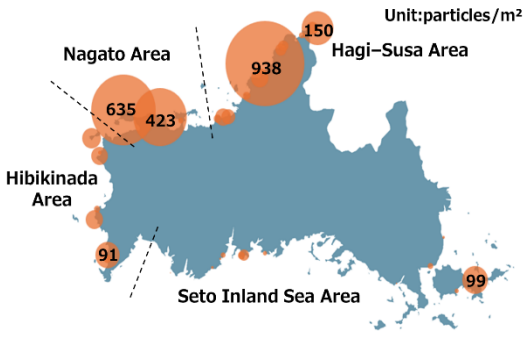

Fig.1Comparison of Average Microplastic Abundance per Unit Area on Beaches in Yamaguchi Prefecture (2021–2024)

4. Conclusion

The study confirmed regional variation in microplastic pollution, with notable accumulation in northern coastal areas. The cyclone separator showed potential but requires enhanced suction to effectively collect microplastics.

KeyWords: Microplastics, Beach pollution, Cyclone separator

[1] Science Council of Japan. (2020). The pollution of water environment by microplastics: The need for research on ecological and health effects and the governance of plastics. Subcommittee on Environmental Risk, Health and Life Science Committee & Environmental Science Committee.

S08-04

Effect of Slug Interfacial Area on Reverse Micellar Extraction of Proteins Using Microchannels

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1. Introduction

The main industrial separation techniques for biochemical substances such as proteins and enzymes are chromatography and electrophoresis. However, these methods have the disadvantage of requiring time and cost due to the processing of small quantities. In order to solve this problem, we are studying the combination of microchannels, which have a very large interfacial area and rapid diffusion, and reverse micellar extraction, which is a low-cost solvent extraction method using surfactants.

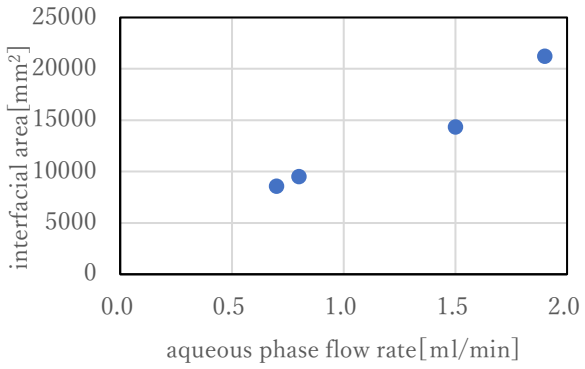
In this study, we investigated the effect of the interfacial area of the slug flow formed in the microchannel on the protein extraction ratio.

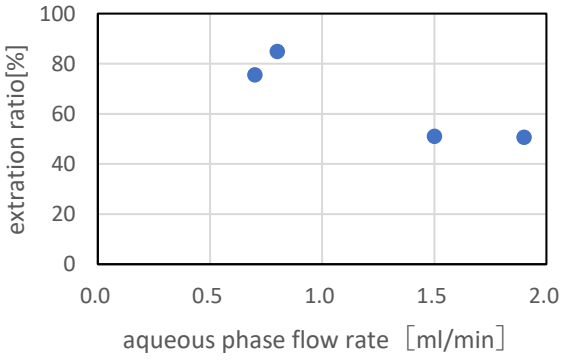
2. Experimental

KCl aqueous solution with lysozyme and AOT isooctane solution were prepared, and reverse micellar extraction of proteins by microchannel was performed for a given time and at an any flow rate. After the operation, the organic and aqueous phases were separated, and the concentration of lysozyme was determined by UV-vis spectrophotometer, and the extraction ratio was calculated. The oil-water interfacial area was determined from the shape of the slug flow formed.

3.Results and Discussion

The flow conditions, the number of slugs, interfacial area, residence time of slug in the channel, and extraction ratio were examined. As shown in Fig. 1, the interfacial area increased when the aqueous phase flow rate was increased due to increasing of the slug. However, the residence time of slug in the channel decreased with increasing the aqueous phase flow rate, and the extraction rate decreased as shown in Fig. 2. Thus, it is necessary to balance the increase in interfacial area and residence time in order to increase the extraction ratio.





S08-05

Electron transfer in methyl ester-substituted aromatic monolayers on gold surfaces probed by soft X-ray spectroscopy

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Molecular-scale control of electron transfer at metal-organic interfaces is essential for the development of nanoscale electronic and energy devices. We employed soft X-ray spectroscopy to investigate the electron transfer processes occurring at the condensed film interface between methyl ester-substituted aromatic molecules and gold nanoparticles (AuNPs).

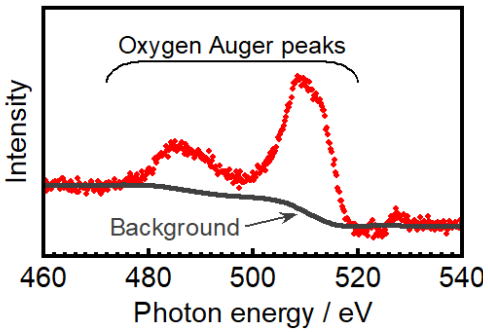

Fig. 1: Auger electron spectrum of the molecular films on AuNPs. The black line represents Shirley background.

As shown in Fig. 1, the oxygen 1s Auger electron spectrum of the molecular films on AuNPs was measured. By applying the core-hole clock method to the spectra, electron transfer time was determined without relying on time-resolved techniques. The electron transfer times observed for the molecular films on AuNPs were found to be comparable to those for SAMs on flat gold substrates, indicating that the electron transfer mechanism remained consistent regardless of the film morphology.

Keywords: Soft X-ray spectroscopy[1], Self-assembled monolayer[2], gold nanoparticle[3]

[1] Tendo, S., Niozu, A., Yoshioka, K., Tabuse, M., Adachi, J., Tanaka, H., & Wada, S. (2025). Comparative study of electron transport through aromatic molecules on gold nanoparticles: insights from soft X-ray spectroscopy of condensed nanoparticle films versus flat monolayer films. Phys. Chem. Chem. Phys. 27, 388. doi: 10.1039/D4CP03556A

S09-01

Improving a Social Implementation Education Program in Collaboration with the Local Community

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At National Institute of Technology, Kochi College, the goal of fostering human resources who can contribute to society through social implementation education is pursued in collaboration with the local community. Key challenges include facilitating collaboration with remote areas and strengthening entrepreneurship education.

By utilizing ICT, the program aims to expand its activities across all of Kochi Prefecture, encouraging students and faculty to work together to solve regional issues. This approach is intended to broaden students' perspectives and increase their interest in local communities through collaborative learning with local businesses, governments, and community organizations.

From the 2024 academic year, a course titled “Regional Collaborative Practice” was made mandatory, with activities extended throughout the prefecture. The program collaborates with a variety of organizations and invites companies and municipalities engaged in problem-solving to participate. A cross-disciplinary support system beyond general and specialized subjects was also established to facilitate broader student learning and collaboration.

In 2024, 17 local organizations, including businesses and administrative bodies, provided project themes. Of the 40 student teams, 28 collaborated with external groups, tackling issues in mountainous and remote areas. A final presentation event was held, attended by students and external stakeholders, providing an opportunity to deepen understanding of local issues. The number of students aspiring to earn the “Regional Revitalization Promoter” certification also increased as a result.

These initiatives have fostered students' awareness of regional contribution and supported the development of local innovators who will play key roles in the future of their communities.

Fig. 1: Remote discussion and work shop event

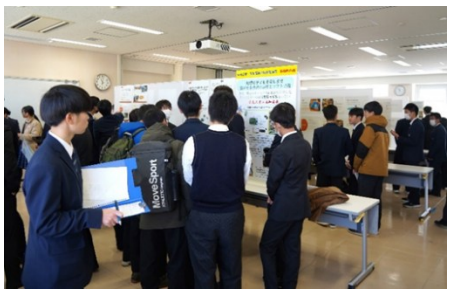

Fig. 2: Final presentation

Keywords: Regional collaboration, Entrepreneurship, ICT solution, Social Issues

S09-02

A New Mode of Micro-Residency Tourism: A Case Study of Taiwan Tourist in Japan

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With the resurgence of global tourism after COVID-19, new travel models emphasizing cultural depth and community interaction are drawing attention. This study explores the micro-residency tourism model pioneered by Yusuke Tanaka in Fukui, Japan, which encourages visitors to "stay a little" and engage deeply with local life and culture. By integrating short-term stays with curated local experiences, this model provides an alternative to commercialized mass tourism.

Researches findings suggest that micro-residency tourism enhances tourists' cultural understanding and fosters genuine human connections. Tourists reported gaining deeper insights into local customs, everyday life, and the perspectives of community members. In addition to increased satisfaction with the travel experience, participants expressed a sense of emotional attachment and a willingness to revisit or support the host community in the future. The collaboration between Japanese and Taiwanese teams further demonstrates the model's potential for transnational adaptation, local empowerment, and sustainable cultural exchange.

This research adopts a qualitative approach, primarily through in-depth interviews. One interview has been conducted with Yusuke Tanaka, the initiator of the micro-residency tourism model. Additional interviews are planned for May, including one operator involved in the implementation of the program and two Taiwanese travelers who have participated in micro-residency tourism in Japan. These interviews aim to explore how participants perceive cultural understanding, interpersonal connections, and the authenticity of local experiences. They also seek to understand how micro-residency travel influences tourists' emotional engagement, post-travel reflections, and willingness to support or revisit the local community.

Keywords: micro-residency tourism, cultural tourism, community-based travel, Fukui, Taiwan-Japan exchange.

S09-03

Corporate Investment in Hometowns as a Strategy for Regional Revitalization: The Case of Local Enterprises in Houlong, Miaoli

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Taiwan faces growing challenges of urban-rural imbalance and population outflow, weakening local industry competitiveness and making it difficult for youth to return home. In response, the government launched the "Regional Revitalization" policy in 2019, highlighting "corporate investment in hometowns" as a key strategy. However, most existing research has focused on government subsidies or community-led initiatives, with limited attention paid to cases where businesses support young returnees. While most companies tend to invest in the technology sector, this study examines a venture capital firm that chose to invest in agriculture. It explores the impact of this investment on the agricultural industry and how returning youth perceive and respond to it.

This study focuses on five main aspects of how businesses invest in their hometowns as part of regional revitalization. It uses qualitative research methods, including literature review, case study, and face-to-face, in-depth interviews. These interviews help analyze the current development of the blueberry industry in Houlong, Miaoli, through the firsthand experiences and professional insights of the interviewees. By gathering diverse perspectives, the study aims to enhance the reliability of the research. It particularly examines how business investment affects five key areas: production, marketing, human resources, research and development, and finance.

Based on the interview findings, the blueberry industry is still in its early stages, with demand significantly exceeding supply. Investment in marketing and promotion remains relatively limited, and insufficient production has become the primary challenge to the industry's development. The study also found that returning young farmers, supported by corporate funding, are working to drive agricultural transformation and enhance local engagement through cooperative management models and community resource integration. However, due to practical constraints such as limited production scale, market development, and logistical infrastructure, the overall effectiveness still relies heavily on external resources and policy support. Looking ahead, it is essential to strengthen support and training mechanisms for young returnees, encourage innovative business models that integrate local culture, and promote sustainable industry development. In doing so, corporate investment can become a key driving force in revitalizing rural communities.

Keywords: Regional Revitalization, Corporate Investment in Hometowns, Youth Returning to Rural Areas, Local Industries

S09-04

Exploring the Leisure and Tourism Behaviors of Vietnamese Migrant Workers in Taiwan

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Abstract

Vietnamese migrant workers have become an indispensable part of Taiwan's migrant labor population, especially in the manufacturing and service industries. In the face of intense labor demands and cultural challenges, they have developed unique leisure and tourism behaviors as a means to relieve stress, foster social interaction, and become more familiar with Taiwanese society. This study aims to examine the tourism behaviors of Vietnamese migrant workers in Taiwan and analyze how these activities impact their personal well-being and identity transformation. Using in-depth interviews and participant observation, the study finds that factors influencing their tourism behaviors include cultural adaptation, economic capacity, and more. Participating in tourism activities not only helps alleviate homesickness and the pressures of daily work, but also enhances their sense of belonging in Taiwan and supports future planning. More importantly, it reflects a strong desire to enjoy the present moment. The identity shift from "laborer" to "tourist" provides a temporary release from daily pressures and highlights the flexible navigation of Vietnamese migrant workers between different social roles. Since most studies on migrant workers focus on leisure constraints, life satisfaction, and behavioral differences, and relatively few examine the benefits migrant workers gain from engaging in tourism activities, this study aims to fill the research gap on the tourism practices and personal benefits of Vietnamese migrant workers, while also providing practical recommendations for the tourism industry and social integration.

Keywords: Vietnamese migrant workers[1], tourism behavior[2], identity transformation[3], cultural adaptation[4], personal benefits[5]

S09-05

The Influence of Bike-Sharing Service Condition and Environmental Consciousness on Consumer Usage: The Case of YouBike

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Bike sharing is one of the most energy-efficient modes of transportation, which can reduce vehicle exhaust emissions and air pollution. It not only improves transportation convenience, but also reduces carbon emissions. YouBike is still not popular, which may be due to the service system or people's lack of environmental awareness. Understanding the reasons will help service system providers improve their quality and the government promote environmental protection as a reference.

This study is based on the theory of planned behavior, and incorporates YouBike's service system availability and carbon reduction awareness to construct a research framework; unlike other studies that use users on campus and certain streets in the city as research subjects, this study uses the general public as the research subject to explore consumers' willingness and behavior to use YouBike. The formal questionnaire collected 300 valid questionnaires, and after necessary verification, the hypothesis was tested.

The results show that, overall, attitude, subjective norms, and perceived behavioral control have a significant positive impact on the intention to use YouBike. However, the overall maintenance of YouBike does not significantly affect the usage intention. Environmental awareness of carbon reduction does not mediate the relationship between usage intention and behavior *(see Figure 1)*. Additionally, when comparing two different groups—those in the top 23% and the bottom 23%—significant differences were found between these two groups regarding their intention to use YouBike and actual YouBike usage behavior.

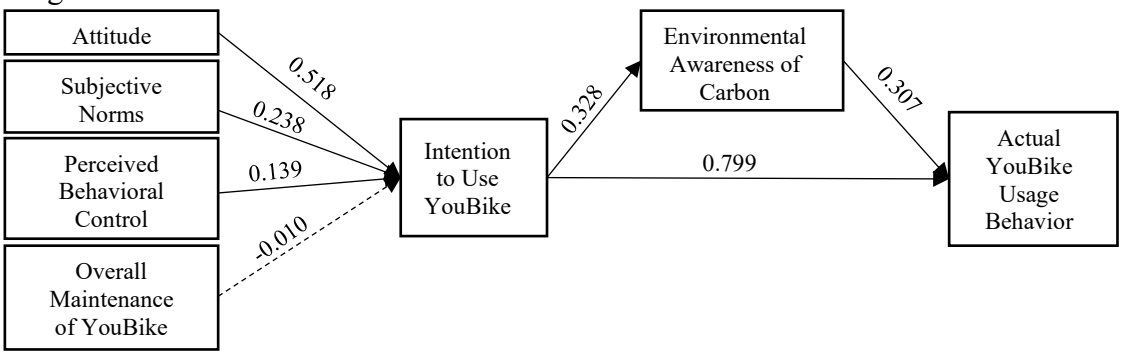

Figure 1. Structural Equation Model Diagram

Keywords: Theory of planned behavior , Proper maintenance, Environmental awareness of carbon reduction

S10-01

Numerical Study of 500 kHz Electromagnetic Wave Irradiation for Root Canal Sterilization in Apical Periodontitis Treatment

Yanakorn Srianant [1 2+*], Hiroo Tarao [1], Thanadol Tiengthong [2], Masatake Akutagawa [3], Hiromichi Yumoto [3], Toshihiko Tominaga [4]

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Apical periodontitis, caused by bacterial infection spreading through the root canal, is difficult to treat in teeth with complex structures like an isthmus, where conventional irrigation often fails. Applying a 500 kHz frequency current via an internal electrode has emerged as a potential solution, inducing sterilizing heat through Joule heating. However, temperature control in narrow areas like the isthmus remains challenging [1].

This study introduces a simplified numerical tooth model featuring an isthmus with a top width of 0.15 mm, narrowing toward the apex, and a root length of 15 mm. Unlike the conical geometry [2], This model captures the complex anatomy of isthmus canals. Simulations showed that 20 V at 70% and 65 V at 5% raised the isthmus temperature to 69.2 °C and 72.1 °C respectively, while keeping root canal temperatures below 60 °C. These results highlight the importance of voltage and duty cycle control for safe, targeted sterilization, with further research needed on timing and energy delivery optimization.

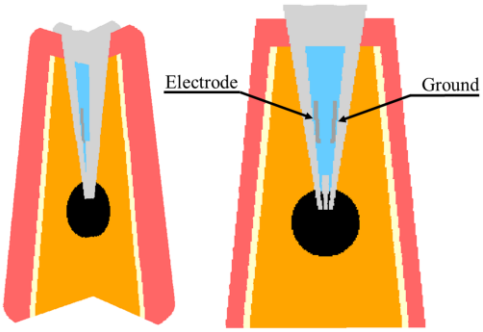

Fig. 1: Cross-sectional view 90° transverse section (left), middle longitudinal section (right) of the tooth model with an isthmus.

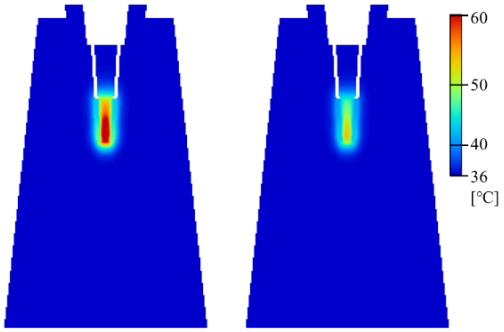

Fig. 2: Temperature distribution on an x–z plane at the end of energization applied voltages 20 V with 70% duty cycle for 1.0 s (left) and 65 V with 5% duty cycle for 1.0 s (right).

Keywords: Coupled Analysis[1], Periodontitis[2], Isthmus Root Canal[3], Temperature Distribution[4]

[1] Ishizaki, H., et al., (2022). Causes of Endodontic Failure of Isthmus-containing Root Canals, and Treatment Strategies. The Japanese Journal of Conservative Dentistry, 65(1), 9-20.

[2] Tarao, H., et al., (2021), Evaluation of Temperature Increase From Joule Heat in Numerical Tooth Model by Applying 500 kHz Current for Apical Periodontitis Treatment—Effect of Applied Voltage and Tooth Conductivity. Bioelectromagnetics, 42: 224-237.

S10-02

Design of Low-Voltage Analog PLL in 16-nm FinFET CMOS Process.

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With continuous advancements in semiconductor technology, FinFET has become the mainstream structure under 16nm processes due to its superior electrostatic control, reduced leakage, and enhanced performance over conventional planar MOSFETs. The demand for ultra-low-power and high-frequency circuits in 5G, IoT, and portable electronics has made power-efficient phase-locked loops (PLLs) a critical component in modern system-on-chip designs. However, traditional PLLs often suffer from performance degradation under ultra-low voltage operation, such as increased jitter, reduced frequency stability, and limited output drive.

This work proposes a 0.3V low-voltage PLL implemented using the 16nm FinFET CMOS technology, targeting a 6GHz output frequency with minimal power consumption. The PLL architecture includes a dynamic phase-frequency detector (PFD) using half-transparent latches to minimize dead zones, a conventional charge pump, a second-order loop filter for ripple suppression, and a voltage-controlled oscillator (VCO) [1]based on a sub feedback ring oscillator structure[2].

Simulation results using HSPICE indicate that the PLL achieves frequency locking at 6GHz with a total power consumption of only 22.1μW under typical process-voltage-temperature (PVT) corners. These results show that it is possible to use low-voltage operation and FinFET design to make PLLs that work well and use little power. This is useful for future devices that need to save energy.

Table. 1: Performance comparison.

	This work*	[1]	[2]	[3]
Architecture	CPPLL	CPPLL	ADPLL	ADPLL
Technology(nm)	16	90	90	90
Supply Voltage(V)	0.3	0.6	10.6	0.6
Frequency (GHz)	6	0.26~1.1	0.95~1.6	0.87~1.16
Power (mW)	0.021	0.25	9.1	0.912

*Only simulation

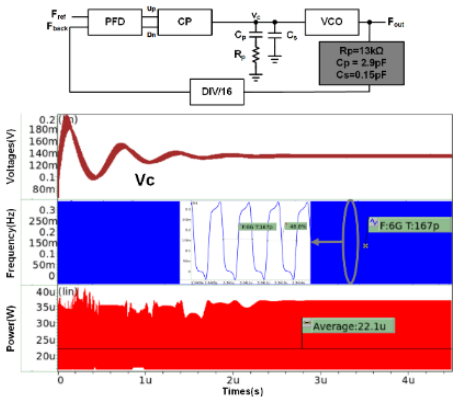

Fig. 1: Block diagram of PLL and simulation results.

Keywords: Charge Pump, Phase-Locked Loop, Low Voltage.

[1] Liu, J.-C., & Ai, R.-C. A Low-voltage And Low-power PLL For Sub-GHz IoT Aplications. *Integration (Amsterdam, Netherlands)*, *103*(102424), 102424, 2025. doi: 10.1016/j.vlsi.2025.102424.

[2] Tu, Y.-H., Liu, J.-C., Cheng, K.-H., Huang, H.-Y., & Hu, C.-C. (2016). A 0.6-V 1.6-GHz 8-phase All Digital PLL Using Multi-phase Based TDC. *IEICE Electronics Express*, *13*(2), 20150950–20150950. doi:10.1587/elex.12.20150950.

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S10-03

Brain-Computer Interface for 3D Spatial Selection and Object Grasping by ROS2 Compatible Robotic Arm

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P300-based Brain-Computer Interface (P300 BCI) is a tool to send our thought to external devices, decoding electroencephalography (EEG). The tool is helpful for persons with disabilities. Three-dimensional spatial selection via brain signal is a challenging problem. A study proposed a combined method of eye-tracking and motor-imagery based BCI (MI-BCI)[1]. However, the MI-BCI still has difficulties in accuracy because its accuracy was 77.5%. We proposed a 3D spatial selection method using P300 BCI, which shows higher classification accuracy than the MI-BCI. Our spatial selection method (Fig. 1) first captures an object from two cameras. Second, object location is identified by counting the appearance of an overlaid white circle. EEG is recorded during the task, and is decoded into a grasping command for ROS2 compatible robot. Ball grasping experiments using the system showed that averaged success rate of 3D-spatial selection was 85.3%, and that of object grasping was 81.3% (Fig. 2), which is higher than the previous study [1]. The proposed method contributes to transfer a kind of non-verbal thought (3D position) to external worlds using brain signals.

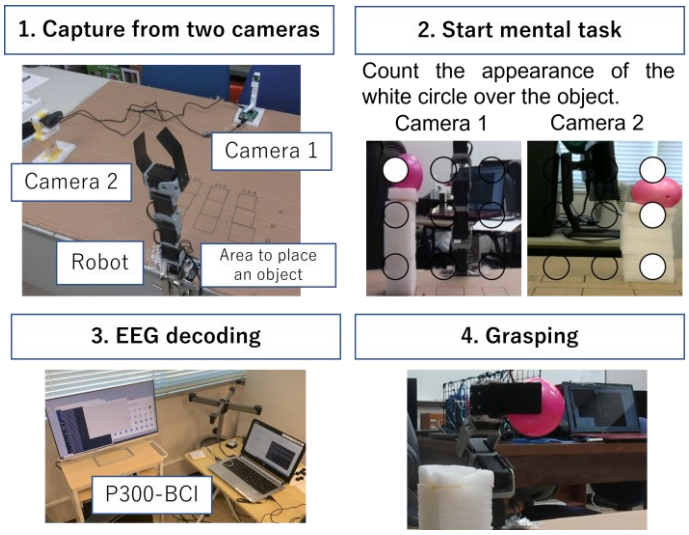

Fig. 1: Overview of grasping system using BCI.

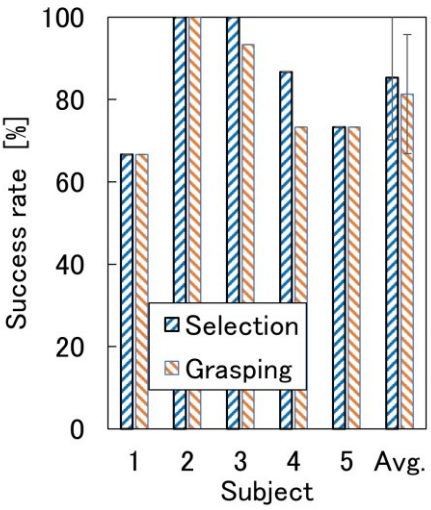

Fig. 2: Success rate of selection and grasping.

Keywords: Brain-computer interface (BCI), Robot arm, Electroencephalography (EEG)

[1] Lee, Eui Chul, et al. (2010). A brain–computer interface method combined with eye tracking for 3D interaction. *Journal of neuroscience methods,* 190.2, pp289-29. doi: 10.1016/j.jneumeth.2010.05.008

S10-04

Initial Performance Evaluation of a C-band Ground Station for Next-generation KOSEN CubeSat

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KOSEN-1 is a 2U CubeSat jointly developed by 10 colleges of the National Institute of Technology, including Niihama College. On November 9, 2021, KOSEN-1 was launched by JAXA's Epsilon-5 Launch Vehicle and successfully placed into orbit. It remains in Sun-synchronous Orbit (SSO) as of June 2025 and had been able to transmit images and sensor data obtained in the orbit. However, KOSEN-1 uses the 430 [MHz] band for communication with the ground station, allowing a maximum data rate of only 9.6 [kbps]. To enable higher-speed downlink for larger data (such as color images), we consider using the 5 [GHz] band, which offers wider bandwidth than 430 [MHz]. Currently, the National Institute of Technology has not demonstrated communication using the 5 [GHz] band. Hence, we attempt to establish a 5 [GHz] ground station (Fig. 1) for the next-generation KOSEN CubeSat, which is the first C-band station in the KOSEN satellite project and can be remotely operated from other KOSEN colleges. The station uses a 2.4 [m] parabolic antenna to receive signals from the satellite. In this presentation, we report initial evaluation results of the antenna's performance and characteristics, such as noise temperature and beamwidth (e.g., Fig. 2), as a first step toward operating the station. The beamwidth was measured to be 1.97 degrees at −3 [dB], and the system noise temperature was 160.3 [K], which includes the LNA and the entire receiving system.

Fig. 1: Appearance of parabolic antenna

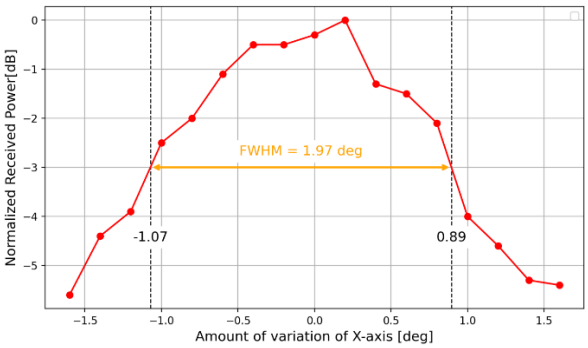

Fig. 2: Results of beamwidth measurements

Keywords: CubeSat, ground station, parabolic antenna, performance evaluation

[1] Imai, M., et al. (2024). One-Year Operation of Technology Demonstration CubeSat KOSEN-1. *Journal of Evolving Space Activities,* Vol. 2, Article No. 215. doi: 10.57350/jesa.215

[2] Yokotsuka, H. , ACY1 Antenna, https://www.astrocub.space/custom1.html (accessed April 24, 2025)

S10-05

A Photonic Crystal-Based Mach–Zehnder Interferometer Filter for Optical Communication Applications

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This study proposes a Mach–Zehnder Interferometer (MZI)-based optical filter that integrates photonic crystals (PC), liquid crystal (LC) materials, and micro-electro-mechanical systems (MEMS) technology to achieve high sensitivity, tunability, and reconfigurability. The photonic bandgap effect of the PC enables precise wavelength filtering [1], while the electrically tunable refractive index of the LC facilitates dynamic phase modulation. MEMS integration further enhances the system's miniaturization and optical tuning precision. A programmable control mechanism allows real-time adjustment of optical characteristics. The system is experimentally evaluated with emphasis on key performance parameters, including maximum guided light transmission, quality factor, and insertion loss.

Fig. 1 illustrates the top and cross-sectional views of the integrated device, highlighting the MZI-based phase modulator, photonic crystal waveguide, and electrode pads for optical tuning. Fig. 2 shows the experimental measurement setup used to characterize the MEMS-integrated optical device. The system consists of a microscope and camera for visual inspection, a computer for control and data acquisition, a power supply to drive the device, and a multimeter for electrical measurements. Probes are used to contact the metal pads on the MEMS chip, which is securely mounted on a holder. This setup allows real-time monitoring of the device's optical and electrical performance under applied bias. These visual representations demonstrate the compact and integration of the system. The proposed device shows strong potential for next-generation tunable filters, phase modulators, and smart photonic sensors in optical communication platforms.

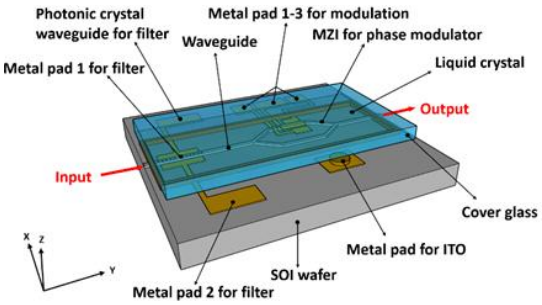

Fig. 1: 3D structure of a PC-based MZI

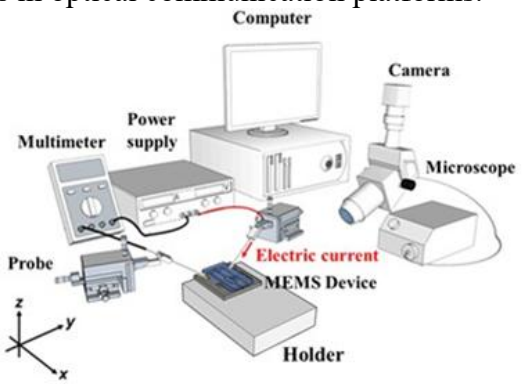

Fig. 2: Experimental measurement setup

Keywords: Mach-Zehnder Interferometer, MEMS, Photonics Crystal, Liquid Crystal

[1] R. A. Integlia, W. Song, J. Tan, and W. Jiang, "Longitudinal and Angular Dispersions in Photonic Crystals: A Synergistic Perspective on Slow Light and Superprism Effects," *J. Nanosci. Nanotechnol.*, vol. 10, no. 3, pp. 1596–1605, Mar. 2010, doi: 10.1166/jnn.2010.2039.

S10-06

Proposal of selective simultaneous thermal diffusion method for improving *V-I* characteristics of p-n junction diodes

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Practical education in semiconductor device fabrication is essential, yet often constrained in educational institutions due to limited budgets and facilities. To address this challenge, we previously proposed a simplified process for fabricating p-n junction diodes suitable for low-cost, classroom-level implementation [1]. In the present study, we further developed this concept by introducing a new method, that is named as selective simultaneous thermal diffusion. This technique provides an one-step formation of n^+ and p^+ regions in a silicon substrate by the diffusion of phosphorus (P) and boron (B), simultaneously. Solid diffusion sources, phosphosilicate glass (PSG) and borosilicate glass (BSG) films, were applied to the front and back surfaces of the silicon substrate. To prevent cross-diffusion, quartz glass plates were used as both barriers and supports during the thermal treatment. The silicon substrates were sandwiched between these plates and thermally processed at 1040 °C for one hour. The resulting diodes demonstrated favorable *V–I* characteristics in both forward and reverse bias, confirming the effectiveness of this selective diffusion method. We will propose this approach as a practical educational platform, "science classroom nanotech foundry", that enables students to gain hands-on experience in device fabrication using accessible tools and materials. This work was supported by JSPS KAKENHI Grant Number JP22K12308.

Keywords: p-n junction[1], thermal diffusion[2], educational device[3], classroom-level[4]

[1] K. Shiota, K. Kai, S. Nagaoka, T. Tsuji, A. Wakahara, M. Rusop, *AIP Conf. Proc. 1733,* 020095 (2016). doi: 10.1063/1.4948913

[2] S. Nagaoka, T. Tsuji, R. Takahashi, A. Wakahara, *Transaction of the 7th International Symposium on Advances in Technology Education* (ISATE2013), 209-214 (2013).

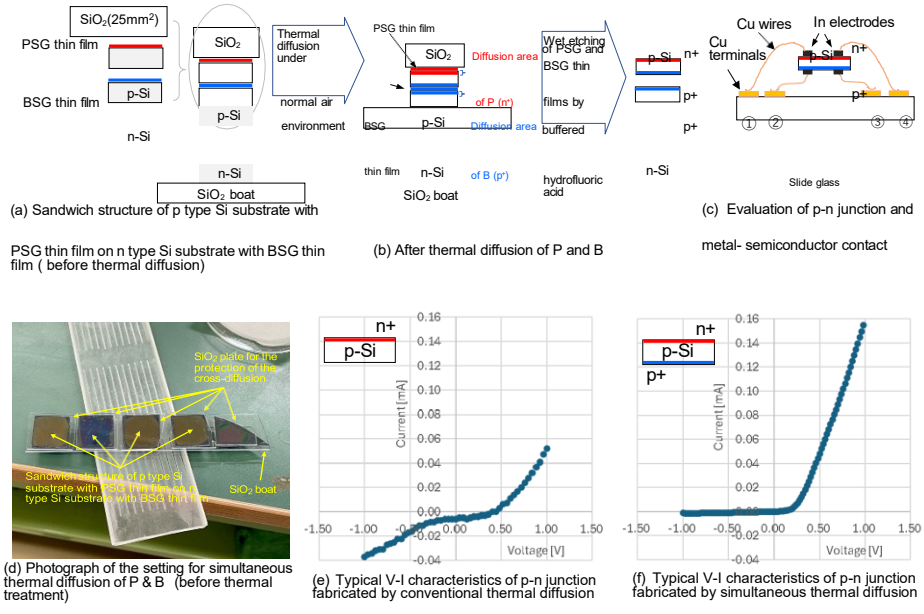

Fig. 1. Typical *V-I* characteristics of a p–n junction diode formed by simultaneous diffusion of phosphorus and boron with SiO_2 plate confinement.

S10-07

Using MEMS Multi-layer Stepped Grating Couplers as Temperature Sensor in Environment Monitor

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This study proposes a temperature-compensated grating coupler with a three-layer Si/SiO_2/Si_3N_4 structure, as shown in Fig. 1. Owing to the high refractive index contrast between the material layers, mode drift and coupling misalignment caused by thermal disturbances can be effectively suppressed, thereby improving the stability of optical coupling [1]. The integrated micro-electromechanical systems (MEMS) architecture enables precise control of the grating period, etching depth, and fill factor. Layers A, B, and C, as shown in Fig. 2, employ a progressive etching design to effectively compensate for thermal expansion and optical path variations, achieving active temperature control capability. The experiment used a tunable 1550 nm laser and was conducted over a temperature range of 0°C to 60°C. According to simulation results, the output wavelength drift is controlled within ±0.1 nm/°C, and the coupling efficiency variation remains below ±1 dB, verifying the component's good thermal stability. In addition, the material properties of SiO_2 make it highly suitable for temperature sensing applications. With the adjustability of MEMS, along with high integration density and scalability, this design is particularly well-suited for precision environmental monitoring.

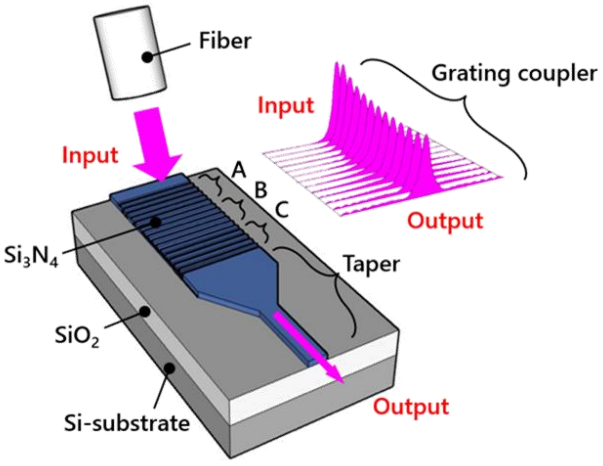

Fig. 1: Three-layer Si/Si_3N_4/SiO_2 structure

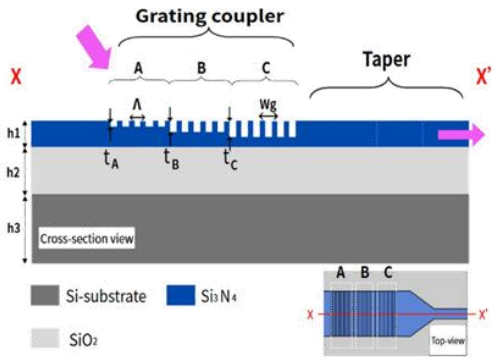

Fig. 2: Cross-sectional and top view

Keywords: Silicon photonics, Grating coupler, Temperature compensation, Coupling efficiency, Micro-electromechanical systems (MEMS)

[1] Korček, R., Quiroz, D. M., Wilmart, Q., Edmond, S., Cheben, P., Vivien, L., Alonso-Ramos, C., & Benedikovič, D. (2023). Library of single-etch silicon nitride grating couplers for low-loss and fabrication-robust fiber-chip interconnection, *Scientific Reports*, 13, Article 17467.

S11-01

Instructions for Preparing Camera-Ready Abstracts for NNBAC2025
Integrating AI Agents into Node-Based Frameworks: Creative Workflow Development for Architectural Design via ComfyUI

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With the rapid development of artificial intelligence, architectural design workflows are undergoing significant transformation. This study explores the integration of AI agents into the creative design process using ComfyUI, a node-based generative AI framework known for its flexibility but steep learning curve. The focus is on Copilot, an AI agent that automates workflow assembly and enhances prompt optimization, allowing novice users to effectively engage with complex generative processes.

The study demonstrates how Copilot interprets user needs, selects appropriate nodes, and constructs workflows in ComfyUI, highlighting how AI agents can reduce technical barriers and enhance design efficiency and accessibility. Findings show that Copilot accelerates image generation for conceptual design while fostering iterative thinking and creative exploration by simplifying technical tasks.

However, the research also identifies some limitations, such as ComfyUI's high hardware requirements and node compatibility issues. These constraints may limit its adoption in educational or resource-constrained environments.

To address these challenges, the study suggests potential solutions like cloud-based approaches and integration with architectural software such as Rhino and Revit. These developments could facilitate smoother transitions from AI-generated imagery to architectural modeling, further embedding AI into mainstream design workflows.

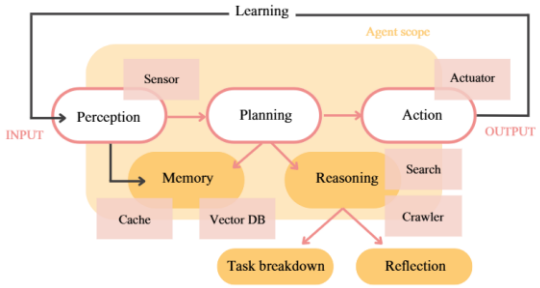

Fig. 1: AI Agent Operation Process

Table 1: The definition and characteristics of AI agents.

Definition of AI Agent	Core Characteristics	Description
AI Agent is an intelligent system capable of autonomously perceiving its environment, processing information, making decisions, and executing actions. It collects input from the external environment via sensors, uses algorithms or machine learning models for analysis and decision-making, and executes tasks through actuators.	Autonomous Perception of Environment	Senses changes in the external environment through sensors (e.g., images, sounds, locations, temperatures, etc.) and processes this information accordingly.
	Data Analysis and Decision-Making Ability	Capable of processing large volumes of data and making appropriate predictions or decisions through machine learning algorithms.
	Adaptability	Can adjust decision-making strategies over time based on feedback and learning, continuously optimizing the decision process.
	Interactivity and Communication Ability	Possesses the ability to interact and communicate with users or systems, such as using natural language processing (NLP) for voice or text communication.
	Automated Decision Execution	Capable of selecting and executing decisions based on learned models and knowledge, with minimal human intervention.

Keywords: Artificial Intelligence [1], Architectural Design Workflows [2], ComfyUI [3], AI Agents [4], Copilot [5]

[1] Hanafy, N. O. (2023). Artificial intelligence's effects on design process creativity: A study on used A.I. Text-to-Image in architecture. *Journal of Building Engineering*, 80, 107999.

[2] Shafaei, M., Sadeghi, A. R., & Hammad, A. (2024). Artificial intelligence's effects on design process creativity: A study on used A.I. Text-to-Image in architecture. *Heliyon*, 10(2), e26112.

S11-02

Evaluation of backhoe operation using Media Pipe

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1. Background

The construction industry is facing a critical challenge due to the aging of skilled workers, particularly construction machinery operators. As many experienced operators near retirement, the insufficient influx of younger labor has made the development of technical skills among the next generation increasingly urgent to ensure sustainable industry growth. In addition, many fatal and serious accidents still occur on construction sites each year, with a significant portion involving heavy machinery. While automation technologies present promising solutions, the highly variable environments and tasks in construction sites make it difficult to implement a universal automated system.

2. Objective

This study aims to develop a method for supporting skill acquisition by quantitatively analyzing the operational movements of backhoe operators. By evaluating the timing and speed of operator actions, we seek to visualize the differences between trainees and experts and provide effective, data-driven feedback.

3. Method

Using recorded videos of operator activity, we extract coordinate data for six key upper-body points—left and right elbows, wrists, and thumbs—through the pose estimation library Media Pipe. From this data, we identify motion change points, which indicate significant shifts in movement patterns, and assess whether each movement is fast, slow, or appropriately timed. By comparing frame-by-frame differences between novice and expert operators at these points, we quantify discrepancies in operational timing.

4. Results and Future Work

Experimental results demonstrate that the proposed method can effectively distinguish between expert and trainee movements. By analyzing real-world backhoe operation videos, we are able to provide numerical, objective feedback to help trainees adjust their actions to better align with expert techniques.

Future efforts will focus on optimizing the selection of body parts for tracking, improving camera placement and resolution to enhance pose estimation accuracy, and refining the segmentation of motion change points. Additionally, adjustments will be made to account for differences in the number of detected points among operators, with the goal of delivering more precise and practical training support.

Keywords: Media Pipe, Construction machinery, Motion analysis

S11-03

Looking at the Technical Evolution and Artistic Practice of Taiwan's Traditional Building Decorative Art of the Cut-and-stick Craft from the Works of Cheng Sheng-Hong

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KEYWORDS: the Cut-and-stick Craft, Taiwan's Traditional Building Decorative Art, Cheng Sheng-Hong

Abstract

Widely used on the roofs and waterwheel block of Taiwan's traditional buildings such as temples, ancestral halls, and houses, the cut-and-stick craft is an indispensable decorative art for traditional architecture in the island. This craft originated in the southern region of China, has a long history and cultural heritage, and with the immigrants to Taiwan, after a hundred years of development, has become Taiwan's unique architectural decorative art. The cut-and-stick craft is a term consisting of two actions: "cut" and "stick". "Cut" refers to the process of cutting ceramic, glass, or plastic sheets in a variety of colors into small but specially shaped pieces. "Stick" refers to sticking these pieces onto the plaster surface of prototypes, such as dragons, phoenixes, flowers, plants, figures, and so on. This study attempts to review the life story, technical heritage, use of tools, and representative works of Cheng Sheng-Hong, a cut-and-stick master, to examine the formation of his style and characteristics of cut-and-stick techniques. This study concludes that Cheng Sheng-Hong, a representative of the Miaoli region's cut-and-stick craftsman, owes the richness of his colorful works and the vividness of his creations such as figures, birds, and animals to his ability to integrate many different traditional techniques such as cut-and-stick, ceramics, and self-adjustment of colors in his studio. It is these characters that make his works very different from those of other cut-and-stick craftsmen and become one of the most representative works of art in the Miaoli region.

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S11-04

A study of geographical characteristics around designated evacuation centers and its surrounding population in Kochi Prefecture

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To protect human lives during catastrophes, it is essential to have evacuation centers where evacuees can safely stay for at least several weeks.

The purpose of this research is to understand the current situation and provide recommendations for the appropriate establishment of designated evacuation centers in Kochi Prefecture.

Data on designated evacuation centers in Kochi Prefecture were collected and organized using GIS, including name, location (latitude, longitude), capacity, elevation, estimated disaster zones by municipality (flood, tsunami, landslide), population data, and road centerlines. The relationship between the geographical characteristics of the evacuation centers and potential natural disaster areas were examined. A three-dimensional analysis of possible evacuation areas was conducted by calculating oblique distances along road networks, taking elevation and road gradients into account. Moreover, the number of local residents expected to use each designated evacuation center was estimated from population data and compared to its capacity.

There were of 1,654 designated evacuation centers in Kochi Prefecture. Among them, about 63.3% were located within disaster zones, indicating safety concerns about their placement. [1] In mountainous areas, the available evacuation distances were significantly shorter than in flat sites. In the flat areas, the range of evacuation distances was almost the same as in the normal case where the slope was not taken into account. For example, the available evacuation distance in mountainous areas decreased by approximately 10% (Fig.1), while in flat areas, the reduction was only approximately 1% (Fig.2). These findings clarified the current challenges in the location of designated evacuation centers, enabling a more rational approach to their future placement.

Keywords: Designated evacuation center[1], GIS[2]

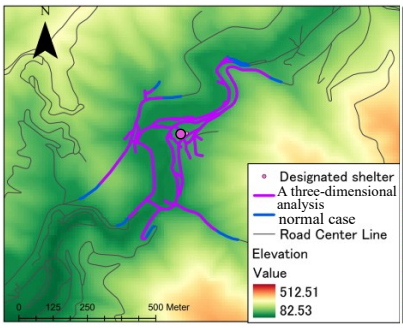

Fig.1 The Available Evacuation Distance in Mountainous Areas

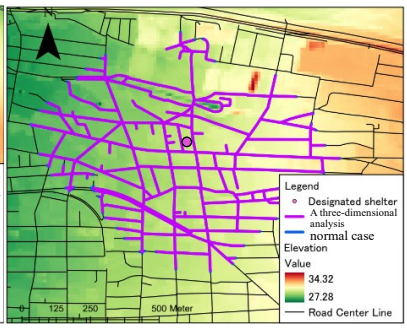

Fig.2 The Available Evacuation Distance in Flat Areas

[1] Kosuke KURIHARA, Yuji KUWAHARA and Tatsuya NUMAO. (2013). PROPOSAL OF ANALYTICAL METHOD OF REGIONAL CHARACTERISTICS FOR EVACUATION CENTER FOCUSED ON QUALITY OF LIFE. (in Japanese). Journal of JSCE, Division F3 (Infrastructure Information), Vol. 39, No. 2, pp. II_13–II_18.

S11-05

Integrating Food Forests and Edible Landscaping for Sustainable Urban Development

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Amid rapid urbanization and food security challenges, traditional urban green spaces often lack ecological and social functionality, while community gardens face sustainability issues. This study, grounded in qualitative methods and drawing on insights from Landscape and Sustainability (Benson & Roe, 2000) and Gaia's Garden (Hemenway, 2001), explores the potential of food forests and edible landscapes—multi-layered, nature-mimicking ecosystems rooted in permaculture principles. Two case studies in Taiwan highlight this approach: the food forest at Mackay Hospital in Hsinchu, maintained by senior volunteers, enhances urban food resilience and reimagines elder care through active community engagement. Meanwhile, the multi-level garden in Jiangjun Village integrates fruit trees, herbs, and edible groundcovers, fostering local identity and ecological literacy. Through surveys and interviews, the research finds that food forests offer strong synergies in food production, ecological services (e.g., heat island mitigation, habitat creation), and social cohesion. These spaces shift green infrastructure from passive to active, improving urban microclimates and reducing external dependencies. By involving residents as co-producers, such initiatives elevate food sovereignty and environmental awareness. In an era of climate uncertainty, integrating edible landscapes into urban planning supports sustainability by combining food security, ecological restoration, and social resilience. Scaling these models offers a transformative path for cities worldwide.

Keywords: Food Forests[1], Edible Landscaping[2], Urban Food Resilience[3], Biodiversity[4], Community Engagement[5]

(1) Zheng, Z.-W., & Chou, R.-J. (2023). Promoting the Development of Edible Landscapes in Suburban Areas with Place Branding—A Case Study in Taiwan. Land, 12(6), 1237.

(2) Shi, X. (2022). The Urban Food Forest: Creating a Public Edible Landscape. URBAN DESIGN International, 28, 189–201. Springer Nature.

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(5) Nordahl, D. (2009). Public Produce: The New Urban Agriculture. Washington, D.C.: Island Press.

S11-06

A Trial on STEAM Education to Develop Students' Multifaceted Perspectives and Social Contribution -First Project Activities-

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In recent years, the Japanese government has been promoting STEAM education as part of its educational policy to cultivate competitive talent capable of adapting to a future IT-driven society [1, 2]. Based on a pilot implementation in elective courses, Tokuyama National College of Technology officially introduced a STEAM subject in 2024.

This paper presents an initiative to implement STEAM education at a technical college by designing a cross-grade, cross-departmental course for lower-grade students, with a focus on fostering social contribution—a core value of engineering education. Students were guided by instructors using themes that could be explored from multiple perspectives, allowing them to identify issues independently and engage in problem-solving activities.

Among the 19 themes, three representative projects—an art installation, a creative club for elementary school students, and the development of campus amenities—were selected for analysis. A questionnaire survey conducted after project completion was used to assess the effects of these activities on student development.

The results indicate that students were able to acquire interdisciplinary thinking skills through exploring issues from the diverse viewpoints encompassed by STEAM. Furthermore, many students developed an awareness of contributing to society, learning to pursue initiatives that benefit others beyond their own interests.

A: Creative Club for Elementary School Students

B: Campus Amenity

C: Art Project

Fig1. The States of Projects

Keywords: STEAM, Art and Liberal Arts, Engineering Education, Project Based Learning, Social Contribution, Team Teaching

[1] Ministry of Education, Culture, Sports, Science and Technology (2021): Promoting cross-disciplinary learning including STEAM education, *Materials 1 of the 125th Education Curriculum Subcommittee*, 2021.
[2] Tadashi Ohtani (2022): Return Cycle of Inquiry and creativity in the practice of STEAM education, *46th Annual Meeting of the Japanese Society for Science Education*, Aichi, 2022.

S12-01

Rocker-Bogie Suspension for Mobile rolling Robots: Quasi-Static Modeling Toward Optimization

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Mobile robots tasked with slow, long-duration traversal must manage energy stringently [1]. We develop an energy-oriented quasi-static model for a rocker–bogie suspension based on the formulation in [2]. A three-wheel contact geometry (Fig. 1) guarantees simultaneous ground engagement, while force equilibrium yields wheel-torque demand including rolling resistance. Suspension postures over representative terrain are generated with a rigid-body tree model.

To obtain the system centroid required by the quasi-static balance, we introduce a local mass-weighted centroid method that aggregates link masses and positions, providing accurate gravity loads on each wheel. An illustrative case in which the rover climbs a vertical obstacle whose height equals the wheel radius is shown in Fig. 2; the plot highlights the quasi-static force distribution at each contact point during traversal. Initial simulations indicate that modifying link lengths and joint angles markedly alters torque demand and total energy use.

Ongoing work will optimise these geometric variables to further minimise drive energy, offering a concise guideline for designing energy-efficient rocker–bogie suspensions under low-speed, quasi-static conditions.

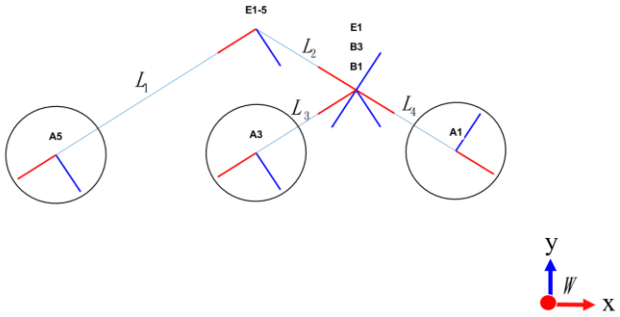

Fig. 1. DH-based kinematic model

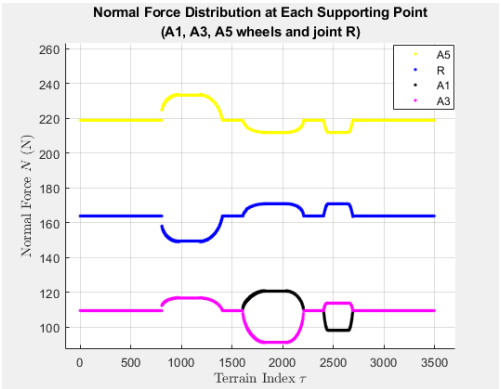

Fig. 2. Distribution of Normal Forces

Keywords: Rocker-Bogie, suspension, mobile robot, quasi-static, force analysis , Optimization

References

[1] Jesús M. García *, Franklyn G. Duarte (2024). Mobile rolling robots designed to overcome obstacles: A review

[2] Tang Ling1, Liu Tao1, Wei Shimin1 and Liu Ya Fang (2019). The Study of Wheel Driving Torque Optimization of Mars Rover with Active Suspension in Obstacle Crossing

S12-02

Polarization-Imaging Measurement System Using Liquid-Crystal Variable Retarders and Lu–Chipman Decomposition for Milk-Fat Analysis

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Polarization imaging provides enhanced contrast in turbid media. In this study, we constructed a single-exposure polarization-imaging system integrating two liquid-crystal variable retarders (LCVRs), with a linear polarizer-array camera, to enable pixel-wise Mueller matrix reconstruction. The optical setup of the system is shown in Figure 1, covering wavelengths of 550, 633, and 700 nm. The polarization state generator (PSG), composed of the dual LCVRs, produces four orthogonal input polarization states, which illuminate raw milk samples with fat contents ranging from 0.5% to 3.0%. The camera, equipped with a linear polarizer array serving as the polarization state analyzer (PSA), simultaneously captures intensity images at 0°, 45°, 90°, and 135°. After completing the Mueller matrix reconstruction, the system applies the Lu–Chipman decomposition method to extract parameters such as polarization, phase retardation, and depolarization from the images. Figure 2 shows the variation of depolarization degree with every 1% increase in milk fat content. Experimental results confirm a strong correlation between depolarization degree and milk fat content, with a sensitivity better than 0.1%. The depolarization difference between samples with 3.0% and 0.5% fat content is most distinct at the 550 nm wavelength. This system possesses rapid quantitative fat analysis capability and holds potential for future applications in online quality monitoring of dairy products and biological tissue imaging.

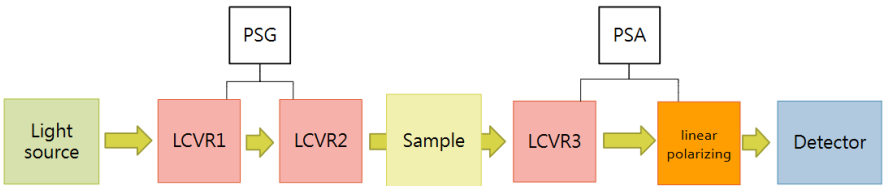

Fig. 1: Depolarization of milk samples with 3.0 % and 0.5 % milk-fat content.

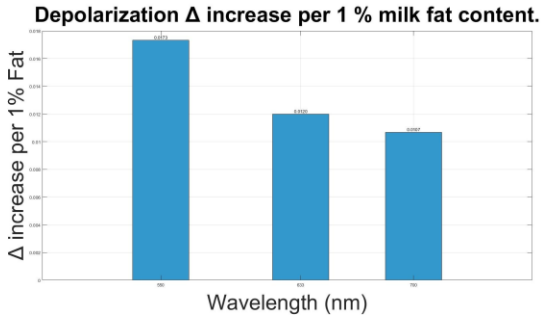

Fig. 2: Depolarization response per 1 % increment in fat content.

Keywords: Liquid Crystal Variable Retarder[1], Mueller matrix[2], Depolarization[3], Milk fat[4]

[1] T. Lee, S. Kim, and H. Wang, "Reverse Design of Pixel-Type Micro-Polarizer Arrays to Improve Polarization Image Contrast," Optical Engineering, 56(3), 2017.
[2] J. Chen, M. Li, and Y. Zhang, "Real-time complete Stokes polarimetric imager based on a linear polarizer array camera for tissue polarimetric imaging," Biomedical Optics Express, 8(11), 4933–4945, 2017.

S12-03

Molecular Simulation of Nitrogen Scattering from the Platinum Surface

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In high Knudsen number flows, the scattering behavior of gas molecules on solid surfaces significantly affects macroscopic thermal flow properties, making the accurate characterization of gas-surface interactions a critical issue. Although diffuse reflection is commonly assumed as the gas reflection boundary condition on solid surfaces, gas–surface interactions are inherently complex, and the diffuse reflection model may become invalid under certain conditions, such as at very clean or high-temperature surfaces or in high-speed flows. This study investigates how various flow conditions affect the scattering behavior of nitrogen gas molecules, which possess internal degrees of freedom, on platinum (Pt) surfaces. The analysis combines the molecular dynamics (MD) method with the direct simulation Monte Carlo (DSMC) method. [1]

We consider the Couette flow problem in which the upper surface moves with a velocity of $-U/2$, and the lower surface moves with a velocity of $U/2$, with nitrogen (N_2) gas between two parallel plates separated by a distance L. Both the upper and lower surfaces are at a temperature of T_W = 300 K. The motion of gas molecules between the plates is calculated using the DSMC method. When a gas molecule collides with the solid surface in the DSMC simulation, the analysis is transitioned to the molecular dynamics (MD) method to resolve the detailed interaction between the gas molecule and the Pt surface atoms.

Figure 1 shows the molecular velocity distribution functions along the wall for the case of K_n = 1.0, S = 0.25, where K_n is the Knudsen number defined as $K_n = \lambda/L$, and S is the speed ratio given by $S = (U/2)/C_m$. Here, λ is the mean free path of gas molecules at equilibrium, and C_m is the most probable speed of gas molecules corresponding to the wall temperature T_W. The filled circles indicate the velocity distribution of incident molecules, while the open circles represent that of reflected molecules obtained in the present study. The solid curves correspond to the velocity distribution functions for diffuse reflection. It can be seen that the velocity distribution of the reflected molecules, indicated by the open circles, does not match the solid curve representing diffuse reflection.

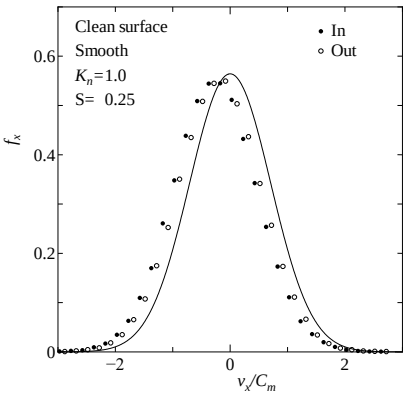

Fig 1: Molecular velocity distribution functions along the wall.

This study clarified the effects of different flow conditions on the velocity distribution functions of nitrogen molecules reflected from a platinum surface.

Keywords: High Knudsen number flow[1], Molecule dynamics[2], Gas-surface interaction[3]

[1] Yamamoto, K., Takeuchi, H., and Hyakutake, T. (2006). Characteristics of reflected gas molecules at a solid surface. *Phys. Fluids*, 18, 046103.

S12-04

Behavior Planning and Rocker Arm Design in Mobile Robots: A Simulation-Based Approach

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This study aims to implement a strategic obstacle-crossing behavior selection method for mobile robots to enhance their capability to traverse complex terrains in disaster environments, thereby reducing the need for personnel in high-risk areas and minimizing operational costs. To address these needs, a four-tracked dual-rocker arm design was adopted, and representative stairs were selected as the primary test obstacle to evaluate the robot's obstacle-crossing capability and strategy-switching performance.

To establish a basis for obstacle-crossing strategy decisions, it is necessary to determine the robot's maximum surmountable obstacle height. This study conducted dynamic analysis to explore the robot's center of gravity variations during movement. MATLAB was used to simulate and analyze the relationships among vehicle pitch angle, rocker arm swing angle, and maximum obstacle-crossing height. In addition, Particle Swarm Optimization (PSO) [1-2] was integrated to optimize the rocker arm parameters. The feasibility of the design was validated through a physical test model. Results showed that the maximum forward-crossing height was 7.5 mm, and the reverse-crossing height reached 16 mm. After optimization, the maximum forward-crossing height increased by 24.42% in simulation, confirming a significant improvement in obstacle-crossing performance.

Furthermore, a behavior selection mechanism was developed in a simulated environment. Based on obstacle height and geometry, the system can automatically determine and select among direct forward crossing, rocker-assisted forward crossing, or reverse crossing. The study also adopted the logic of artificial potential field methods, commonly used in dynamic environments for obstacle avoidance and path planning. A basic planning mechanism was introduced to simulate multi-step terrains and determine optimal action combinations and obstacle-crossing sequences based on obstacle characteristics, aiming to minimize total traversal time and maximize task continuity.

Keywords: Dual-rocker arm robot, Particle swarm optimization, Obstacle crossing, Artificial potential field

[1]Kennedy, J. and Eberhart, R., "Particle Swarm Optimization," Proceedings of ICNN'95 - International Conference on Neural Networks, Perth, WA, Australia, pp. 1942-1948, 2002.

[2]Juneja, M. and Nagar, S.K., "Particle swarm optimization algorithm and its parameters: A review," 2016 International Conference on Control, Computing, Communication and Materials (ICCCCM),Allahbad, India, pp. 1-5, 2016.

S12-05

Effects of wheel clogging and dressing on quartz glass grinding

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Quartz glass is widely used as semiconductor process fixtures and optical components as a material with excellent heat resistance, permeability, and chemical resistance. Quartz glass is processed by diamond wheel, but the processing efficiency is not high. The reason for this is that the grinding wheel's machining capacity is reduced due to clogging and dulling. [1][2]

In this study, we focused on the bonding agent of the grinding wheel to investigate the grinding ability and dressing property of the wheel. It was found that the grinding ability of vitrified grinding wheels does not deteriorate easily, while the grinding ability of resin-bonded grinding wheels can be easily recovered by dressing. As a result, the importance of the choice of bonding agent in quartz glass grinding was clarified.

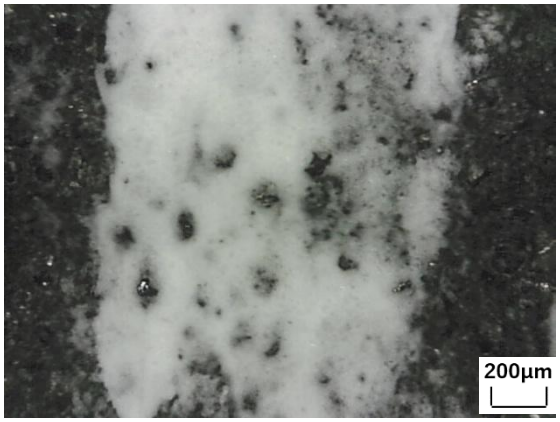

Fig.1: Grinding wheel surface with clogging (Resin Bond)

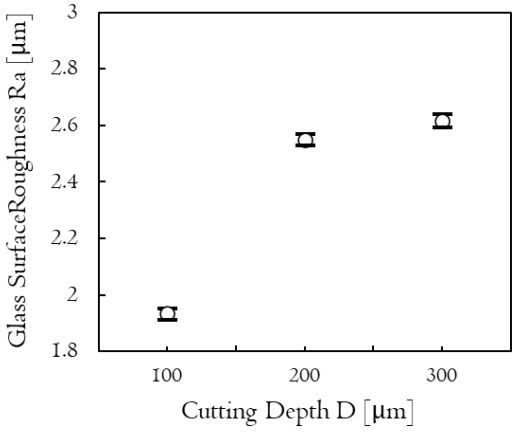

Fig. 2: Quartz glass surface in Grinding (Resin Bond)

Keywords: Grinding, Wheel, Quartz Glass, Dressing

[1] Takayuki Hirata, Manabu Iwai, Shinichi Ninomiya (2023). Application of Laser Cleaning Assisted Dressing Method to Resin Bonded Fine Diamond Wheel, *The 25th International Symposium on Advances in Abrasive Technology*, 1061

[2] Yoshiki Fjii, Uenishi Jyunichi, Takayuki Hirata, (2010). Spherical grinding of quartz chambers by the wheel axis turning method, *Proceedings of Japan Society for Abrasive Technology*, 2010, 369-372

S12-06

Deep Learning–Based Welding Path Reconstruction from Point Clouds

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Traditional geometry-based welding trajectory generation methods often suffer from defects when handling noisy or occluded point-cloud data, primarily due to unstable feature extraction at the junction between the main and branch pipes. To address this issue, this study proposes an end-to-end welding path reconstruction framework that integrates a deep neural network with NURBS fitting. The proposed method first utilizes a deep learning–trained model to directly extract junction feature points from the raw point cloud, computes the centroid positions, and then applies a nearest-neighbor search to sort the points and form the initial trajectory. Subsequently, a Non-Uniform Rational B-Spline (NURBS) curve is fitted to the sorted points, and the result is converted into 4×4 homogeneous transformation matrices suitable for industrial robot execution.

In comparative experiments with traditional geometric methods, the error distribution analysis shows that most predicted points fall within the range of 0.3 to 0.6 mm, with a more dispersed distribution—indicating limited accuracy when dealing with complex surfaces. In contrast, the proposed method, tested on simulated three-way pipe point clouds, significantly reduces both the RMSE and maximum deviation of the welding path, while greatly shortening the average computation time, thereby demonstrating superior performance and efficiency. Further ablation studies confirm the independent contribution of each module to overall system performance, showcasing the proposed method's strong generalization ability and stability, and highlighting its potential for real-world automated welding applications.

Keywords:point cloud[1], deep learning[2],welding trajectory[3],NURBS[4]

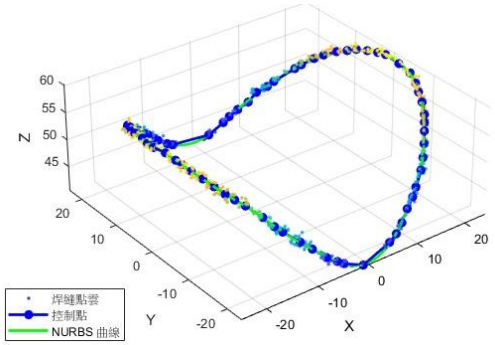

Fig. 1. NURBS curve fitting result of welding trajectory feature points

[1] 1. Liu, Y., Tang, Q., Tian, X., & Yang, S. (2023, March 7). A Novel Offline Programming Approach of Robot Welding for Multi-Pipe Intersection Structures Based on NSGA-II and Measured 3D Point-Clouds. ScienceDirect.

S12-07

Investigation of Microplastic Pollution in Coastal Areas of Yamaguchi Prefecture

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2 Universiti Teknologi MARA (UiTM), Malaysia

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1. Introduction

Microplastics have been ingested by marine organisms such as sea turtles and seabirds, causing adverse health effects [1]. Yamaguchi Prefecture, surrounded by the Seto Inland Sea, Hibiki-nada, and the Sea of Japan, offers a diverse coastal environment. Our previous surveys revealed regional differences in microplastic pollution, with significant accumulation in the Nagato area. This study aims to analyze the number, weight, and composition of microplastics at 32 beaches in Yamaguchi Prefecture and to design a cyclone-type separator for robotic collection.

2. Methods

At each site, sand was collected from three 1 m² quadrats, and microplastics were separated using sieves (4.75 mm, 2.00 mm, 0.85 mm). The number and weight of particles were measured, and sand grain size distribution was assessed. For composition analysis, samples were treated with hydrogen peroxide and analyzed using FT-IR spectroscopy with ATR. A small cyclone-type separator was designed based on material properties and tested using sand mixed with known quantities of microplastics.

3. Results and Discussion

Microplastic accumulation was highest in the Nagato region and along the Sea of Japan coast (Fig.1). FT-IR analysis showed polypropylene was the most common polymer (16.8%). Expanded polystyrene was notably abundant in Tabe (30%), likely due to fragmentation from wave action. The cyclone separator effectively discharged sand but failed to separate microplastics, indicating insufficient suction power and the need for design improvements.

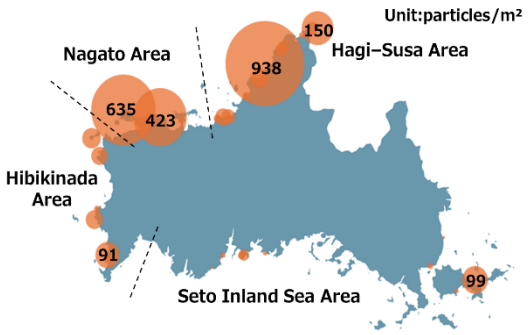

Fig.1Comparison of Average Microplastic Abundance per Unit Area on Beaches in Yamaguchi Prefecture (2021–2024)

4. Conclusion

The study confirmed regional variation in microplastic pollution, with notable accumulation in northern coastal areas. The cyclone separator showed potential but requires enhanced suction to effectively collect microplastics.

KeyWords: Microplastics, Beach pollution, Cyclone separator

[1]Science Council of Japan. (2020). The pollution of water environment by microplastics: The need for research on ecological and health effects and the governance of plastics. Subcommittee on Environmental Risk, Health and Life Science Committee & Environmental Science Committee.

S12-08

Intelligent Conveyor Picking System with Six-Axis Robot

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Abstract

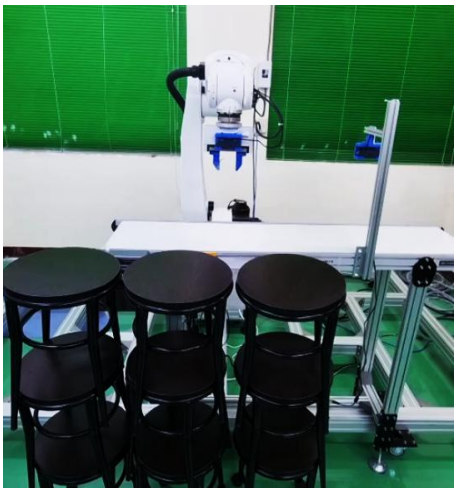
First, Principal Component Analysis (PCA) is applied to extract the object's principal axis and feature vectors for accurate pose estimation. Subsequently, the object's velocity is determined using two spatial detection zones. The computed position and orientation are then converted into a transformation matrix compatible with the robot's motion planning system.

In addition to geometric processing, object classification and recognition are performed using the YOLOv8 deep learning model, which operates on the images captured by the first camera. The output class and bounding box information assist in identifying object types and refining the grasping strategy.

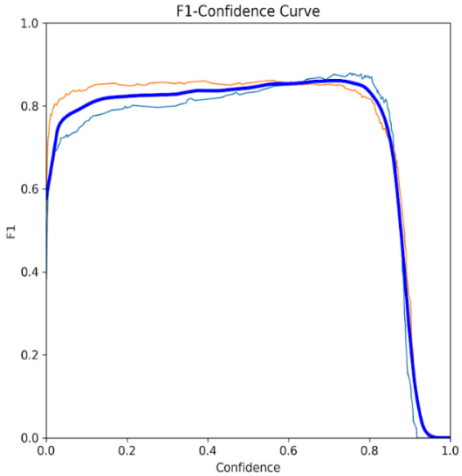
A second camera, fixed near the grasping area, monitors whether the object has entered the robot's workspace and provides real-time feedback for correction. Following a grasp attempt, the first (arm-mounted) camera is reused to verify the success of the pick-up, thereby completing the grasp validation process.

The performance of the YOLOv8 model is assessed via F1-confidence analysis, as shown in Figure 1(B). The results demonstrate high detection accuracy and robust performance across a range of confidence thresholds.

keyword: Vision-guided, conveyor-based picking, grasp validation, YoloV8



(A)



(B)

Figure 1 (A) System configuration. (B)AI training F1 confidence curve of project

[1] Tran Dai Nhan，*Research on Trajectory Planning for Collaborative Robot System*，碩士論文，國立聯合大學，2023。

[2] John J. Craig, "Introduction to Robotics: Mechanics and Control.″ , 3/e, Pearson Press, 2017.

S12-09

Collection of Marine Plastics Using Cyclone Separator

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This study focuses on vortex flows in the collection of microplastics using a cyclone separator and examine it through CFD analysis and experiments. A cyclone separator is a device that separates solid particles contained in a liquid by using the centrifugal force generated by a swirling flow. Centrifugal force causes microplastics, which have a lower specific gravity than water, to collect in the center and flow to the top of the cyclone.

For the CFD analysis, a cyclone separator model is created using 3D-CAD, and the internal flow state is simulated using ANSYS Fluent, while the behavior of solid particles is predicted using DPM analysis. As shown in Figure 1, it is predicted that several vertical vortex flows exist inside a cyclone in addition to the swirling flow.

In the experiment, we will conduct an experiment to separate and collect plastic particles using a cyclone separator, and investigate the effects of the inflow speed and cyclone shape on the collection of plastic particles.

Based on these analyses and experiments, this study will consider the separation and collection of microplastics using a cyclone separator.

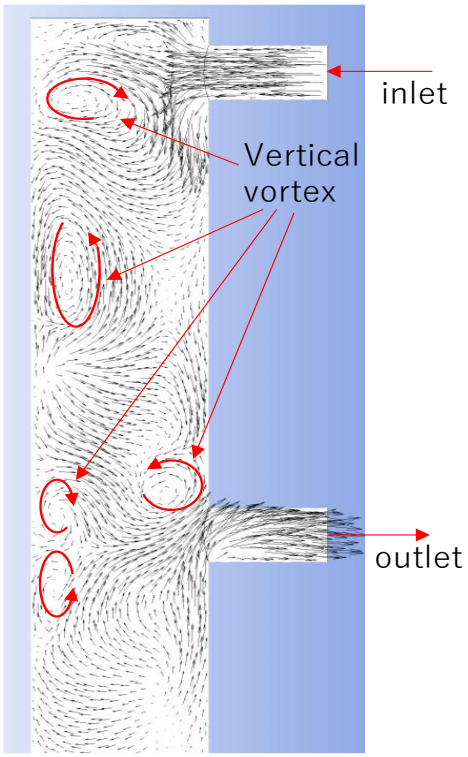

Figure1: Velocity vector distribution inside fluid cyclone (vertical plane)

Keywords: Cyclone Separator, Microplastics, Vortex flow, CFD, simulation

S13-01

A Study on Constructing a Cultural Image Generation Framework for Minority Groups Using Reverse Engineering

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The rapid advancement of Artificial Intelligence Generated Content (AIGC) presents new avenues for cultural representation and digital preservation. However, generating culturally accurate images for minority groups remains challenging due to data scarcity, insufficient understanding of cultural nuances, and imprecise semantic translations, often leading to stereotypical or distorted outputs. This gap underscores a significant deficiency in applying AIGC within the cultural domain. This study addresses this issue by employing a reverse engineering approach combined with content analysis to systematically develop a prompt framework capable of capturing the depth and distinctiveness of minority cultures, aiming to improve the cultural fidelity and accuracy of AIGC-generated images. Using Hakka culture as a case study, the research categorized data across eleven themes, such as ethnic traits, beliefs, food, crafts, and architecture, collecting numerous representative images for each.

The methodology involved compiling prompts and systematically analyzing them through content analysis, focusing on seven key elements like visual descriptions, temporal contexts, and object details. High-frequency cultural elements were then extracted and generalized using reverse engineering logic to build a standardized prompt framework. Midjourney was used for image generation, utilizing commands like "/describe" and "/blend" to analyze vocabulary sensitivity and integrate reference images for enhanced detail.

Findings indicate Hakka culture can be deconstructed into spiritual, everyday, and material layers. Effective prompt design requires precise extraction and semantic translation of unique cultural elements, strategically using reference images to boost the AI's comprehension of cultural nuances. This study's academic contribution is a systematic process for creating minority cultural image prompts using reverse engineering and content analysis, addressing shortcomings in AIGC's cultural representation. Practically, it offers actionable strategies for cultural technology, digital humanities, and creative industries. Future work could extend to other cultures and incorporate quantitative metrics to evaluate prompt framework effectiveness, furthering AIGC's role in global cultural preservation.

Keywords: Reverse Engineering, Minority Cultures, AIGC, Prompt Construction, Content Analysis, Hakka Culture

S13-02

Exploring Immersive Experiences of AI VTubers from the Perspective of Parasocial Presence

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Amidst the rapid progression of artificial intelligence and virtual character technologies, AI VTubers (Virtual YouTubers) are becoming a prominent medium for immersive digital experiences across entertainment, marketing, and education. However, existing AI VTuber designs often concentrate on mainstream languages and cultures, creating a knowledge gap and technological hurdle in representing and disseminating minority languages and cultures. Specifically, elements like intonation, tone, word choice, and vocal traits frequently fail to capture the unique cultural characteristics of minority groups, impacting cultural communication and social identity formation. This study addresses this gap by investigating, through the lens of parasocial presence theory, how integrating minority language elements into AI VTubers influences immersive experiences and social presence. It seeks to understand variations in perceived parasocial presence across different AI VTuber streaming scenarios, the effect of incorporating minority language nuances on audience immersion, and how cultural image delivery and voice design enhance parasocial presence.

Employing a quantitative approach, the research uses surveys measuring parasocial presence, immersion, and cultural identity perception. Participants will view three distinct live-stream types: human-operated VTubers, entirely AI-generated dialogue streams, and streams with human-AI VTuber interaction, before completing the survey. Data analysis, using descriptive statistics, ANOVA, and SEM, will explore the impact of stream types and design elements on parasocial presence and immersion. The research model positions parasocial presence and immersive experience as core dependent variables, with cultural language integration and interaction type as independent variables, and cultural identity perception as a mediator.

This study anticipates contributing to parasocial presence theory within minority language contexts and offering practical design guidelines for integrating cultural features into AI VTubers to boost immersion. Future research could explore cultural perception differences, the specific effects of AI voice synthesis, and applications in other immersive media.

Keywords: AI VTuber, Immersive Experience, Parasocial Presence, Minority Languages, Cultural Identity, Virtual Character

S13-03

Quantitative Study of Comprehension of Japanese Texts by Humans and Artificial Intelligence

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This study aims to investigate the differences in understanding Japanese texts between humans and AI (Artificial Intelligence). One hundred texts were generated using ChatGPT 4o [1], developed by Open AI, categorized into four genres based on understandability: 1) well understandable, 2) understandable, 3) slightly understandable, and 4) not understandable, with twenty-five texts in each category. We then conducted an evaluation to assess the level of understanding by both humans and AI using BERT (Bidirectional Encoder Representations from Transformers). For the human evaluation, forty-five students from Niihama College participated. Their levels of understanding were rated on a seven-point scale, as shown in Figure 1.

For the AI evaluation, we used a BERT model trained on Japanese texts developed by Tohoku University (“cl-tohoku/bert-base-japanese") [2]. BERT analyzes each text by converting it into 768-dimensional vectors. We applied PCA (Principal Component Analysis) to reduce these vectors to three dimensions using Embedding Projector [3], as shown in Figure 2, where a clear separation between the different genres can be observed. In this presentation, we will share the findings from our comparative analysis.

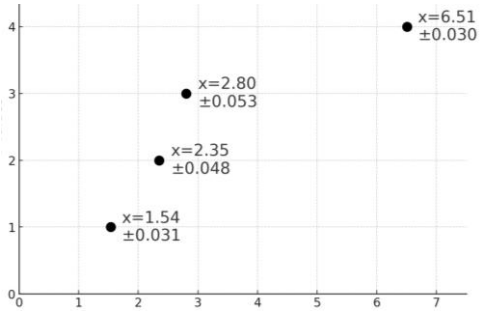

Fig. 1: Questionnaire tabulation results (The horizontal axis shows the level of understanding from zero to seven. The horizontal axis shows four categories of texts.)

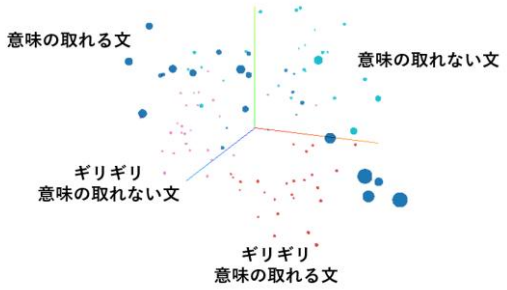

Fig. 2: Results of PCA to 3D (a clear separation between the different genres can be observed.)

Keywords: LLM[1], Quantitative linguistic[2], ChatGPT[3], BERT[4]

[1] ChatGPT, https://chatgpt.com/

[2] Hugging Face, http://huggingface.co/models

[3] Embedding Projector, http://projector.tensorflow.org/

S13-04

Nascent Word Connector

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1.Introduction

UNCT has many international students from various countries. They work hard in their daily lives in Japan. With the aim of deepening exchange with them, we launched a board game and card game development project five years ago. These allow students to learn about Japanese customs and culture, which is difficult to learn from textbooks. By using these games, students can learn in a fun and practical way. The project will develop "Word Connector," a card game that focuses on daily conversation and can be easily enjoyed, and come up with ideas to improve the game to make it more interesting.

2.The purpose of study

Based on the presentations at the last international conference, there are many areas for improvement. For example, it lacks excitement, there are not enough strategic elements, etc. To address these improvements, we asked Japanese and international students to play a sample game. Based on the opinions obtained, the purpose of this study is to improve the quality of the game by adding "event time" and changing the rules.

3.Word Connecter

This game has been improved with simpler rules, making it more fun to play and learn. Players draw up to 11-word cards, 2 event cards, and a card with a theme written on it from a deck and choose a theme. Players score points by making Japanese sentences. The game then proceeds to Event Time. Event Time is the time to use cards that can change the theme or take away the opponent's word cards. The final winner is influenced by the number of words and the accuracy of the sentences. The person who comes up with the closest sentence to the displayed theme becomes the "MVP" and earns additional points. Depending on the event time and MVPs won, this game offers a high possibility of expanding your chances.

4.Conclusion

We were able to experience "Word Connector" with the students twice and hear their feedback. As a result, we were able to obtain feedback from almost all students that they were able to enjoy the game to their satisfaction, that they were able to develop a strategy for the game, and that they had a meaningful time. However, some students commented that the rules were complicated and troublesome. Therefore, we decided to create an easy-to-understand rulebook. There are three advantages for Japanese students to play this game: "to review Japanese grammar," "to deepen understanding of Japanese culture," and "to provide an opportunity to communicate by learning Japanese.

5.In the future

We want many Japanese people to be interested in this product as a communication tool and as a Japanese language teaching tool for international students. The way to do this is to make the "Word Connector" widely known. These will make it possible to establish it as a communication tool!

S13-05

Are you baited: The Composition of Online Content Farm News Headlines and Readers' Perceptions in Taiwan

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With the development of information networks, people's habit of reading print newspapers has gradually shifted toward consuming news online. Online news headlines employ various strategies to attract readers' attention and encourage clicks. This study investigates the phenomenon of clickbait in Taiwanese content farm news, analyzing the linguistic features of the "hooks" in content farm headlines through content analysis, and examining Taiwanese readers' perceptions of such headlines via a questionnaire survey. An analysis of 200 content farm news headlines reveals that soft news is significantly more likely to adopt content farm-style headlines than hard news. Among the linguistic elements used as hooks or bait, nouns (including numerals) are the most frequently employed. Furthermore, the study identifies three main syntactic patterns commonly found in content farm headlines: (1) declarative sentences, (2) interrogative sentences, and (3) rhetorical questions (self-questioning and answering). In addition to examining the linguistic features of the headlines, the study—based on a questionnaire survey—finds that readers generally hold negative perceptions of content farm headlines. Many respondents reported that they still felt unclear about the actual news content even after reading articles with such headlines. Participants also agreed that content farm headlines are overly prevalent and stated that they tend to avoid clicking on them. Regarding syntactic preferences, the study found that Taiwanese readers are more inclined to click on headlines written in the rhetorical question format. Furthermore, readers' educational backgrounds were found to influence their perceptions of content farm headlines.

Keywords: content farm[1], news headline[2], Taiwan[3], online news[4], forward referencing[5]

S13-06

Design-Based Action Research on Sustainable Sports Branding and OMO Spectator Experience: A Case Study of the Hackathon Award-Winning Proposal

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This study adopts a Design-Based Action Research (DBAR) methodology to explore how cross-disciplinary, design-driven collaboration can build an integrated sports event solution that combines sustainability, urban branding, and OMO (Online-Merge-Offline) spectator experience. Based on an award-winning proposal from the 2024 “Fun Sports Hackathon Competition,” the research focuses on developing service prototypes and experiential strategies for the International Men’s Football Tournament in Kaohsiung. Key elements include digital ticketing, LINE-based Web App flow, gamified interactions (e.g., “Egg-Breaking Moment,” Cheer Wave Challenge), and local cultural integration through mascot and place-based branding. By visualizing the spectator journey through user journey maps and interactive touchpoint blueprints, the study also employs carbon reduction estimates and media engagement models to forecast impact. Findings suggest that digital technology and narrative-driven design significantly enhance audience participation, urban identity, and sustainable value, offering concrete insights for future OMO sports branding practices.

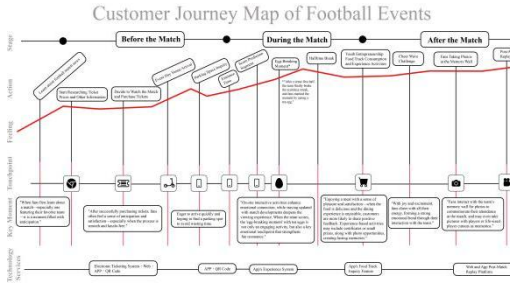

Table. 1: Customer Journey Map of Football Events

Fig. 1: Awarded First Prize in the 2024 Fun Sports Hackathon Competition.

Keywords: Design-Based Action Research[1], OMO Spectator Experience[2], Sustainable Design[3], Urban Branding[4], Interactive Service Design[5], Hackathon[6]

S13-07

The Application of Participatory Design and Service Design in Rural Low-Carbon Tourism Experiences: A Case Study of Xihu Township, Miaoli

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This study originated from the "College Students Returning to Rural Villages Competition" organized by the Soil and Water Conservation Bureau under the Ministry of Agriculture. It aims to address current issues in rural tourism, such as insufficient integration of tourism resources, lack of ceremonial design in service processes, and inadequate depth of experience. The research explores the application of participatory design and service design in low-carbon tourism experiences.

The study takes Xihu Township in Miaoli County as the research site, leveraging its rich cultural landscapes and suitability for e-bike tourism. Through a residency-based co-creation process, the research team collaborated with local residents, farm operators, and travelers to develop tour content. The design incorporated experiential touchpoints such as a "Low-Carbon Departure Ritual," "Carbon Reduction Certificate," and "DIY Low-Carbon Meals," and utilized tools such as experience journey maps and service blueprints to design and optimize the overall service flow.

The results demonstrate that participatory design fostered community engagement and place identity; service design clarified customer touchpoints and enhanced the flow of experiences; and ritual design enhanced tourists' emotional engagement with sustainability and strengthened cultural memory. Overall, this study validates that integrating participatory and service-oriented design strategies effectively enhances low-carbon rural tourism experiences and offers concrete references for sustainable tourism and rural revitalization.

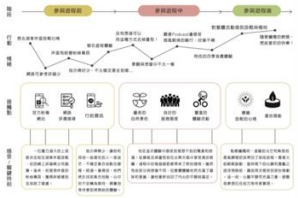

Fig. 1: Experience Journey Map developed in this study (College Student Returning to Rural Villages Project).

Fig. 2: National United University's Cultural and Creative Industries Department won six awards, including Bronze, at the 14th Rural Revitalization Competition, with Vice President Hsiao Bi-Khim presenting the prizes.

Keywords: Participatory Design[1], Service Design[2], Low-Carbon Tourism[3], Ritual Design [4]

P-01

Residual Stress Measurement of Copper thin film on Polymer Substrates by Sputtering Method.

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1. Background and Objective

Multilayer composite materials are used in various fields because they provide functionality by coating different materials on the surface of the substrate. However, it is important to study the stress state inside the material because the performance of the material changes due to repetitive internal loading caused by vibration and other factors in the operating environment. In a previous study, we evaluated the crystalline state and residual stress changes per diffraction line by in situ measurements when mechanical loading was applied to three differently characterized multilayer films (TiN, Cu, SiO2) on an S45C substrate. It was found that the Young's modulus of the substrate was larger than that of the Cu thin film when the film was deposited on S45C substrate, and therefore, the residual stress of the Cu layer may not have been evaluated accurately. The purpose of this study is to evaluate the residual stress of a single layer of Cu thin film deposited on a polymer substrate using the sputtering method.

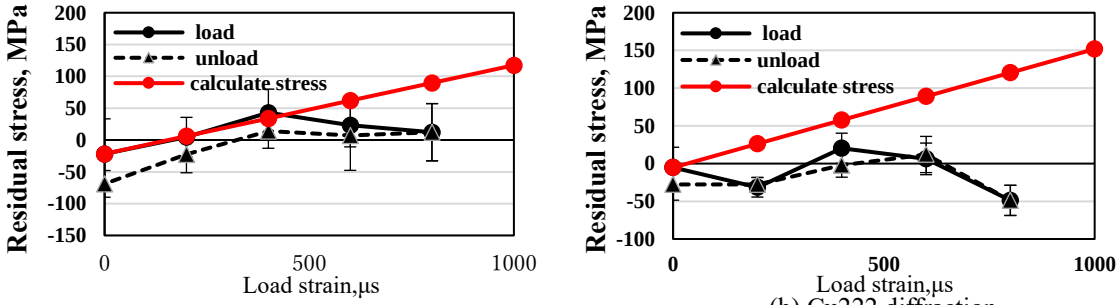
2. Experimental method

The substrate was made of PPS resin 1 mm thick and 10 x 70 mm in size. The surface was polished with 1000-grit emery paper. Next, films were deposited on both polished and unpolished samples. A single layer of Cu was formed on the substrate by sputtering. The deposition was performed at an Ar gas pressure of 0.6 MPa, and the sputtering power and substrate temperature were set to Cu (300 W: 200°C), respectively. The mechanical loading was a four-point bending load, loaded and unloaded in 200 με steps from 0 to 800 με. CuKα characteristic X-rays were used for qualitative analysis and residual stress evaluation of the samples. residual stress of the Cu layer was measured using the $\sin^2\psi$ method. Residual stress was examined using the following evaluation equations (1) and (2). where M is the slope detected in the $\sin^2\psi$ diagram, K is the x-ray elastic constant, E is the elastic constant of the sample, and ν is Poisson's ratio.

$$K=\frac{E}{2(1+\nu)}\cdot\cot\theta_0\cdot\frac{\pi}{180} \quad (1) \qquad \sigma=\frac{E}{1+\nu}\frac{\varepsilon\Phi\varphi}{sin^2\Psi}=K\cdot M \quad (2)$$

3. Experimental Results and Discussion

Figure 1 (a) shows the relationship between the residual stress change in the Cu220 diffraction when the Cu monolayer film is subjected to mechanical loading; a similar residual stress change is observed in the Cu311 diffraction. (b) shows the residual stress change in the Cu222 diffraction. Unlike (a), the graph in (b) shows an increase in compressive residual stress from 0 to 200 με. Since this data shows no change corresponding to the load stress and may indicate that strain was not applied correctly, the measurement should be performed again by increasing the substrate thickness and fabricating a sample without bending.



(a) Cu220 diffraction (b) Cu222 diffraction

Fig.1 Residual Stress Change in PPS Resin (with Friction)

P-02

Residual Stress Change in Aluminum Alloy Material by FSW with Mechanical Loading

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1. Background and objective

Friction stir welding (FSW) is the process of joining metals tightly by plastic flow using a rotating tool. This joining method does not melt the metal and does not use welding materials or atmospheric gases, resulting in fewer joining defects and higher joining strength.

In this study, we evaluated the mechanical properties of aluminum alloy materials joined by friction stir welding using a general-purpose milling machine by measuring in situ the change in residual stress in the joint when mechanical loading was applied.

2. Experiment details

Two types of aluminum alloy materials (JIS: A5083 (Al-Mg alloy) and A2017 (Al-Cu-Mg alloy)) were used as the joining base metal. The angle between the joining surface and the tool rotation axis (tool inclination angle) was 0°, and the joining length was 120 mm. To compensate for the lack of heat input during joining, a gas burner was used to heat the joining area to about 200-250°C. The heating was applied along the joining direction to the butt joints of the base materials to be joined. The joined specimens were cut using an electric discharge machine to make test specimens. The specimens were subjected to scanning electron microscopy (SEM) observation of the bonded cross section and hardness testing. Residual stress was evaluated using the X-ray stress measurement method. The measurement used Cukα rays as characteristic X-rays, and stress values were calculated using the $2d\text{-}\sin^2\psi$ method. The mechanical load was applied by uniaxial tension. The loading conditions were 200 με in increments from 0 to 800 με, and the residual stress change in the joint was evaluated by in-situ measurement.

3. Experimental results and discussion

The cross section of the joint by FSW bonding was observed using SEM. The results showed that internal tunneling defects were generated when the temperature difference between the AS side, where the joining tool rotation direction is the same as the joining direction, and the RS side, where the direction is opposite, was approximately 100°C or higher. The hardness of the FSW-joined material was almost the same as that of the pre-joined material when no defects occurred and the material was properly joined.

Figure 1 shows the distribution of residual stress in the joined material. The residual stress in the joint is almost homogeneous due to stress relaxation caused by heat generation during processing, and the 2017 material is stress-free. However, when a tensile mechanical load is applied, the joining tool side tends to change significantly to the tensile side.In addition, the residual stress distribution in the FSW joints with defects tended to relax around the stirred area and defects when mechanical loading was applied.

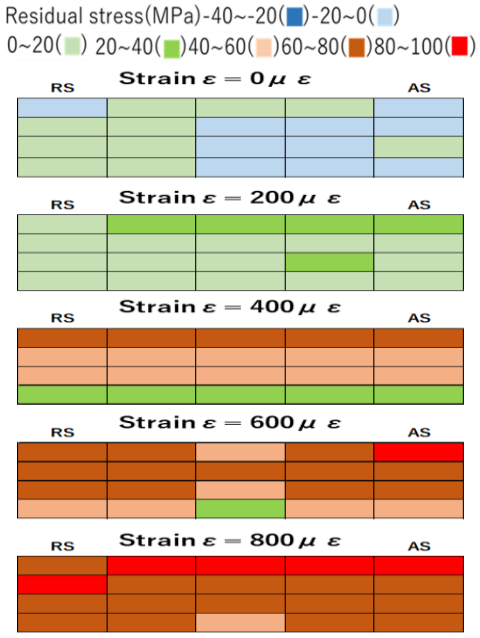

Figure 1 Residual stress distribution in FSW joining materials subjected to mechanical loading.

P-03

Palladium-Catalyzed Nucleophilic Substitution of Benzyl Carbonates

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η^3- Benzyl–palladium complexes are known intermediates in organic synthesis[1], yet nucleophilic substitution reactions involving benzyl esters have not been extensively studied. In this research, we investigated the development of a palladium-catalyzed system for the efficient substitution of benzyl esters with nucleophiles, aiming to expand the utility of palladium catalysis in C–C and C–P bond formation. Benzylmethyl carbonate was synthesized as the substrate and subjected to substitution reactions using various palladium catalysts, ligands, solvents, and nucleophiles under mild conditions. While dimethyl phosphite failed to yield the desired products under any tested conditions, a successful reaction was observed when dimethyl malonate was used as the nucleophile. Optimization of the reaction solvent revealed that non-protic polar solvents, especially tetrahydrofuran (THF), facilitated the substitution reaction, albeit with modest yield. The use of protic solvents, in contrast, completely suppressed product formation. These findings suggest that the high nucleophilicity of the enolate anion derived from dimethyl malonate is essential for attacking the η³-benzyl–palladium intermediate and driving the reaction forward. Further studies will focus on improving reaction efficiency through the selection of optimal catalysts, ligands, and solvents, as well as expanding the scope to a broader range of nucleophiles and electrophilic benzyl derivatives.

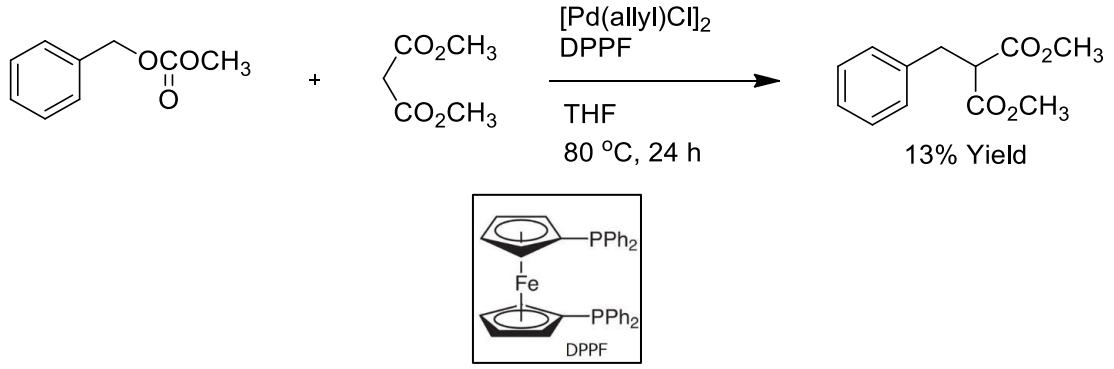

Fig. 1: Nucleophilic substitution reaction of benzyl carbonate with dimethyl malonate

Keywords: Palladium catalysis[1], Nucleophilic substitution[2], Benzyl carbonate[3]

[1] Hata, G.; Takahashi, K.; Miyake, A. *J. Chem. Soc., Chem. Commun.***1970**, 1392−1393. Takahashi, K.; Miyake, A.; Hata, G. *Bull. Chem. Soc. Jpn.***1972**, *45*, 230−236. Atkins, K. E.; Walker, W. E.; Manyik, R. M. *Tetrahedron Lett.***1970**, *11*, 3821−3824.

P-04

Effect of Substituent Position in Salicylideneaniline-Metal Complexes on Antimicrobial Property

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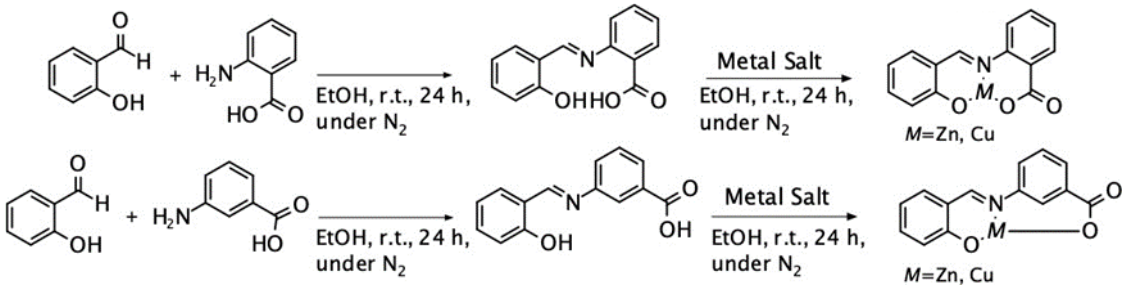
Schiff bases are organic compounds bearing nitrogen-carbon double bonds. Due to their easy structural design and synthesis, they have been studied as materials for organic dyes and ligands to metal atoms. We have synthesized the metal complexes bearing salicylideneaniline skeleton, a type of Schiff base, and reported that introducing halogen substituents on the ligand exhibited remarkable antimicrobial activity against *Bacillus* [1]. In this study, we investigated the synthesizing ligands with salicylideneaniline skeletons having different structures from each other by modifying the position of the functional group on the aromatic amine used as a ligand precursor and comparing the antimicrobial activity of the metal complexes obtained by interacting with the metal salt. The synthesized metal complexes were examined for their antimicrobial activities against *Bacillus subtilis* (IFO13719) and *Escherichia coli* (HB101). To synthesize salicylideneaniline derivatives as ligands, salicylaldehyde and the corresponding aromatic amines (3-aminobenzoic acid or anthranilic acid) were reacted in dehydrated ethanol at ambient temperature under a nitrogen atmosphere. The corresponding metal complexes were obtained from salicylideneaniline derivatives with zinc or copper salt, respectively (Scheme 1).

The antimicrobial activity test of the obtained metal complexes was evaluated using the paper disc method. Filter paper discs were soaked in the aqueous solution and placed on an agar medium inoculated with *Bacillus subtilis* or *Escherichia coli*, respectively, and incubated. After incubation, the antibacterial activities were evaluated by measuring the diameter of the inhibition zone formed around the disc.



Scheme 1: Synthetic route of salicylideneaniline-metal complexes

Keywords: Schiff Base, Metal Complex, Antimicrobial Activity

[1] Arisa Niinobe, Satoshi Ohmura, (2024) The 104th Annual Spring Meeting of the Chemical Society of Japan, P1-3pm-89

P-05

Investigation of UV Absorption Properties and Biodegradability of Cyclic Diketone Compound without Aromatic Ring Structures

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In recent years, it has been revealed that certain organic compounds used in sunscreens can adversely affect marine life when discharged into the ocean. As a result, sunscreen ingredients are being regulated and reconsidered. Our group focused on dialkyl 1,4-cyclohexanedione-2,5-dicarboxylate derivatives, which are characterized by the absence of a benzene ring. These compounds exhibit ultraviolet (UV) absorption due to the stabilization of the unstable enol form by the formation of intramolecular hydrogen bondings.

In this study, two derivatives with different alkyl chains at the ester moiety, dimethyl 1,4-cyclohexanedione-2,5-dicarboxylate **1**, and dicetyl 1,4-cyclohexanedione-2,5-dicarboxylate **2**, were used. Compound **2** was synthesized by transesterification using ammonium salt as a catalyst, starting from commercially available compound **1**. Samples were prepared by dispersing each derivative in vaseline. Each sample was applied to a quartz plate and then immersed in a 3% NaCl aqueous solution or artificial seawater for 24 hours, and the progress of UV absorption was measured. In addition, the total organic carbon (TOC) amount was measured in a microbial decomposition test using sludge to evaluate the biodegradation properties.

The results of the immersion test showed that the sample containing compound **2** bearing cetyl chains showed a smaller decrease in absorbance in the UV absorption spectrum than the sample containing compound **1** bearing methyl chains. This is thought to be because the longer carbon chain length at the ester moiety improved the compatibility of the compound with vaseline and suppressed leaching into the aqueous phase. In the biodegradation test, a decrease in TOC was observed, suggesting that both derivatives were decomposed by microorganisms present in the sludge.

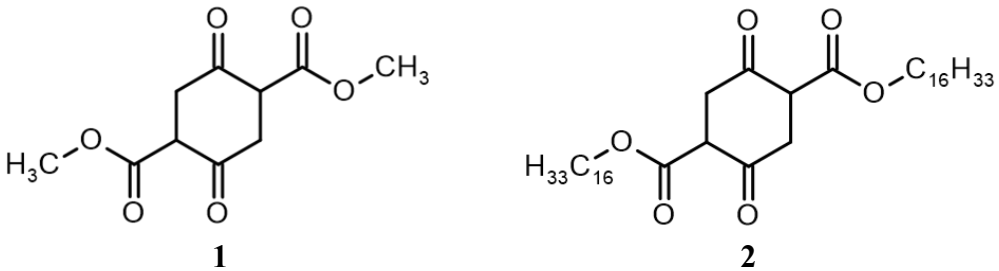

Fig. 1: The cyclic diketone derivatives **1** and **2** bearing ester moieties

Keywords: Sunscreen, Enol compound, Transesterification

P-06

Exploration of Functional Constituents of “Sansha” (Bombyx Faces) Extract: Effect of Ultraviolet Light on Antimicrobial Properties

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An attempt to add value to the by-products generated during the production of Iyoito (Iyo Raw Silk), one of Japan's Geographical Indications of Ehime Prefecture products, is essential to maintaining a sustainable local industry. Bombyx faces, called "Sansha," is silkworm droppings that make raw silk, are known as herbal medicine and have been used for medicinal tea/liquor, field fertilizer, and livestock feed from olden times.

In this study, we attempted to examine how to utilize the components contained in Sansha to explore its unique uses. Sansha was pretreated by immersing it in hot water for a short period of time, then immersed in water or ethanol and kept at a constant temperature to extract the components contained in it. The antibacterial properties of the obtained extract against *Escherichia coli* (HB101) strain and *Bacillus subtilis* (IFO13719) strain were evaluated, and the photodegradation properties of the green component extracted with ethanol were examined.

The antibacterial activity of the obtained extract was evaluated. Filter paper disks with a diameter of 1 cm were immersed in each extraction solution for 1 day. These disks were then placed on agar plates inoculated with bacteria and cultured for 24 hours. Antibacterial activity was evaluated by measuring the diameter of the inhibition zone around the disk. Furthermore, to investigate the effects of photodecomposition, the ethanol extracts were exposed to ultraviolet light for a particular time, and similar evaluations were performed. Antibacterial activity was observed in each extract, and a decrease in activity due to decomposition by ultraviolet light was also confirmed. These results are reported in detail in this paper.

(a) (b)

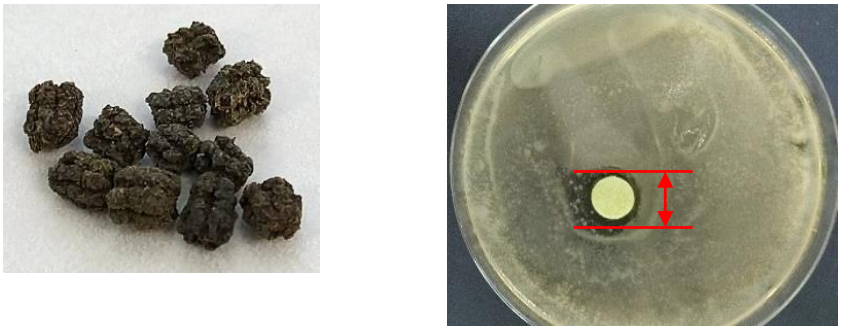

Fig 1. : Photograph of Sansha (a) and Antimicrobial Property (b)

Keywords: Bombyx faces, Extract, Antimicrobial activity, Photodegradation

P-07

Photochromic and fluorescent properties of thinylvinylthizazole derivative having methyl group

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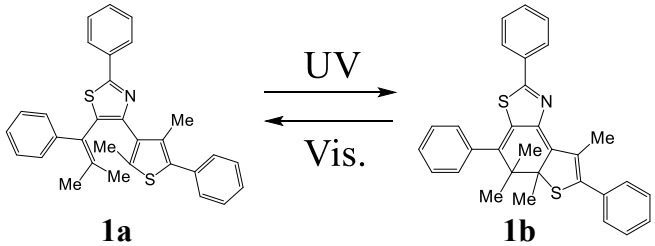
Photochromism is a photoinduced reversible transformation of a chemical species between two forms having different absorption spectra. Photochromic compounds have attracted much attention because of their potential ability for optical memory, photo optical switching and display devices. Arylvinylthiazole derivatives [1] are similar in chemical structure to terylene [2] and diarylethene [3], and exhibited reversible photochromic reaction. Recently, we observed that thienylvinylthiazole derivatives emit fluorescence of different colors along with photochromic reaction. However, the details of the fluorescence behavior have not been clarified. In this study, we have synthesized thienylvinylthiazole derivative **1a** having methyl group to examine the photochromic reaction and fluorescence property.



1a **1b**

Fig. 1: Photochromism of thienylvinylthiazole derivative having methyl group

Keywords: Photochromic mole, Fluorescence switching, Methyl group.

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[2] S. Fukumoto, T. Nakashima, T. Kawai, *Angew. Chem. Int. Ed.,* 50, 1565-1568 (2011).
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P-08

Effects of Spin-Orbit Interaction on MnAs-Monolayer in GaAs(110)

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Isolated Mn atomic wire in vacuum, with Mn atomic spacing equal to that in the bulk, are found to have no direct exchange interaction between the atoms, indicating that the electronic state of the GaAs plays an important role in the development of ferromagnetic coupling. [1] Therefore, one-dimensional replacement of Ga atoms with Mn atoms in the bulk-GaAs is expected to development magnetic properties different from those on the surface.

In this study, we revealed the effect of the SOI on the ground state of the one-dimensional spin alignments of the Mn atomic wire on the bulk-GaAs(110) (Fig. 1), using the spin-density functional pseudo potential method considering the spin-orbit interaction. In the alternate alignments, the energy difference with the ferromagnetic one exhibits a curve that seem to decay while oscillating(Fig. 2).

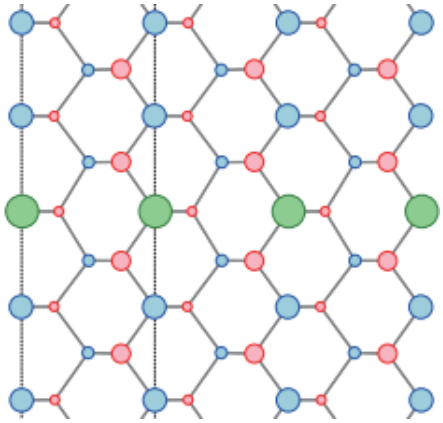

Figure 1: Atomic arrangement of Ga substituted Mn atomic wire on GaAs(110) bulk. Green, blue, and red spheres indicate Mn, Ga, and As atoms, respectively.

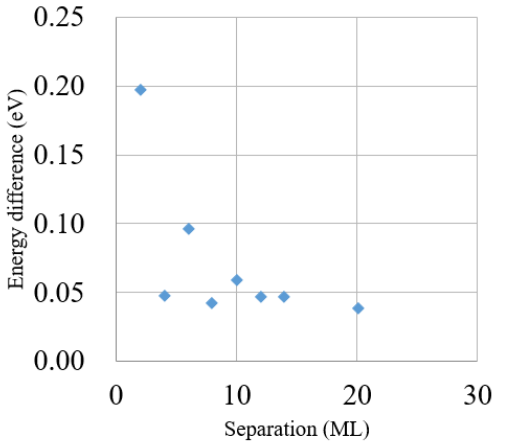

Figure 2: Energy difference from parallel spin alignment. Circle and square indicate spiral and alternative spin alignments.

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P-09

Interdiffusion and impurity coefficients of Zr and Hf of Be-ta solid solution in Ti

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1. Introduction

In recent years, reduction of carbon dioxide emissions has been considered essential for solving global warming, and there is a need to improve the fuel efficiency of power plants and transportation equipment. This calls for the development of light metal structural materials that require control of the mechanical properties associated with advanced microstructural control. In particular, the control of the microstructure and elucidation of the high-temperature strength of titanium alloys involve diffusion phenomena, and simulation data of such phenomena are becoming increasingly important. However, data on the diffusion coefficients of Ti alloys are still scarce. Therefore, the purpose of this study was to measure the interdiffusion coefficients, impurity diffusion coefficients, and activation energies of Zr and Hf in the β-phase of titanium alloys.

2. Experimental procedure

After weighing the raw materials (Ti, Zr and Hf), the alloys Ti-20at.%Zr and Ti-20at.%Hf were prepared in a vacuum arc melting furnace. The alloy was then homogenized at 1000°C for 24 h. Next, the specimens for the diffusion couples were cut using an electrical discharge machine, placed between handmade jigs, and heat-treated from 1373 K to 1523 K to reach the β-phase region. Heat treatment was performed in a transparent quartz tube filled with argon. The prepared diffusion couples were sliced to a thickness of approximately 2 mm, and the cross-section was mirror polished. Based on the concentration gradients, the interdiffusion coefficients of Zr and Hf were calculated using the Boltzmann-Matano and Hall's method. The activation energies were calculated from the experimentally obtained diffusion coefficients and by first principal calculation using VASP.

3. Results and Discussion

Based on the concentration gradients of Zr and Hf in the cross sections of the diffusion couples, the Matano interface was determined, and a concentration-distance curve was made with the $x = 0$ at the Matano interface. The interdiffusion coefficient was obtained for each concentration. The concentration dependences of the Zr and Hf interdiffusion coefficients in β-titanium, and the impurity diffusion coefficients were obtained by extrapolation. On the other hand, the Hall's method was used to determine these impurity diffusion coefficients. In this method, data were plotted on a normal probability paper, and impurity diffusion coefficients were calculated from their slopes. The impurity diffusion coefficients for Zr and Hf at 1200°C obtained using each method were compared with those values in previous reports. The results obtained for Zr were in good agreement with previous reports, confirming the validity of the measurements in this study, and suggesting that the impurity diffusion coefficients of each element can be organized by the atomic radius ratio with titanium.

Keywords: *Interdiffusion, Boltzmann-Matano method, Be-ta solid solution, Ti alloys*

P-10

Proposal for Utilization of Volatile Data in Factory Large-scale Machines.)

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Random Access Memory (RAM) is a type of memory that retains data only while power is being supplied and loses the data when the power is turned off. In general, volatile data is well known to occur in electrical storage media such as RAM and flash memory [1], but this phenomenon can also be seen in information that is temporarily displayed on a display. The factory is equipped with a variety of large machines for machining, such as cutting, grinding, drilling, polishing and molding. The monitors attached to these machines temporarily display information such as operating status and error codes, but because this data is volatile, it has not been used much.

Therefore, this paper proposes a method to effectively utilize the error codes temporarily displayed on the monitors of large machine tools by capturing and digitizing them with a Wi-Fi camera. Since the subject of this study was the monitor of factory large machines, we asked a local company for cooperation. First, we visited the factory and proposed the system shown in Figure 1. Next, we proposed using the volatile error codes utilizing shown in Figure 2, and developed an application based on those requirements. Then we verification using sample videos collected at the site. For text conversion, we adopt EasyOCR [2] with high accuracy through preliminary experiments. As a result, we were able to convert the error code field from a display showing a sample video in the laboratory into a number, search the code list from the number, and successfully notify the smartphone.

However, in the factory verification, we encountered unexpected problems, such as differences in the shape of the display and monitor, issues with light reflecting off the monitor, resolution issues due to compression, and delays in data transfer. As a result, we were unable to achieve our initial goal of utilizing data at the factory, and overcoming these issues remains a challenge for us going forward.

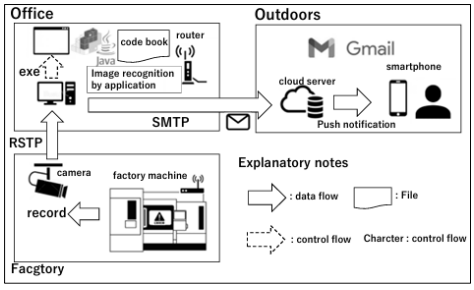

Fig. 1: Overview of the proposed system.

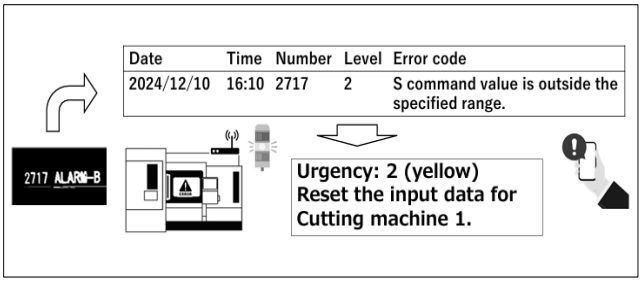

Fig. 2: Utilizing volatile error codes.

Keywords: Volatile data, EasyOCR, Error code, Wi-Fi camera

[1] Naoki.Tamaoki, Nobutoshi.Aoki, & Hideaki.Aochi, (2018), *Current status and issues of flash memory*, Journal of the Physical Society of Japan, Vol. 73, No. 9, pp.648-657

[2] Python Package Index(PyPI), easyocr 1.7.2
https://pypi.org/project/easyocr/

P-11

Trial of Automatic Driving by Road Sign Recognition using JetRacer.

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In recent years, various studies on AI have been conducted and significant progress has been made, and it is predicted that the development of AI will make the world more convenient and change our lives drastically. In the field of automobiles, development of self-driving cars is progressing. In Japan, the revised Road Traffic Law went into effect on April 1, 2023, lifting the ban on “Level 4” automated driving, which allows unmanned driving on public roads.[1]

Therefore, this research was conducted with Level 4 in mind and with an eye toward what kind of ADAS (Advanced Driver-Assistance Systems) would be needed to enable unmanned driving on public roads. The JetRacer [2], a 1/12 Radio Control model AI race car powered by NVIDIA's Jetson Nano, becomes smarter each time it is repeatedly trained to drive by an onboard camera. This makes it possible to recognize lanes and road signs through machine learning, and to control the JetRacer's steering (angle) and throttle (speed) according to traffic rules.

As a result of the verification experiment shown in Figures 1 and 2, it was confirmed that by capturing video using the JetRacer's onboard camera and using machine learning, the vehicle was able to recognize several types of road signs that had been learned beforehand and drive automatically on the test course without deviating from its lane.

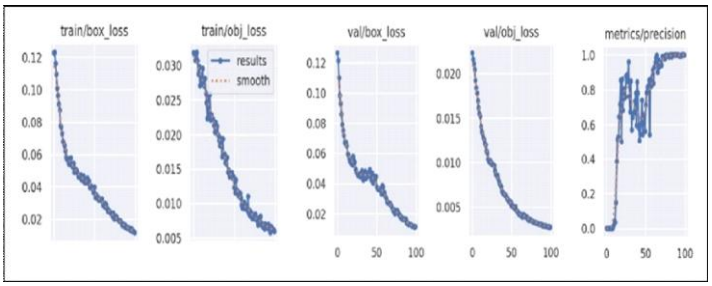

Fig. 1: Training process of YOLOv5.

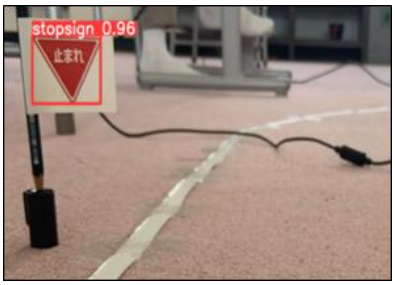

Fig. 2: Detection image Road sign.

Keywords: ADAS, JetRacer, Road Sign, Recognition

[1] Ministry of Land, Infrastructure, Transport and Tourism, (2020) *Recent trends surrounding autonomous driving*, 2nd Vehicle Safety Measures Review Meeting
https://www.mlit.go.jp/jidosha/content/001844082.pdf
[2] NVIDIA, DEVELOPER, JetRacer
https://developer.nvidia.com/embedded/community/jetson-projects/jetracer

P-12

Proposal for Children's Handwritten Character Recognition using CNN.

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One of the difficulties in teaching in school education is that graders cannot read the letters of learners whose writing skills are not sufficiently advanced. In addition, it may take a long time to grade the work or it may be impossible to grade the work.[1] It is necessary to automatically recognize students' handwriting to speed up grading.

In this paper, we apply a recognition method based on CNN (Convolutional Neural Networks) to handwritten characters. MNIST is available for a large-scale handwritten digit image dataset, and CNN using this dataset has achieved 99.84% accuracy in recognizing handwritten digits.[2] Using MNIST as a reference, we estimated the number of data required for Japanese handwritten character recognition, which is approximately 70 million characters, which is a huge amount of training data. Therefore, we decided to collect hiragana character data, which is limited to 46 characters. We collected character data by scanning handwritten hiragana written on paper. The collected character data is divided into two sets, one for training and the other for testing. After training with the training data using CNN, the test data is used to evaluate the recognition accuracy of the handwritten characters.

We created teaching materials for learning hiragana, and collected handwritten hiragana data by actually learning with these materials at elementary schools. As a result of recognition using this data, we succeeded in creating a model that can recognize children's handwritten hiragana with an accuracy of 94.10%. In addition, this model recognized not only children's handwritten hiragana but also adult hiragana with an accuracy of 97.38%. However, since the practical level of character recognition accuracy is more than 99%, the recognition accuracy needs to be improved.

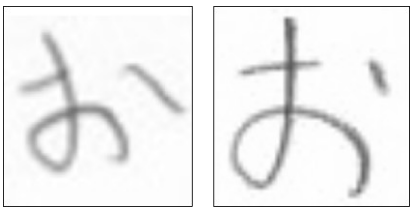

Fig. 1: Collected samples and AI predictions.

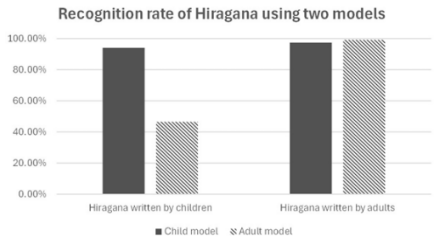

Fig.2: Recognition rate for child and adult models.

Keywords: Children, Handwritten, Convolutional Neural Networks

[1] AERA DIGITAL, https://dot.asahi.com/articles/-/70673?page=1
[2] Kaggle, MNIST Dataset https://www.kaggle.com/datasets/hojjatk/mnist-dataset

P-13

A basic research of aqua getter made by precast concrete based on analysis of experimental data of laboratory tests

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In recent years, damage from internal flooding caused by localized heavy rainfall associated with climate change has become increasingly serious. In order to mitigate the damage caused by internal flooding, rainwater harvesting and infiltration gutters that add storage and infiltration functions to gutters as drainage channels are being utilized. However, although the runoff control function by storage has been evaluated, the infiltration function has not been evaluated. In this study, we conducted an experiment using a 1/10-scale infiltration gutter model to reproduce the construction conditions in an acrylic tank, and evaluated the infiltration conditions and infiltration performance in order to clarify the infiltration mechanism of infiltration gutters and the optimal locations of infiltration holes. According to the experimental results, if the occlusion rate is about 10%, the effect on penetration performance is small, but if the occlusion rate is 37% or more, it is penetration.

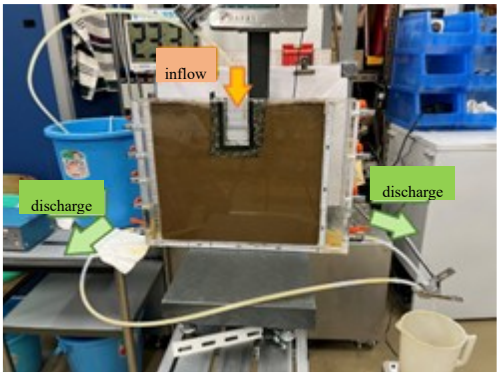

Fig. 1: Schematic diagram of 1/10 scale of aqua getter's model test apparatus.

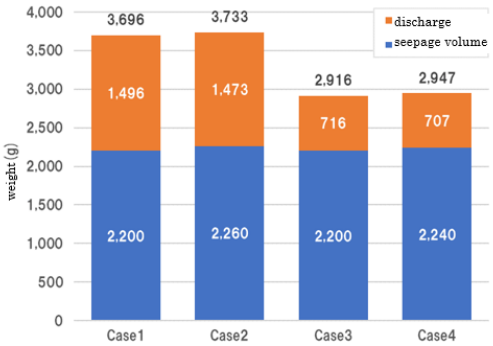

Fig. 2: Relation between rate of occlusion, discharge and seepage volume in test apparatus.

Keywords: Aqua getter[1], Model test apparatus[2], Strage[3], Inflow[4], Discharge[5], River basin flood control[6]

[1] Endo, J. & Tamoto, H. (2008). An investigation on change in infiltration capacity of rain water infiltration facilities. *Civil engineering journal*, 50-11, pp. 30-33.

[2] Watanabe, K., Hosokawa, K., Mukaitani, M. & Aramaki, H. (2025). A performance evaluation of aqua getter made by precast concrete based on analysis of experimental data of laboratory tests. *Journal of annual conference of Japan society of Civil Eng. Shikoku brunch*, VI-11.

P-14

Effects of Large-Scale Flooding on Ayu Spawning Grounds in the Shimanto River

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In the Shimanto River in Kochi Prefecture, gravel mining in the 1960s and 1970s caused a decrease in ayu (sweetfish) spawning grounds and fish catches[1]. Today, about 80% of the spawning grounds are concentrated in a place called Ozui. This is a problem because if a big flood happens, most of the spawning grounds could be lost[2].This study aims to understand how floods change the riverbed and affect ayu spawning areas. We used two tools: iRIC Nays-2DH to analyze river flow and bed changes, and EvaTRiP to evaluate river environment. We looked at areas with water depth between 0.1–0.5 meters and flow speed between 0.5–1.7 meters per second, which are good conditions for ayu to spawn.From the results (shown in Figures 1 and 2), we found that the spawning area at Ozui stayed safe even after a large flood. However, at Kobatake, Nyuta, and Oura, the spawning areas got smaller because of changes in river shape and flow speed. Near 10 km from the river mouth, sand built up after the flood, raising the riverbed and improving spawning conditions (as seen in Figure 2). Still, overall, the total spawning area decreased, and the risk of losing spawning grounds is increasing.

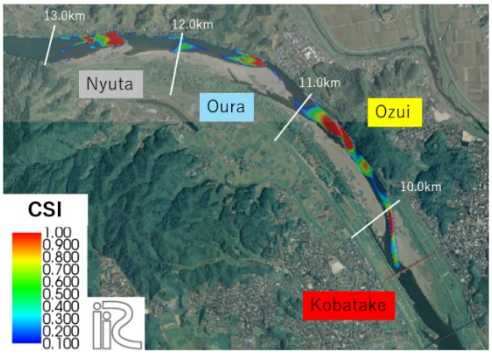

Fig.1: Current ayu spawning ground environment

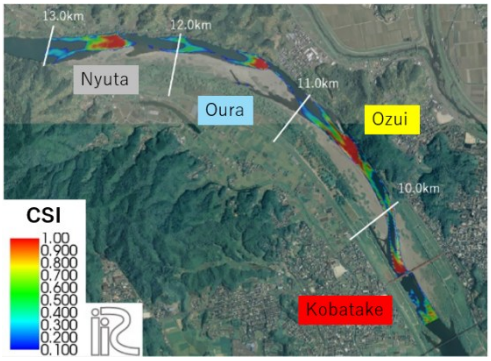

Fig. 2: Ayu spawning ground rings after large scale flooding (results of riverbed fluctuation analysis)

Keywords: Massive flooding[1], Flow and riverbed fluctuation analysis[2]

[1] Nakamura Office of Rivers and National Highways, Shikoku Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism: Results of Monitoring Survey on Ayu Riparian Development and Future Project Development, February 2024, p. 3.

[2] Masaharu Okada, Naoaki Matsuoka, and H. Zhang: A Study on Extraction of Environmental Sites Suitable for Ayu Spawning in the Shimanto River and Prediction after the Outflow, Journal of River Engineering, Volume 23, June 2017.

P-15

Development and Field Application of a Smartphone-Based River Turbidity Measurement Method

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Turbidity is an important sign to understand how much sediment comes from rivers and how water quality changes after heavy rain. But special devices to measure turbidity are expensive and not used by many people. This study wanted to make a cheap and easy way to measure turbidity using a smartphone. We took underwater photos and used image data like red brightness and saturation. Then, we used a machine learning method called Random Forest to predict turbidity. In tests, the prediction accuracy was low (R^2=0.64 on sunny days and R^2=0.57 on cloudy days). We thought that in improving accuracy, we could use the red brightness value of the gray board, which reflects 18% of the light, to consider the difference in sunlight. When we used a gray board, the accuracy became much better (around R^2=0.87 for both sunny and cloudy days). The correlation between measured and estimated turbidity is shown in Fig. 1. This shows the gray board helps fix image changes caused by different lighting and makes the smartphone method more useful and reliable.

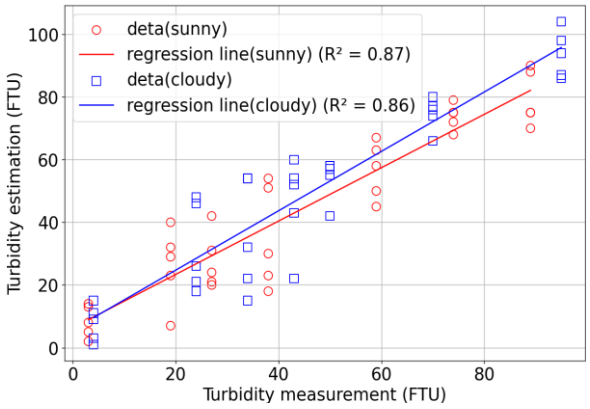

Fig. 1: Correlation of Turbidity Estimates from Smartphone Images in Sunny and Cloudy Weather.

Keywords: Turbidity, smartphone, machine learning model,

[1] Tanaka, T., Takeda, R., Okada, S., (2024). A study of simple turbidity measurement technique using images taken by smart phone. JSCE Shikoku Branch, Japan Society of Civil Engineers.

P-16

Aiming to improve efficiency at construction sites with the power of ICT

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1. Introduction

ICT construction refers to the integration of information and communication technologies into processes such as surveying, design, construction management, and on-site operations. Although ICT offers significant potential to improve efficiency and precision, adoption in the field remains limited due to perceived complexity and uncertainty.

2. Field Experience with ICT Construction

Through joint research with Nishio Rent All Co., Ltd., we gained hands-on experience with various ICT construction tools and surveying devices. We were particularly impressed by the efficiency and accuracy of one-person surveying using a Total Station (TS) and prism. Furthermore, we followed the complete workflow—from data collection to computer-based design and automated execution using construction machinery. During excavation work with an ICT-equipped grader, we observed how the machine performed precise operations with minimal human intervention, clearly demonstrating the advantages of ICT construction.

3. Observation of Advanced Technologies

During a visit to the Kansai Machinery Center, we observed the latest ICT innovations in action, including machine control (MC) backhoes, 3D scanners, and augmented reality (AR) devices. The 3D scanner enabled fast and accurate site digitization, while the AR device allowed real-time visualization of design data over the actual construction environment. These technologies highlighted the transformative potential of ICT in modern construction.

4. Realizations and Challenges

Initially, we assumed ICT tools would be difficult to operate. However, after using the equipment, we found them surprisingly accessible—even for users with little prior experience. Despite this, many practitioners in the field remain hesitant to adopt ICT due to concerns such as: - “I don’t know where to start.” - “The technology seems too complicated.”

5. Proposal: EST (Eye See Technology)

To support first-time users and promote broader ICT adoption, we propose an app called EST (Eye See Technology). EST is designed to recommend suitable ICT tools and methods tailored to the specific characteristics of a construction project. By providing easy-to-understand guidance, EST aims to reduce anxiety and facilitate the first step toward implementing ICT on-site.

6. Conclusion

Our experiences underscore the importance of ICT as a core technology for the future of construction. With appropriate support tools like EST and increased exposure to hands-on practice, we believe ICT can be seamlessly integrated into the industry, enhancing productivity and bridging the gap between traditional skills and digital innovation.

P-17

An Investigation into the Service Quality and Customer Satisfaction of Taiwan High-Speed Rail

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This study examines the impact of Taiwan High Speed Rail (THSR) service quality on customer satisfaction and behavioral intentions (revisit and recommendation willingness), specifically focusing on the Miaoli HSR Station. The research addresses the gap between public expectations for THSR's speed and convenience and the actual experience, which often involves long waiting times, inconvenient transfers, and unsatisfactory staff attitudes.

We adopted Parasuraman et al.'s (1988) SERVQUAL model, categorizing service quality into five dimensions: tangibles, reliability, responsiveness, assurance, and empathy. Data was collected through a questionnaire survey, yielding 118 valid responses. These were then analyzed using SPSS for reliability and multiple regression analysis.

The results indicate that all five service quality dimensions significantly and positively influence customer satisfaction, with reliability and empathy showing the most substantial impact. Furthermore, a significant positive correlation exists between customer satisfaction and behavioral intentions, confirming that enhancing customer satisfaction effectively boosts passengers' willingness to reuse and recommend THSR services.

The study also reveals that different passenger types (business, tourist, elderly) prioritize varying service aspects. Accordingly, we recommend that THSR implement customized services tailored to these diverse customer segments. Improving waiting times, transfer convenience, and staff attitudes are crucial steps to enhance overall service image and customer loyalty. The practical recommendations from this study can serve as a valuable reference for THSR and the government in optimizing transportation policies and customer service quality.

Keywords: Service Quality, High-Speed Rail Operations, Customer Satisfaction, PZB Model

P-18

Connecting, Expanding: Ube KOSEN's Global Power

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International exchange activities at Ube National College of Technology

Many students at our school are interested in international exchange, which is why they actively participate in related activities.
Our goals are to encourage students to engage in international exchange, improve their English communication skills, and nurture engineers who can thrive in a global environment.

Through these activities, we aim to deepen interactions between international and Japanese students both on campus and in the dormitory, while also creating opportunities for students to use English in real-life situations.

We observed noticeable improvement in English communication skills through interactions with international students.
It was also a valuable opportunity to learn about foreign cultures while staying in Japan.

These experiences not only enhanced our English abilities and cross-cultural understanding, but also promoted exchange among Japanese students from different departments.
We hope to continue expanding such activities in the future to foster globally competent engineers.

P-19

Religious Practice and Identity: A Discussion Based on Women's Participation in Miaoli County

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Article 11 of the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) aims to ensure women's equal rights in employment and participation in public affairs. With the gradual implementation of CEDAW in Taiwan, the concept of gender equality has been increasingly integrated into various sectors. Even in the traditionally male-dominated religious sphere, structural changes have begun to take place, with women's participation and visibility steadily rising.

This study adopts an action research approach, supplemented by qualitative interviews, and applies perspectives from gender sociology and gender role theory for in-depth analysis. The research focuses on gender distribution in religious positions in Miaoli County, including temple leaders, funeral ritual specialists, and members of ancestral worship organizations . The findings show that among the 379 temples currently in Miaoli County, 65 are led by women, clearly indicating that women are gradually entering the core decision-making circles of religious organizations.

In the funeral service sector, the proportion of female ritual specialists has shown a steady upward trend, reaching 54.5% in 2023. This figure is significantly higher than the national average of 44%, reflecting growing societal acceptance of women working in funeral-related services. Although the proportion of female members in ancestral worship organizations remains relatively low—only 6.64% in 2023—it has increased slightly by 0.1% compared to 2022. Overall, women's actual participation in the religious domain of Miaoli County has notably increased, affirming that gender equality ideals are gradually taking root in local religious practices. This study will conclude by offering policy recommendations aimed at further addressing and improving the gender-discriminatory customs that still exist within religious contexts.

Keywords: Gender customs, Gender sociology, Gender role theory, Pai-hsia staff, Gender discrimination

P-20

The Promotive Effects of Gamification Marketing on Cultural Identity and Travel Intention

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With the rapid development of the digital gaming industry, the internet has become a powerful medium for presenting diverse cultural characteristics to a global audience. In addition to conventional channels of information dissemination such as informational videos, advertisements, and news, the film and gaming industries have proven to be among the most effective platforms for delivering cultural content and creating lasting impressions. Black Myth: Wukong stands out as a successful recent case in which Gamification Marketing was employed to promote cultural tourism. By offering a novel perspective on the classic literary work Journey to the West and integrating real-world geographic settings into the game's environment, the game presents culture in a way that is both innovative and faithful to its origins. This unique approach has attracted widespread attention from fans and players alike, sparking a tourism trend to the real-world locations depicted in the game. This phenomenon highlights the potential of Gamification Marketing as an effective strategy to enhance cultural identity and stimulate tourism-related consumption.

This study investigates how Gamification Marketing influences local cultural identity and tourism consumption behavior. By adopting psychological frameworks such as Immersion Theory and Herd Behavior Theory, a research model is constructed to examine the mechanisms through which gamified experiences affect individuals' perceptions and intentions. A quantitative survey method is employed, targeting both players who have experienced games featuring specific cultural elements and non-players who express interest in those elements. The study analyzes participants' levels of cultural identity and willingness to travel, aiming to explore the relationship between Gamification Marketing and cultural identification, as well as whether gamified experiences can effectively promote real-world tourism intentions.

Data were collected through online communities, resulting in a total of 167 valid responses, with 97 male and 70 female participants. The age distribution of respondents ranged primarily from 20 to 44 years old. Preliminary findings indicate that games with a high level of immersion can enhance players' understanding of local culture and foster a stronger sense of cultural identity, which in turn increases interest in visiting the locations featured in the game. Furthermore, the influence of Herd Behavior Theory suggests that cultural content embedded in games can spread among social networks, thereby encouraging the transformation of players into actual tourists. Based on the findings, this study aims to offer practical recommendations for cultural tourism development and digital marketing strategy design.

Keywords: Gamification Marketing[1], Cultural Identity[2], Travel Intention[3]

P-21

A Study on Agritourism Experience Economy, Tourist Motivation, and Satisfaction: A Case of Young Farmers' Businesses.

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The COVID-19 pandemic has reshaped the global tourism landscape, altering travelers' preferences and travel behaviors. In recent years, there has been a notable shift from superficial sightseeing to immersive, interactive travel experiences. In response, Taiwan has actively promoted themed tourism such as ecological, cultural, culinary, and wellness travel, integrating local industries and cultural resources to create distinctive travel itineraries. Within this context, agritourism has gained increasing attention. Especially among businesses participating in regional revitalization initiatives, many young farmers have introduced more innovative and engaging activities—such as DIY workshops, immersive guided tours, and food and agriculture education—to enhance visitor interaction and participation, going beyond traditional orchard visits.

This study adopts Pine and Gilmore's "Experience Economy" framework, which categorizes experiences into four dimensions—Entertainment, Education, Escapist, and Esthetics—based on the level of visitor participation and environmental immersion. It explores how these different experience modes influence tourist satisfaction and motivation in the context of regional revitalization-focused agritourism. A quantitative approach is employed, using structured questionnaires distributed to visitors who have participated in such experiences, and the data will be analyzed using SPSS to examine correlations between the four dimensions and visitor satisfaction, as well as the impact on travel motivation.

In total, 248 valid questionnaires were collected. Among the respondents, 145 (58.7%) were female and 102 (41.3%) were male. The majority were in the 20–29 age group, accounting for 129 individuals (52.2%). Regarding visit frequency over the past year, 211 (85.4%) were first-time visitors, while 36 (14.6%) were repeat visitors. The average scores across the four experience dimensions were all above 4 (Education: 4.246; Esthetics: 4.346; Entertainment: 4.198; Escapist: 4.056), indicating that participants were primarily young people motivated by learning new knowledge and seeking relaxation. This suggests that the educational and esthetic dimensions—characterized by knowledge enrichment and an appreciation for beauty—hold strong appeal for this age group.

Through this research, the study aims to offer practical recommendations for agritourism operators in designing engaging experiences and marketing strategies, ultimately supporting the sustainable development of Regional Revitalization and Agritourism.

Keywords: Agritourism; Experience Economy; Travel Motivation; Satisfaction

HITACHI

変化の激しい時代。
この星のいたるところで、身近な暮らしの中で、
私たちはさまざまな課題に直面している。
その課題を解決するためには
課題の本質を正しく知ることが重要だ。
知ることは、世界や未来を変えるスタートライン。

日立ハイテクは「知る力」で、
社会やお客さまが直面する課題の本質を、
広く、深く、正しく把握する。
そして真に必要な解決策を提供し続ける。

持続可能な地球環境、
健康で安全安心な暮らし、
科学と産業の持続的発展の実現をめざして。

知る力で、
世界を、未来を変えていく
日立ハイテク

ナノテクノロジー ソリューション

半導体デバイスの製造、検査・計測のソリューションを提供することで未来を、ともに創り、ともに変えていく

エッチング装置、計測装置・検査装置、半導体製造・計測・検査ソリューション

ヘルスケア ソリューション

「医療従事者とともに患者さんに笑顔を」「がんを恐れることのない社会の実現」をめざし、ヘルスケア・イノベーション創生に挑戦し続ける

生化学・免疫分析装置、検体検査自動化システム、キャピラリー電気泳動シーケンサー、粒子線治療システム、X線治療システム、臨床検査システム

コアテクノロジー ソリューション

技術をコアにした「知る」力で、社会課題を解決していく

電子顕微鏡(SEM・TEM・FIB)、光度計・蛍光X線分析装置、熱分析装置、液体クロマトグラフ

産業・社会インフラ ソリューション

社会潮流・顧客課題を起点とし、産業分野における次の柱事業を創生・スケーリングをめざす

通信インフラ、電池ライフサイクル、検査・測定装置、デジタル、半導体関連、モビリティ、環境・エネルギー

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【日立ハイテクWebサイトはこちら】

レンタルって、未来だ。

ご存じですか？

実は、建設機械はレンタルが増えています。

近年もその市場は成長し、建設業界を支えています。

必要な時に必要なだけ利用できるレンタルは
地球環境にやさしいサステナブルなサービス。

西尾レントオールは最先端の ICT を駆使した建築 DX を
はじめ、イベント・展示会分野でもレンタル資材を
取り扱う総合レンタル業界のパイオニア。

■ 建設ＩＣＴ

道路･土木工事や建築･設備工事現場に必要な多種多様な建機をレンタルしています。
ICT 施工技術やメンテナンスのノウハウを持った人材も多数活躍しています。

■ ＧＸ

環境負荷の低減と建設現場の生産性向上を目指し、ショベルカーをはじめとした様々な種類の電動建機のレンタルだけではなく、NISHIO グループの総合力をいかした電動建機の開発もおこなっています。

■ 木造モジュール・大阪咲洲Ｒ＆Ｄ国際交流センター

展示・交流・研究開発の拠点である「大阪咲洲 R&D 国際交流センター」や、
国産材活用と持続性を追求した転用可能な木造モジュール「Morena（モリーナ）」
により、SDGs にも積極的に取り組んでいます。

■ グローバルキャンプ

次世代を担う技術者のグローバル化を目指した国際交流を NISHIO で実施。
高専生と世界の学生を繋ぐ場として、KOSEN Global Camp を全面協力しました。

西尾レントオールは国内外で約 400 拠点を構える NISHIO グループの一員です。NISHIO グループの持株会社「ニシオホールディングス株式会社」は東証プライム市場に上場しています。

総合レンタル業のパイオニア
西尾レントオール株式会社

The 8th NIT-NUU Bilateral Academic Conference 2025