# RISALAH

## ISSUE 3 . OCTOBER 2023

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
Garden of Knowledge and Virtue

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# LETTER FROM EDITOR

اَلسَّلَامُ عَلَيْكُمْ وَرَحْمَةُ اللهِ وَبَرَكَاتُهُ

It is with great pleasure that we welcome you to the latest edition of our department's newsletter – Issue 3. In this issue, we will highlight department's achievement in its latest program accreditation from Board of Engineers which is a testament to the collective efforts of the Kulliyyah, staff, and students who tirelessly work for it. You will find stories of ROBOCON Malaysia where we actively participate and our achievement is showing improvement year by year, which reflects the remarkable journey our students and staffs have embarked on. Throughout these pages, you will discover articles showcasing groundbreaking research projects, exciting collaborations, and the invaluable contributions of our department members to their respective fields. You will also delve into the remarkable work of some of our students through the showcase of their Final Year Projects and Integrated Design Projects for previous two semesters. Last but not least, we would like to extend our heartfelt gratitude to all the contributors, without whom this newsletter would not be possible. Your dedication to sharing your knowledge and experiences enriches our community and strengthens the bonds that unite us.

Happy Reading!

**DR. AZNI NABELA WAHID**

**DR. NOR HIDAYATI DIYANA NORDIN**

**DR. KHAIRUL AFFENDY MD. NOR**

# MESSAGE FROM HEAD OF DEPARTMENT

**ASSOC. PROF. DR. ALI SOPHIAN**

السَّلامُ عَلَيْكُمْ وَرَحْمَةُ اللّٰهِ وَبَرَكَاتُهُ

Praise be to Allah, who has bestowed upon us countless blessings.

First and foremost, I extend a warm welcome to the third edition of Risalah, the newsletter of the Mechatronics Engineering Department.

Alhamdulillah, with the grace of Allah SWT, the past year has witnessed remarkable achievements within our department. Our dedicated staff members and students have obtained a six-year accreditation for our Bachelor's program in Mechatronics Engineering, secured research grants, excelled in competitions, actively engaged with the community through various activities, and made numerous other commendable achievements. However, our aspiration remains to continuously elevate our department to greater heights. To achieve this, we seek closer collaboration with our industrial advisors, alumni, parents, higher education institutions, and all other stakeholders. We eagerly welcome productive cooperation and value any suggestions that can contribute to enhancing our department, ensuring that we continue to produce well-rounded mechatronics engineers who will make significant contributions to our nation and the ummah.

Lastly, I extend my heartfelt gratitude to the newsletter editorial team and all contributors for their dedication in delivering updates about the department through this wonderful newsletter.

Enjoy your reading!

# DEPARTMENT HIGHLIGHT



# Mechatronics Engineering Program Accreditation by Board of Engineers Malaysia

Numerous engineering programs in Malaysia receive accreditation from the Engineering Accreditation Council (EAC). Accreditation serves as an endorsement that institute of higher learnings deliver a level of education meeting the expectations of the public, industry and recognized by the educational community. This rigorous process is essential to ensure that the engineering program not only aligns with global standards but also produces high-caliber engineers.

During the accreditation process, educational institutions undergo comprehensive assessments, including managing institutional data, designing curriculum, conducting assessments to evaluate and improve student performance, and engaging stakeholders like industrial advisory panels, external accessor, technical staff and importantly, students. Importantly, the accreditation also will access the ability of the institute of higher learning in providing top-notch facilities including labs, workshops and other general facilities like library and sport centre for teaching and learning process.

The significance of accreditation is underscored by the fact that many, if not all, major industry players express a preference for hiring graduates from accredited institutions. Accreditation assures employers that graduates possess a specific set of skills and abilities stipulated by accreditation standards. Furthermore, students from accredited institutions enjoy the advantage of pursuing additional certificate examinations to fulfill their professional requirements after graduation.

Acknowledging the significance of this endeavor, the Department of Mechatronics Engineering is dedicated to maintaining ongoing recognition and accreditation from EAC. In the most recent evaluation in 2022, our program underwent a comprehensive two-day audit conducted by EAC panels comprising industry experts and academics from other universities.

We are pleased to share that, Alhamdulillah, through the collective efforts of our academic and support staff, Industry Advisory Panels, and students, our Mechatronics Engineering program successfully secured a maximum 6-year accreditation with an interim period spanning from 2023 to 2028. This achievement reflects our commitment to upholding the highest standards in engineering education.

**By: Dr. Farahiyah Jasni & Dr. Aimi Shazwani Ghazali MCT Program Accreditation and Quality Assurance (PAQA)**

During opening session with EAC panels

Representing the department, we extend our heartfelt gratitude to the entire IIUM Mechatronics family for their invaluable contributions throughout the audit process. Your dedication before, during, and after the audit has played a crucial role in our program's success. Special thanks are also due to Dr. Nor Fadhillah binti Mohamed Azmin, Head of Program Accreditation and Quality Assurance at the Kulliyyah of Engineering, and Sr. Sharifah Junita Binti Syed Idrus, Senior Engineer of Kulliyyah of Engineering, for their unwavering and continuous support. Your guidance has been instrumental in achieving our accreditation goals.

We aspire that the accreditation bestowed upon our program will serve as a catalyst, propelling the department to "Lead the Way" in establishing an international center of educational excellence. Our goal is to rejuvenate the dynamic and progressive role of the Muslim Ummah across various branches of knowledge and intellectual discourse. InshaaAllah, with this accreditation, we are poised to make significant strides toward fostering excellence and contributing meaningfully to the broader intellectual landscape.

REFERENCES:
1. https://eac.org.my/v2/#
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# IIUM ROBOTEAM's journey in
# ROBOCON MALAYSIA 2023 COMPETITION

By: Dr. Khairul Affendy Md Nor

IIUM Roboteam was founded in 2007 by a small group of students who shared a passion for robotics. Since then, the society has expanded to include many IIUM students from different Kulliyyah across the campus. One of their primary activities is planning and taking part in regional and international robotics and technological competitions. A group of 16 students from IIUM Roboteam have been sent to ROBOCON Malaysia 2023 this year.

ROBOCON Malaysia is a national-level competition in Malaysia that qualifies students for the international ROBOCON event. It is part of the Asia-Pacific Robot Contest, where students showcase their engineering and problem-solving skills by designing and building robots to complete specific tasks. The competition features a unique theme and challenges each year, and teams must design and construct robots that can complete tasks within a specified timeframe. This year, Cambodia hosted ABU ROBOCON 2023 with the theme "Casting Flowers over Angkor Wat" on August 27, 2023. At the national level, the competition was hosted by Universiti Sains Malaysia (USM) and held on June 11–13, 2023, at Kompleks Sukan Azman Hashim, USM, Penang.

This year's theme requires each competing team to build two robots, i.e., a rabbit robot and an elephant robot, which can be maneuvered manually or automatically. The game consists of one round where each team needs to cast flowers over the Angkor Wat with the cooperation of the rabbit robot and the elephant robot. The robots need to cooperate with each other to toss rings (flowers) into the eleven poles with different sizes and heights located strategically at the Angkor Wat area. At the end of the game, the team with the highest number of rings tossed successfully into the polls will get points.
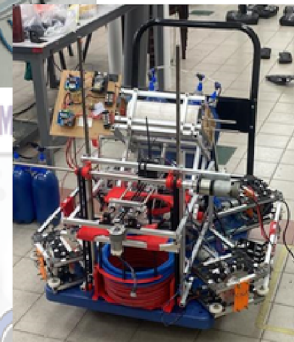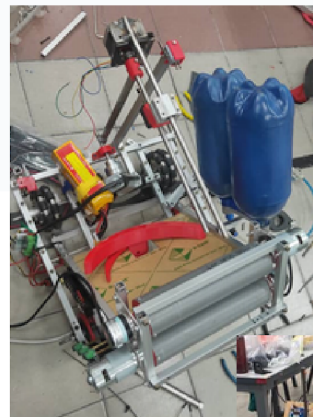
Rabbit and elephant robots developed by IIUM ROBOTEAM

IIUM Roboteam managed to build both robots within three to four months. For precise maneuverability, the robots are equipped with four motorized omniwheels with encoders. Aside from that, the robots are outfitted with pneumatic cylinders, motors, and proximity sensors, allowing them to pick up rings from the floor, lift and feed them onto the shooting feeder, and finally shoot them to the targeted poles. To program and remotely control the robots, STM microcontrollers embedded with ROS programming and PS4 controllers are used..

During the 3-day event, all the teams matched with intense strategy to shoot the rings as fast as possible, as much as possible, making the competition fierce. Despite the competitive atmosphere, the spirit of sportsmanship and collaboration prevailed throughout the event. Teams frequently exchanged ideas, tips, and technical know-how, among participants. This spirit exemplified the core values of Robocon Malaysia.

In the end, IIUM Roboteam team secured the fourth place among the 22 participating teams and are already looking ahead to future opportunities for improvement. The team is determined to learn from this experience and come back stronger in future competitions.

IIUM Roboteam's achievements in Robocon Malaysia 2023 reflect their commitment to excellence and innovation in the field of robotics. Their success should be celebrated and used as a catalyst for further advancements in robotics education and research particularly in IIUM's Mechatronics Engineering program.



SUN, JUN 11, 2023
UPM B 0 | 90 IIUM Roboteam

SUN, JUN 11, 2023
IIUM Roboteam 30 | 10 UPSI ROBOVERSE

MON, JUN 12, 2023
UTM A 50 | 60 IIUM Roboteam

MON, JUN 12, 2023
IIUM Roboteam 0 | 0 TUAH

MON, JUN 12, 2023
MMU Cybertron 140 | 0 IIUM Roboteam

MON, JUN 12, 2023
UTAR 30 | 60 IIUM Roboteam

TUE, JUN 13, 2023
UniMAP A 50 | 0 IIUM Roboteam

TUE, JUN 13, 2023
IIUM Roboteam 10 | 160 UTM A

IIUM Roboteam on the scoreboard





IIUM ROBOTEAM members and advisors posing with their well-deserved prize

# ALUMNI WORDS OF WISDOM

"UNI LIFE IS LIKE A PID CONTROLLER. YOUR STUDIES, RELATIONSHIPS, AND EMOTIONS HAVE TO BE TUNED TO GET THE BEST OUTCOME (MEMORIES AND KNOWLEDGE). NEVER OVERLOOK ONE OVER THE OTHER."

MUHAMMAD HAFIZ BIN RUSHDI
CLASS OF 2022
SOFTWARE ENGINEER IN GREATECH INTEGRATION

"IIUM IS TRULY A UNIQUE UNIVERSITY THAT OFFERS AN EXCEPTIONAL ENVIRONMENT. IT IS LIKE A VIBRANT GARDEN WHERE KNOWLEDGE AND VIRTUE FLOURISH, MAKING IT AN EXTRAORDINARY PLACE FOR PERSONAL GROWTH AND LEARNING"

USWAH KHAIRUDDIN
CLASS OF 2008
SENIOR LECTURER, UNIVERSITI TEKNOLOGI MALAYSIA

"NEVER GIVE UP, LIFE IS FULL OF OPPORTUNITIES -MOSTLY HIDDEN OR NOT DIRECTLY SEEN-, NEVER EVER UNDERESTIMATE YOURSELF AND YOUR ABILITIES, AND ALWAYS TRY TO FIND A MOTIVE TO PUSH YOURSELF FORWARD"

HUSSAM ELDIN RABAH,
CLASS OF 2019
POSTGRADUATE STUDENT, MASTERS IN DATA SCIENCE, THE UNIVERSITY OF TEXAS IN AUSTIN

## Dr. Masud Rana

**Alumni (MSc in Mechatronics Engineering, 2016)**

### Tell us a bit about yourself

I obtained my bachelor's degree in Electrical and Electronic Engineering from Rajshahi University of Engineering and Technology, which is one of the reputed public universities in Bangladesh. Later, I joined IIUM and was awarded Ummatic Scholarship to accomplish my Master's degree in Mechatronics Engineering. In the year of 2017, I was awarded a prestigious Australian government scholarship (Research Training Program) to conduct Ph.D. on rechargeable batteries at the School of Mechanical and Mining Engineering, The University of Queensland, Australia. I successfully completed my Ph.D. in 2020. After completing my Ph.D., I joined Redflow International Pty Ltd in the R&D as a Research Scientist and worked there for around three years (this company is a Brisbane-based redox flow energy storage company that manufactures Zinc Bromine flow batteries).

I am currently working as a lead researcher and have been awarded a UQ Research Stimulus Fellowship, ARC Linkage fund and Advanced Queensland Industry Research Fellowship to conduct research on redox flow battery systems at the Australian Institute of Bioengineering and Nanotechnology (AIBN). Energy Storage Industries-Asia Pacific is an essential industry partner with this fellowship to commercialize the Redox flow batteries in Queensland. My research interests and expertise completely align with battery storage systems - specifically battery storage for electric vehicles and portable applications also redox flow batteries for large-scale grid applications to reduce $CO_2$ emission. I am very passionate to grow my career to contribute to both research and teaching.

### Can you tell us what was your postgraduate research is all about?

During my Masters in IIUM, the major focus of my research was the encoder fabrication on the micromechanically bent Carbon nanotubes to measure the micro displacement of an object. My master's research outcomes are published in various reputed journals such as Caron Letters, Chemical Physics Letters, Microelectronic Engineering etc.

During Ph.D., I was responsible for developing different materials and their implementations to achieve a high-performance rechargeable battery (Lithium-sulfur). My works are published in high-impact journals such as Energy Storage Materials, Journal of Materials Chemistry A, Journal of Energy Chemistry and ACS Central Science etc.

> **Follow your dream, earn good credits in your course and be proactive in your lab's tutorials and research**

## Can you tell us about your experience as a postgraduate student at KOE

I had an exciting memorable experience as a postgraduate student at KOE, IIUM. I was awarded the Ummatic Assistantship support from KOE to conduct my Master by Research, under the supervision of my supervisors, Prof. Dr. Tanveer Saleh and Prof. Dr. Asan Gani Abdul Muthalif. The facilities offered for my research, along with the exceptional support from both my supervisors during my time pursuing my Master's degree at IIUM, have been instrumental in enabling me to successfully carry out my Ph.D. research and advance my professional career. I had a great and comfortable time during this postgraduate journey. My supervisors, closest people and friends were always very supportive.

## Can you share any memorable moments or experiences from your time as a student at our institution?

I have lots of exciting memories with IIUM and I always cherish and miss them such as the peaceful IIUM campus, the weather, good, having iftars and prayers in IIUM Mosque during Ramadan, having dinner in Mahallah's canteen, friends etc



## You received the Best Master Student Award at the 32nd IIUM Convocation Ceremony. What factors do you believe contributed to your outstanding academic performance?

Firstly, I would say I was very much focused and enjoyed the research which I was supposed to do during my master's journey. On the other hand, I did effective time management, was hardworking, used laboratory resources, and sought support and mentorship from supervisors and mentors. I can't but say a few names from IIUM who played a significant role in shaping my research and academic career. My supervisors Prof. Dr. Tanveer Saleh and Prof. Dr Asan Gani Abdul Muthalif have been always supportive during my master's and thereafter as a mentor. I have learnt the foundation of my research from them. Last but not least, Dr. Mohd Asyraf Bin Mohd Razib who was always there as as my mentor during my postgraduate journey in IIUM. I also appreciate help from laboratory technicians and associated friends and collaborators for the successful completion of my master's.
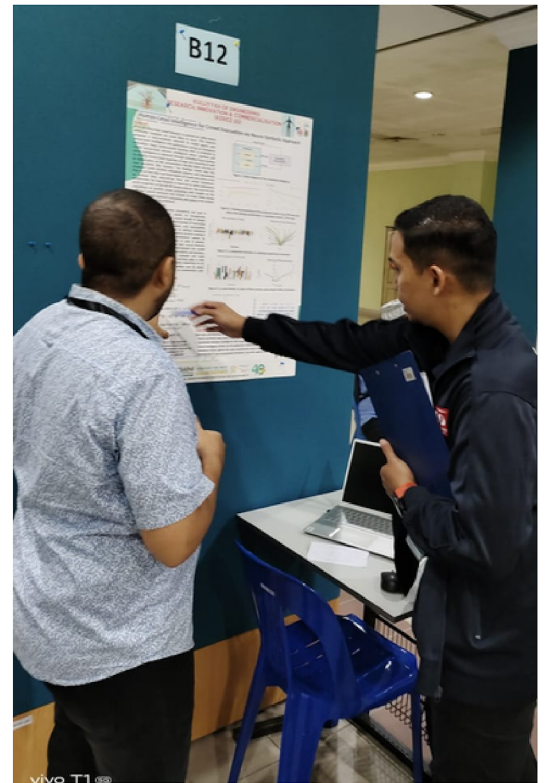
## What advice would you give to current students who are preparing to graduate (both undergraduate and postgraduate)?

My advice to undergraduate and postgraduate students is that follow your dream, earn good credits in your course and be proactive in your lab's tutorials and research. I always believe both in hard working and believing on myself to achieve goals in life. I advise the same for the current or aspiring postgraduate students.

# ALUMNI ENGAGEMENT

The department is thrilled to witness the active involvement of our alumni in the events organized by our department or the kulliyyah. On 22 December 2022, we invited Br. Abdul Hadi Ab Aziz, who is currently the Product Engineering Manager at Texas Instruments Malaysia to serve as one of the judges for Kulliyyah of Engineering Research, Innovation and Commercialization (KERICE) 2022. Their valuable experiences, insights, and expertise make them ideal assessors of the work and innovations presented by our students. KERICE, which is conducted annually, serves as a platform for sharing and showcasing the discoveries and accomplishments of academics, researchers, and students while also exploring any potential for commercialization.

# ALUMNI ENGAGEMENT

On 9th Dec 2022, the department invited two of our alumni and an academic staff to become expert panelists in a forum entitled "Graduate Finishing Program". The forum had several key objectives, including providing students with insights into engineering careers, emphasizing the importance of Islamic principles and ethics in their profession, and inspiring students through the experiences and success stories of MCT alumni.

The panelists' expertise and experiences contributed significantly to the forum's success by providing the students with valuable insights, guidance, and inspiration for their future careers and personal growth. It is hoped that the forum inspired the students to aim high, work hard, and embrace opportunities in their lives. The department would like to express our gratitude to the moderators, panelists, and all participants for their valuable contributions. This forum has been a significant step in guiding our students toward a successful and principled engineering future.



**MODERATORS:**
BR. MUHAMMAD KHAIRUL ANWAR BIN IBRAHIM (1917199)
SR. BALQIS BINTI NAGUWIB (1918314)

**PANELISTS:**
(1) TS. HAJI MUHTAR BIN SUHAILI
(CLASS OF 2005)
GROUP CHIEF OPERATING OFFICER, EASTERN PACIFIC INDUSTRIAL CORPORATION BERHAD

(2) PROF. IR. DR. SITI FAUZIAH BINTI TOHA
DEPARTMENT OF MECHATRONICS ENGINEERING, KOE

(3) BR. MOHD SHAFIQ BIN SUHAIMI
(CLASS OF 2007)
HEAD, BUSINESS PLANNING & DEVELOPMENT,
SAPURA ENERGY BERHAD

# INDUSTRIAL ATTACHMENT:
## MY YEAR WITH GTS PETRONAS

**By: Dr. Noor Hazrin Hany Mohd Haniff**

*I made the momentous decision*
to take a leap beyond my comfort zone the day I arrived at Level 20, Tower 3, KLCC to begin my industry attachment with the Electrical department of Group Technical Solutions (GTS), PETRONAS. I was initially concerned whether I could thrive the year in a completely different environment. My worries were however unfounded, and I am very glad I took the bold step.

## The motivations

My ultimate reason to commit into this industry attachment was because I wanted to attain the Professional Engineer (PE) status from the Board of Engineers Malaysia (BEM), which require a year of industry experience. Also, being a passionate academician as I am, I aspire to integrate real-world industry scenarios for our engineering students, which I hope will produce graduates that fit the demands of industry in the future. Additionally, I embarked on this journey because I felt it was time for me to engage with something differently for a change.

## Day-to-day routine

We were required to work in office on Tuesdays to Thursdays, at flexible hours between 7 am – 6 pm. Mondays and Fridays were the days that we normally work from home (unless required to be present at the office / site).

Site Visit to a PETRONAS facility

My daily routine with GTS Electrical has been nothing short of enlightening. From working alongside experienced engineers on asset life study of offshore platforms to technical review assessments on alternator rotor windings, everyday brought new challenges and opportunities to learn. For instance, being one of the core members for the Internet of Energy –Peer-to-Peer (IOE-P2P) for Renewable Energy (RE) project, I had the opportunity to be involved in due diligence process for selecting technology partner, developing frameworks for reliability analyses, and participated in user acceptance tests. Additionally, I had occasional site visits to PETRONAS facilities to carry out inspections that could assist in basic engineering designs for some of the projects.

Technical sharing with GTS PETRONAS

## Expanding Networks

The nature of tasks in GTS PETRONAS involves inter-disciplines and cross-subsidiaries collaborative teamwork, not to mention regular external engagements with other local and international organizations. This attachment has provided me the opportunity to foster new acquaintances, while at the same time rekindle with long lost connections. I had pleasant surprise crossing paths with many of my friends and former students, and these encounters has made my journey even more meaningful.

## Humbling Experience

While I was honoured to be working with a multi-talented and warm group of people, my time with GTS Electrical has also been a humbling experience for me. I came to fully appreciate the meaning of vastness of knowledge of our Creator. The willingness of these industry professionals to kindly share their expertise, has truly shaped the kind of academician I shall be upon resuming my duty with IIUM. I aspire to be even kinder and compassionate educator – the qualities that represent a true murabbi.

IOE team during PETRONAS Digital Day 2023

## Final Thoughts

My sabbatical with GTS PETRONAS has been a transformative journey. This attachment has reshaped my approach to teaching, research, and collaboration. I believe that academia and industry can mutually benefit from such experiences, and I encourage everyone to explore similar opportunities. Feel free to reach me if you'd like to discuss my experience further or explore potential collaborations that bridge the gap between academia and industry, I will be more than happy to accommodate.

# Shape Memory Alloy
## A smart material that can remember

BY: DR. AZNI NABELA WAHID

Imagine a building made from material which is 'smart', where the windows can change shape according to weather, or pipes that can change its own diameter when the water temperature changes, or clothes that can fit body according to body temperature. These might sound like scenes from a movie but with vast development in materials engineering, it is not a science fiction anymore. 'Smart materials' first appeared in the late 1980s and since then, research activities around this area has been vastly explored. The materials are often referred to as intelligent or responsive materials, which possess one or more properties than can be changed with an external stimuli such as stress, temperature, electric, magnetic fields and many more.

**Shape memory alloy (SMA)** is a type of smart material that has the ability to return to its pre-programmed shape when subjected to heat (austenite phase) after being deformed at a low temperature (martensite phase). Among its attractive attributes are high force-to weight ratio, noiseless operation, simple to control, relatively low-cost compared with other type of actuators and high compactness which means easier integration into systems. Compared to the prevalent pneumatic and hydraulic type actuators at the same volume, SMAs are able to produce 150 times higher force than the hydraulic actuator, and 400 times more force than the magnetic actuators. This unique property making them valuable materials for various innovative and adaptive technologies especially as actuators of a system. Soft robotics, biomedical engineering, aerospace, civil engineering, automotive and even textiles are amongst the industries that have high potential for SMAs application and is continually expanding year by year.

In multiple research studies, SMAs are used as actuator in various biomimetics robots to exhibit motions like swimming in fish and jellyfish robot, crawling and climbing in millirobots (inspired by millipede), jumping in flea robot, walking in microrobots and even rolling motion for rolling robots.


Jellyfish soft robot using SMA spring as actuator [1]


SMA-based soft gripper developed by this author [2]

The use of SMAs are also extensively researched for building artificial muscle in exoskeleton and exosuits to support human muscle in rehabilitation or lifting weight. For instance, fabric-type SMA actuator is built as upper-arm wearable assistive device and able to carry 1kg of load. In addition, SMA actuator in the form of wire or spring is embedded in polymer to create soft robotic grippers which generally are better compared to rigid gripper in grasping various object shapes.

Recently, NASA has discovered SMAs as the game changing material which dramatically advanced the design of tires in Martian or Lunar environment. They designed compliant tires that would allow rovers to explore greater distance, and can absorb energy from impacts from the extreme terrain.


The Mars SMA Spring Tire developed by NASA [3]

In aerospace, SMAs are embedded in airfoil to create a morphing wing panel. By having adaptive airfoil control, the lift coefficient of the aircraft can be changed accordingly at different modes of the flight to reduce drag.


An aerofoil embedded with SMA for morphing ability [4]

SMAs have big potential in variety of applications which far exceeds what this article can cover. However, the main limitation is its actuation frequency which is limited to how fast the rate of heat transfer along the material can be subjected. Thus, future research should focus more on finding the best method to thermally cycled the SMA at the highest rate possible to achieve an efficient and reliable actuator.

[1] Cruz Ulloa, C.; Terrile, S.; Barrientos, A. Soft Underwater Robot Actuated by Shape-Memory Alloys "JellyRobcib" for Path Tracking through Fuzzy Visual Control. Appl. Sci. 2020, 10, 7160. https://doi.org/10.3390/app10207160

[2] ABDULLAH, M. D. F., WAHID, A. N., & MUTHALIF, A. G. (2023). DEVELOPMENT OF SHAPE MEMORY ALLOY (SMA) BASED ARTIFICIAL MUSCLE FOR APPLICATION IN SOFT GRIPPER. Journal of Engineering Science and Technology, 18(3), 1413-1426.

[3] Padula, S., & Creager, C. (2018, September). Shape Memory Alloy (SMA) Tires-A New Paradigm in Tire Performance. In Annual Meeting and Conference on Tire Science and Technology (No. GRC-E-DAA-TN59946).

[4] Abdullah, E. J., Bil, C., & Watkins, S. (2010, September). Testing of adaptive airfoil for uav using shape memory alloy actuators. In Proceedings of the 27th International Congress of the Aeronautical Sciences, Nice, France (pp. 19-24).

# FEATURED COURSE:
# NATURAL LANGUAGE PROCESSING

## BY DR. AHMAD JAZLAN HAJA MOHIDEEN

## What is Natural Language Processing?

Natural Language Processing (NLP) is a branch of artificial intelligence which enables computers, single board computers and other mobile devices to comprehend spoken words and also text. NLP is a computing method which mimics the natural ability of human beings to comprehend spoken words and text. NLP combines deep learning, statistical and advanced mathematical methods to further interpret spoken words and text and determine the sentiment or intent of the writer/speaker. NLP is the driving force behind modern day speech to text converters, language translators, voice activated phones, customer service chatbots and even ChatGPT.

The human language is full of complexities which pose a challenge to develop NLP techniques. Homophones, synonyms, grammar and accents are some examples of factors which need to be addressed in the development of NLP techniques. The first step in NLP is to perform processing of the raw voice and text data to extract meaningful information. A few processing techniques commonly used in NLP are:

## A) Speech Recognition

Speech recognition is the process of converting voice data into text data as shown in Fig. 1. Voice controlled home automation appliances are an example which utilize speech recognition. The challenge of speech recognition is due to the variations in how people talk, for example different accents, incorrect grammar, soft and loud voices, etc.
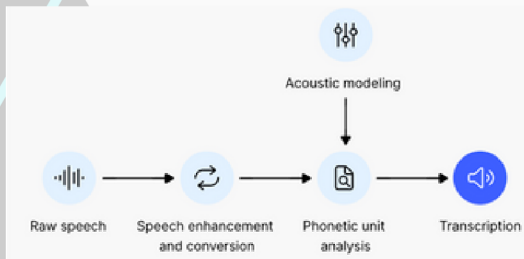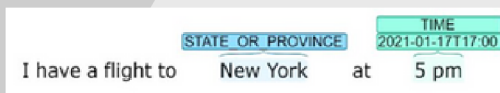


FIG. 1: SPEECH RECOGNITION FRAMEWORK[1].



FIG. 2: SPEECH RECOGNITION FRAMEWORK[2].

## B) Named Entity Recognition

Named entities refer to specific people, organizations, places, brands, time etc as shown in Fig.2. By using Named Entity Recognition, computers will be able to recognize Jazlan as a person and Nasi Lemak as a type of food.

## C) Natural Language Generation.

Natural language generation is a technique which generates text which can be understood by human beings based on numerical or other types of input as shown in Fig. 3. One example of the application of Natural Language Generation is the generation of financial reports based on raw stock market data or the generation of weather updates based on raw meteorological data.



FIG. 3: NATURAL LANGUAGE GENERATION[3].

## D) Sentiment Analysis

Sentiment Analysis is a method which can be used to determine whether a sentence represents a positive, negative or neutral meaning as shown in Fig.4 . Sentiment analysis can also detect more complex information such as sarcasm, emotions and confusion.
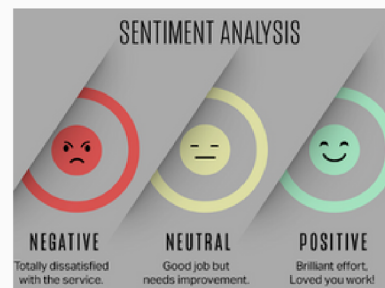


FIG. 4: SENTIMENT ANALYSIS[4].

NLP has shown promising potential to improve our quality of life with the application of tools such as Siri, google Bard and Slido. However there is more to explore on NLP to address complexities and variations of of human language.

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[2] Deep Mehta (17 Januari 2021). Named Entity Recognition in Natural Language Processing. Retrieved 16 September 2023 from https://byteiota.com/named-entity-recognition/.
[3] Phrazor (18 February 2019). Natural Language Generation Explained. Retrieved 16 September 2023 from https://phrazor.ai/blog/natural-language-generation-explained.
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# OUTREACH AND COMMUNITY ENGAGEMENT

## INDUSTRIAL TALK



**"Sustainability Talk - Sharing from Industrial Lens"organized by Intelligent System Research Unit (ISRU) - 3rd August 2023**

The enriching talk was delivered by two distinguished speakers from PETRONAS: Ir Ts Ftiriah Shafe'i and Ts. Ahmad Luqman Maryani. Among the key points they shared are the initiatives taken by Petronas for sustainability at different sectors of the company. Petronas is also actively bridging the gap between academia and industry by providing students with valuable opportunities, mentorship, and real-world experiences through various activities with universities.

Ts. Luqman also gave an insightful presentation on battery energy management system in terms of the application, technology, and successful implementation within their process plants. We look forward to hosting similar events in the future to continue facilitating connections and knowledge sharing between Petronas and IIUM.

## USRAH IN ACTION

**Usrah in Action,** which is one of the university-required courses (to be completed in two semesters), was introduced as part of the university's initiative - "Education for Sustainable Development". This initiative is committed to fostering community empowerment through a comprehensive project. This project encompasses community profiling, mapping critical issues within the selected community, as well as planning and execution of a viable solution. At the end of the second semester, the students will showcase their work in a symposium. We're proud to share that several of our dedicated staff members have eagerly volunteered to contribute to this noble community initiative.



**Community: Students of SK (L) Jalan Batu, KL**
**Project Title: STEM Activity with SK (L) Jalan Batu**

**Community: Muslim Community at Kampung Sg Chinchin**
**Project Title: Qura: Digitalization of Quranic Ecosystem for Sustainable Ummah**

**Community: Primary school students, Surau Jabal Al-Nur, Sri Gombak**
**Project Title: Recycling Through Fun Urban Farming**

**Community: Primary school children, Kampung Batu 11, Gombak**
**Project Title: Robotics Workshop for Children**

# INDUSTRIAL VISIT TO AERONERVE GROUP

## ORGANIZED BY THE MECHATRONICS STUDENTS ASSOCIATION (MCTSA)

On the 1st June of 2023, 40 students from the Kulliyah of Engineering had gone for an Industrial Visit to Aeronerve Group in Seksyen 9, Bandar Baru Bangi. Aeronerve group is a company which provides commercial drone services focusing on oil and gas, construction, mining, and the agriculture industry. The Chief Executive Officer, Mr. Muslim Abdullah Zaik is an alumni of the Mechatronics Engineering Degree program at IIUM. Among the services provided by the Aeronerve group are remote sensing, aerial mapping and geospatial data acquisition. The Aeronerve group is actively engaging collaborations with industries, universities and other learning institutes. Recently the Aeronerve group has explored the possibility of doing a research collaboration with Institut Sultan Iskandar related to Geographical Information Systems (GIS) for flood mitigation.



FIG. 1: BRIEFING BY REPRESENTATIVE FROM THE AERONERVE GROUP.



FIG. 4: BRIEFING ON COURSES PROVIDED BY THE AERONERVE INSTITUTE.

This visit is a starting point for closer collaboration between the Kulliyah of Engineering and Aeronerve group. The industrial visit started with a briefing by representatives from Aeronerve (Fig. 1), followed by a demonstration of software used for processing data collected from drones (Fig. 2). Models of drones used for agriculture related applications were also described (Fig.3) and finally the courses provided by the Aeronerve institute were mentioned together with previous clients who have benefited from the courses.



FIG. 3: EXAMPLE OF A DRONE USED IN AGRICULTURAL APPLICATIONS
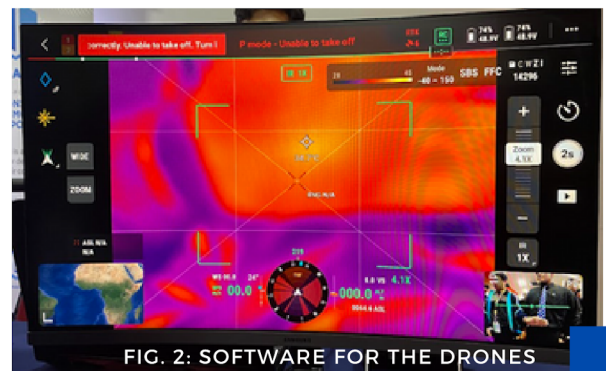


FIG. 2: SOFTWARE FOR THE DRONES

# A WHEELCHAIR SITTING POSTURE DETECTION SYSTEM USING PRESSURE SENSORS

*MUHAMMAD ANNUAR ALHADI BIN MOHAMAD YUSOFF*
*SUPERVISOR: DR. NUR LIYANA AZMI*

**1**

### Aim

To develop a sitting posture detection system that predominantly focuses on monitoring and detecting the sitting posture of a wheelchair user by using pressure sensors in order to avoid any possible discomfort resulting in prolonged sitting on the wheelchair.

### Predefined sitting postures

5 predefined sitting postures from 5 different subjects with 3 repetitions for each posture.
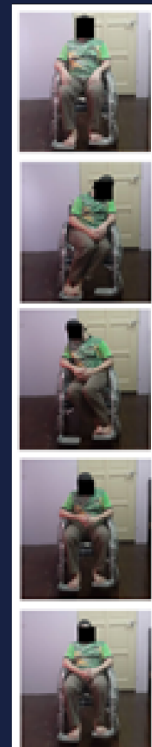
Normal Posture

Lean Left Posture

Lean Right Posture

Lean Forward Posture

Lean Backward Posture

**2**

On the backrest

FSR6    FSR5

On the buttocks

FSR4    FSR3

On the knee

FSR2    FSR1

### Data Processing

The readings of all 6 pressure sensors for each sitting posture were analysed.

**3**

Sensors deployed on the wheelchairs
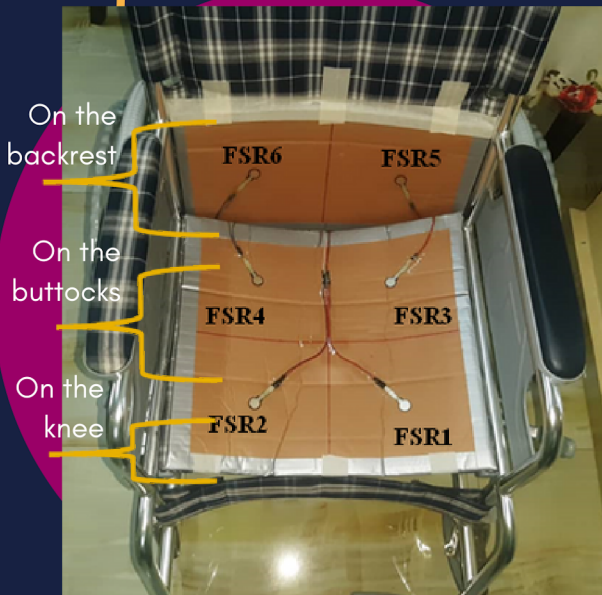
### Classification

Three classification algorithms based on the supervised learning of the machine learning were used to classify the postures and Decision Tree (DT) has the highest accuracy (98.8%).

**4**

### Graphical-User Interface (GUI)

GUI was developed using DT classifier to illustrate the result of the posture classification to the wheelchair user for any posture correction to be made in case of improper sitting posture detected.

**SITTING POSTURE DETECTION SYSTEM FOR WHEELCHAIR USER**

**1. Bluetooth Settings**

Scan for Bluetooth Connection

Status: Bluetooth is Connected

**2. Posture Detection Settings**

Start Detection    Stop Detection

Status: The posture is recording...

**3. Type of Sitting Posture Detected**

Status: Lean Left Posture
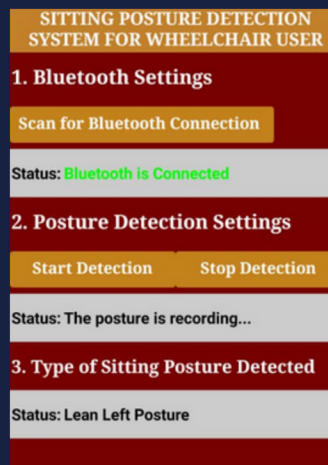
Running view of the Mobile Appss

Confusion matrix of DT classifier

## INVESTIGATION OF MIST SPRAY DEVICES EFFECTIVENESS FOR WATER AND POWER CONSUMPTION REDUCTION

**BY: BASONDOWAH HUSSEIN HASSAN**

SUPERVISOR:
DR. SYAMSUL BAHRIN BIN ABDUL HAMID

The study uses thermal camera image processing together with mist spray devices to monitor and assess the average amount of water consumption during ablution at various locations. A thorough examination of the design, operation, and effectiveness in lowering water and energy consumption of various mist spray devices is carried out. The study shows that using mist spray devices can significantly reduce water usage by more than 95%. .

## MACHINE LEARNING-BASED CHANGE DETECTION METHOD FOR BORDER MONITORING

**BY: MUHAMMAD FAREED BIN MOHD NOOR 1810757**

SUPERVISOR: DR. AZHAR BIN MOHD IBRAHIM

This study aims to explore the use of remote sensing for change detection methods in border monitoring. Random Forest machine learning algorithm is used as image processing algorithm, resulting in a training accuracy of 99.6% and a test accuracy of 80% for Land Use Land Cover (LULC) classification. Change detection is then conducted through image subtraction of two different timelines of LULC images across Wang Kelian, Sungai Golok and Pengerang. A graphical user interface that serves as a valuable tool for working with geospatial data and performing geospatial analyses is developed, making it an essential resource for organizations such as the Ministry of Defence Malaysia (MinDef) in the monitoring of national borders.
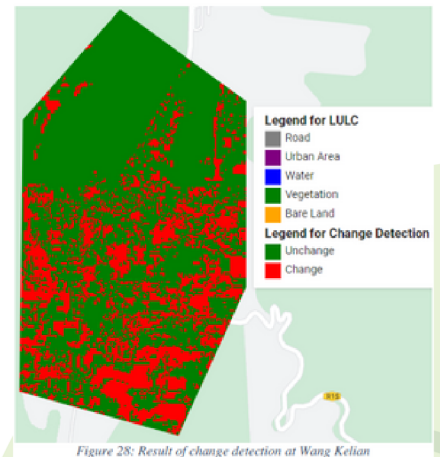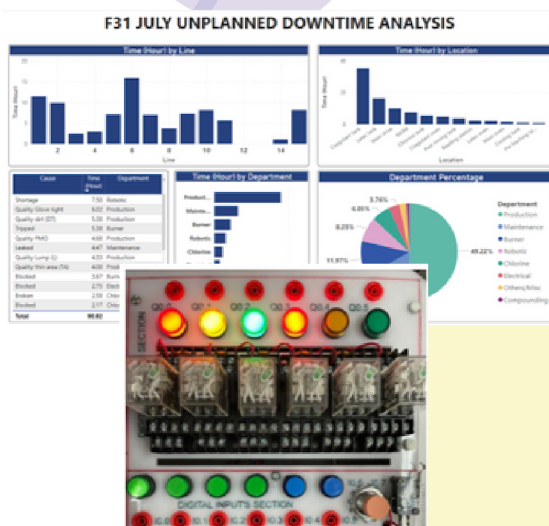


Figure 28: Result of change detection at Wang Kelian

## SMART DOWNTIME MONITORING SYSTEM IN GLOVE PRODUCTION

**BY: FATIN DIYANA BINTI YAHYA 1819666**

SUPERVISOR: DR. ABDUL HALIM BIN EMBONG



The monitoring processes of the lines in Top Glove F31 such as recording the lines' downtime duration, checking the source of the stoppage, transferring the data into spreadsheet, and analyzing the downtime of the lines are all being carried out by human operators. There is a high tendency for the workers to overlook the maintenance of the system because of this work practice, and it will contribute to higher unplanned downtime of the lines. This project proposes to design an automatic downtime monitoring system that consists of sensors, PLC's programming, and IoT technologies that can decrease the dependency on workers and not prone to human mistakes to reduce the unplanned downtime of the lines and increase the efficiency of the system.

## DEVELOPMENT OF UNMANNED FLOORCLEANING MACHINE FOR COMMERCIAL USE
### BY: MUHAMMAD IRFAN BIN MOHAMAD SALINI 1814705
SUPERVISOR: DR. KHAIRUL AFFENDY BIN MD NOR

The aim is to retrofit an existing semi-autonomous floor scrubber machine into a fully autonomous machine. The machine's navigation system is done by implementing the Robot Operating System (ROS) framework to the system. Simulation for the new navigation system was done to verify the working possibilities of the navigation system ins Gazebo software. The navigation stack consists of NavfnROS as the global planner and Dynamic Window Approach algorithm as the local planner. Gmapping SLAM produce a better and clearer output without any wall duplication on the mapping compared to the Hector SLAM. It was found that there were small percentage of inaccuracy of the movement of the machine based on the DWA planner performance. The navigation system produce 0.30% of error for 1-meter, 3.25% for 2-meter and 1.53% for 3-meter distance goal.
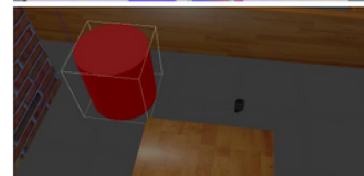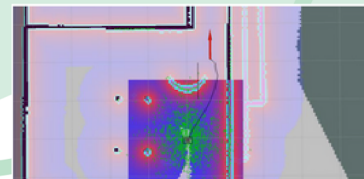


## UPGRADING AND VALUE ADDITION TO AN EXISTING 3-AXIS CNC MACHINE FOR TEACHING AND LEARNING
### BY: DAKHEL ABDULRAHMAN 1621727
SUPERVISOR: PROF. IR. DR. TANVEER SALEH
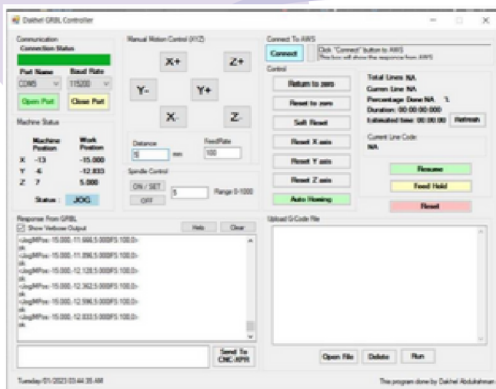


The objective of this project is to develop a replacement controller for stepper motor-based CNC machines that can be easily installed and used to get the machine back into operation in the event of controller damage, with the goal of minimizing waste and lost productivity. An Arduino-based GRBL controller is utilized as it is an open-source firmware that can be easily integrated with the stepper motor drivers of the CNC machine to provide precise control over the movement of the machine's axes. The graphical user interface (GUI) is built using C# Windows Forms, which will make it easy for users to control the machine, load g-code files, and monitor the machine's status. A Raspberry Pi is used as the computer for the machine, which provides a low-cost and powerful platform for running the GUI and other software.

Before → After
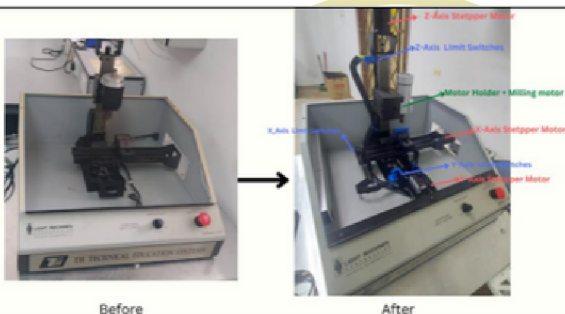
# Best FINAL YEAR PROJECT
## SEMESTER 2 2022/2023

## DEEP LEARNING BASED PORTABLE DENTAL CARIES DETECTION DEVICE FOR INCREASING ORAL HEALTH AWARENESS

BY: MUHAMMAD IQMAL DANISH BIN HASNAN 1912461

SUPERVISOR: DR. AHMAD JAZLAN BIN HAJA MOHIDEEN

The objective of the study is developing machine learning models specifically designed for detecting dental caries, identifying the most suitable pre-trained model for this task, and developing a mobile application that utilizes the deep learning model for classifying the condition of teeth. The deep learning model was trained using an epoch training approach; Images of healthy and unhealthy teeth were collected and used to construct and train a Convolutional Neural Network model on Google Colab. An Android mobile application called Smart Dentist is developed, utilizing the MobileNetV2 model for non-real time dental caries classification. Through extensive testing, the app achieves an accuracy of 100% in classifying healthy teeth and 70% in classifying unhealthy teeth.
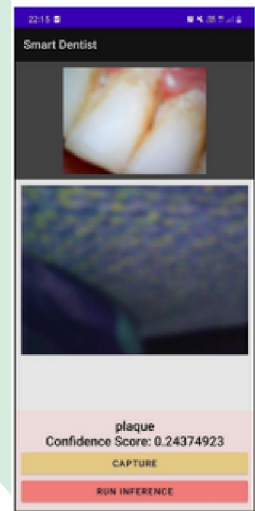


## AUTOMATED ROBOTIC SEALING PROCESS FOR AIRCRAFT COMPONENTS USING UR10e BY: NURSYAFIQAH BINTI SOBRI

SUPERVISOR: DR. HASMAWATI BINTI ANTONG



This project develops an innovative automated sealing technique using a robotic arm in collaboration with human workers to seal aircraft components. The goal is to achieve precise and reliable sealing outcomes. This study focuses on integrating three distinct mechanisms: a dispensing mechanism, a nozzle applicator, and a robotic arm with a dedicated workstation. Extensive testing has been conducted on this hardware setup to establish the necessary parameters for configuring the automated robotic sealing system regarding the pressure, mixing quality and volume flow rate of the used epoxy.

## GESTURE RECOGNITION SYSTEM USING HRI PLATFORM TO ENHANCE IMITATION SKILLS
BY: MUHAMMAD KHAIRUL ANWAR BIN IBRAHIM

SUPERVISOR: DR. AIMI SHAZWANI BINTI GHAZALI

To enhance the ASD children's imitation skills for a better social life, this project proposes to develop and embed a robust gesture recognition system onto a therapy robot called QTrobot. Performance of three algorithm namely MediaPipe algorithm, OpenPose algorithm, and Teachable Machine Learning, have been compared to select the best algorithm for detecting human posture for the upper part of human body (from head until hip). As results, the MediaPipe pose detection algorithm has the highest efficiency, with average accuracy of 96% and 60% for both straight facing the camera and 60 degrees away from the camera, respectively
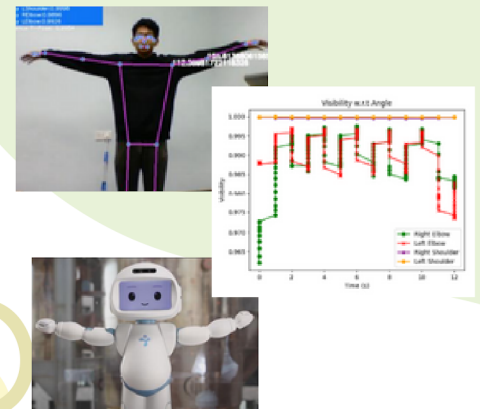
## ENHANCING MOBILE ROBOT NAVIGATION PERFORMANCE WITH DEEP DETERMINISTIC POLICY GRADIENT ALGORITHM: A SIMULATION-BASED INVESTIGATION

### BY: MUHAMMAD FAQIIHUDDIN BIN NASARY

SUPERVISOR: DR. AZHAR BIN IBRAHIM

This research project focuses on the development of a mobile robot navigation system that utilizes deep reinforcement learning techniques, specifically the Deep Deterministic Policy-Gradient (DDPG) algorithm, using the MATLAB and Simulink software. The aim of this research project is to address the existing limitations in mobile robot navigation by investigating the potential of enhancing its performance through the utilization of the DDPG algorithm, with a particular focus on simulating and evaluating the effectiveness of a neuro-symbolic approach utilizing Fuzzy Logic for constructing a reward and penalty system. The proposed system employs the DDPG algorithm as a means of acquiring an optimal policy for avoiding obstacles, while concurrently integrating sensor-derived information from the mobile robot's surroundings to enhance decision-making capabilities.
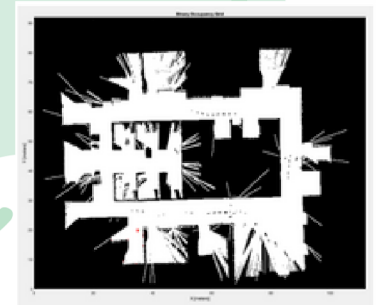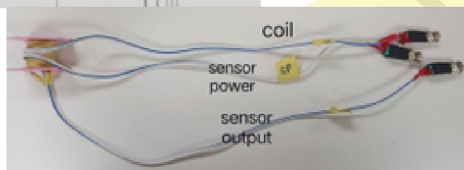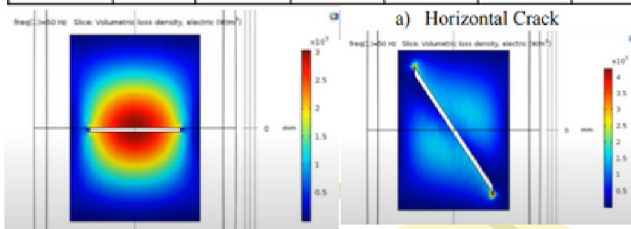
## PULSED EDDY CURRENT NON-DESTRUCTIVE TESTING FOR WELDED STRUCTURES

### BY: BALQIS BINTI NAGUWIB 1918314

SUPERVISOR: ASSOC. PROF. DR. ALI SOPHIAN

| Machine Learning Model | Mean Square Error (MSE) | | | Accuracy Percentage | | |
|---|---|---|---|---|---|---|
| | Probe 1 | Probe 2 | Probe 3 | Probe 1 | Probe 2 | Probe 3 |
| SVR | 1.29 | 1.53 | 3.35 | 57.24% | 13.42% | 49.48% |
| PSO-SVR | 1.29 | 1.53 | 1.07 | 61.45% | 51.02% | 68.01% |
| PSO-SVR with 5 times fold | 0.15 | 0.51 | 0.0197 | 85.16% | 77.87% | 94.24% |

a) Horizontal Crack

Pulsed Eddy Current Testing (PECT) is used in several sectors to test welded structures non-destructively. However, it lacks precise information on crack characteristics, hindering accurate flaw analysis. This study aims to optimize PECT probe design, employing signal extraction methods, and applying machine learning algorithms. The study focuses on introducing cracks on Q235 steel specimens to improve eddy current dissipation. Signal processing techniques like filters, normalization, and FFT are used. Signal characterization is performed utilizing the Particle Swarm Optimization (PSO) Support Vector Regression (SVR) algorithm, incorporating K-Fold cross-validation for improved performance.

# INTEGRATED DESIGN PROJECT

Integrated Design Project (IDP) is a group project executed during semester 6 which provides students with an understanding of the design process, allowing students to apply what they have learned toward the solution of a real-world problem, through a team-based project experience. Students apply their knowledge and skills to develop, design, analyse, creating prototype, and verify their design, together with a basic business plan.

## SEMESTER 1 2022/2023



### Floor Cleaning Robot using IOT (Bluetooth)
Hamed Hamed (1912957)
Muhamed Ramić (1915869)
Abdelrhman Mohamed Amir Alaqeb (1824839)
Wan Alya Athirah bt Wan Roshdi (1912914)
Supervised by:
Dr. Mohd Asyraf Mohd Razib
& Dr. Khairul Affendy Md Nor

The proposed wireless floor cleaning robot is a semi-autonomous solution to the problem of manual mopping which causes fatigue and back pain. The robot can be controlled via Bluetooth, allowing users to clean any area they desire. This user friendly interface benefits the community, especially the elderly, by keeping their homes clean and their health in good condition. The robot's design aims to improve the efficiency of mopping tasks.
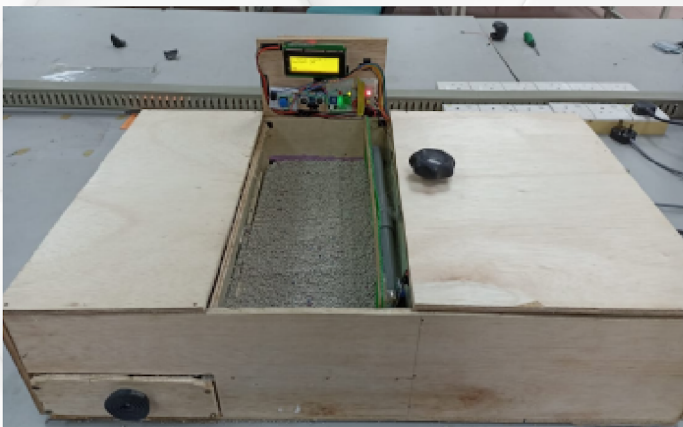


### Semi Autonomous Cat Litter House
Muhammad Hafizuddin Omran (1916353)
Al-Saiaari Omar Yaser (1733863)
Ghassan Abdulsalam Al-Duais (1815065)
Wan Nurul Aisyah Wan Khairul Annuar (1919658)
Supervised by:
Dr Aimi Shazwani Ghazali
& Dr Hazlina Md Yusof

The Semi Autonomous Cat Litter Box aims to address the issue of stray cats on Gombak campus, particularly in Mahallah. Many cats lack proper food and suitable places, leading to complaints from students and residents. The project proposes a mini litter house with a large, comfortable entrance, suitable for cats over 3.5lbs and older than 6 months. The product features an all-sealed waste drawer, a smart spray system, and multiple guards for safety. The PETKIT app provides real-time health monitoring, scheduling, and is compatible with all cat litter.
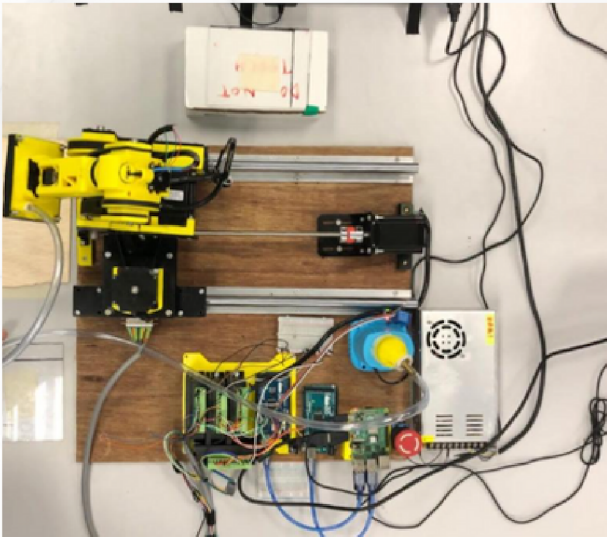
## Tele-operated Robotic Arm to Virtualize Construction

Muhammad Zakiuddin Halim (1922431)
Mohd Afiq Izzuddin Md Arman (2010223)
Afnan Faisan Ab Fatah (2014221)
Muhammad Afiq Ahmad Zawawi (2015567)
Muhammad Syamil Tamlikha Md Nasir (2018395)
Supervised by:
Dr Farahiyah Jasni & Dr NH Diyana Nordin

In this project, a remote control device is integrated with the robotic arm that allows the operator to intuitively control the movements of the robotic arms. The ultimate goal of the project is to create a reliable and user-friendly method for remotely operating construction robotic arms, enabling efficient and safe construction work
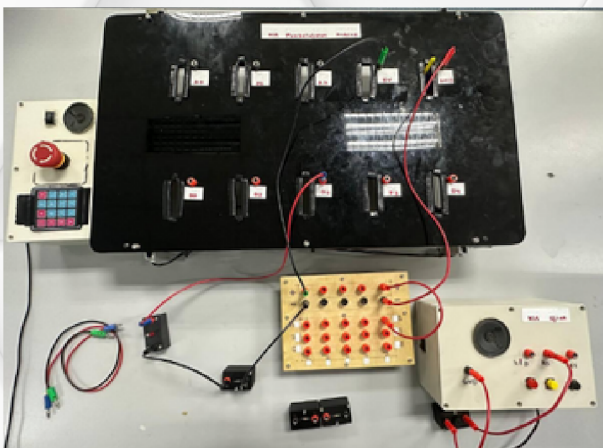


## Assistive Teaching and Learning Tool for The Blind and Visually Impaired
## Students to Learn Circuit Prototyping

Muhamad Adib Suid (2013847)
Muhammad Taufiq Ikhmal Mohamad Roshidi (2012475)
Muhammad Baihaqi Mohd Nazri (2014821),
Muhammad Hakimi Hasnal (2014945),
Amirul Taufiqur Rahman Ayob (2015131)
Supervised by:
Dr Hazlina Md Yusof & Dr Aimi Shazwani Ghazali

Fundamental electrical circuit concepts are introduced to elementary school pupils in "Reka Bentuk Teknologi (RBT)." At the end of the course, students should possess the knowledge of a basic electric circuit and its elements. Nevertheless, visually impaired students may encounter challenges when trying to grasp these concepts. Hence, the goal of this project is to provide an assistive teaching and learning tool for blind and visually impaired students to learn circuit prototyping.

# Congratulations!

**PROF. DR. AMIR AKRAMIN SHAFEI**
**APPOINTED AS DEPUTY RECTOR,**
**RESPONSIBLE RESEARCH AND INNOVATION**

**PROF. DR. SHAHRUL NA'IM SIDEK**
**APPOINTED AS DEAN, CENTRE FOR POSTGRADUATE STUDIES**

**PROF. IR. DR. TANVEER SALEH**
**PROMOTED TO PROFESSOR (VK7)**
**AND**
**APPOINTED AS HEAD OF RESPONSIBLE RESEARCH & INNOVATION, KOE**

**DR. AZHAR IBRAHIM**
**APPOINTED AS DEPUTY DEAN,**
**CENTRE FOR POSTGRADUATE STUDIES**

**PROF. IR. DR. SITI FAUZIAH TOHA**
**APPOINTED AS THE DEPUTY DIRECTOR,**
**BUSINESS DEVELOPMENT AND MARKETING,**
**IIUM ACADEMY**

**ASSOC. PROF. DR. HASAN FIRDAUS**
**PROMOTED TO ASSOCIATE PROFESSOR**

**IR. DR. AHMAD JAZLAN HAJA MOHIDEEN**
**OBTAINED PROFESSIONAL ENGINEER FROM BEM**

**ASSOC. PROF. IR. DR. ZULKIFLI BIN ZAINAL ABIDIN**
**OBTAINED PROFESSIONAL ENGINEER FROM BEM**

**Congratulations!**

A round of applause for our staff members who have emerged as winners in recent research competitions. It is equally important to acknowledge the role our students played in this success, as their invaluable contributions, dedication, and collaborative spirit have undoubtedly propelled our staff towards this remarkable achievement.



**Silver Award
Engineering, Science & Technology Exhibition 2023**

**Empowering Inclusive Circuit Prototyping for the Blind and Visually Impaired (collaboration with SMKPK Setapak)**
*Dr. Hazlina Md. Yusof, Dr Aimi Shazwani Ghazali, Adib Suid, Ikhmal Mohamad Roshidi, Baihaqi Mohd Nazri, Hakimi Hasnal, Amirul Ayob, Ikmal Hakim Shamsul Bahrin*

**Gold Award & Outstanding Award
Malaysia Technology Expo AHLS 2023**

**Miniaturise RoVision: A Revolutiniased Travelling Aid for Visually Impaired Community (Collaboration with UTM)**
*Prof. Dr. Siti Fauziah Toha, Ir. Dr. Ahmad Syahrin Idris, Dr. Azhar Mohd Ibrahim, Dr. Nor Hidayati Diyana Nordin*





**First Prize & Best Product Demo**

**Automation, Characterization and Monitoring of Cell Culture Growth for Bio-Manufacturing Using AIoT Towards IR4.0 (collaboration with University of Southampton Malaysia & UniKL)**
*Prof. Ir. Dr. Siti Fauziah Toha, Muhamad Hafizi Abdul Malek*

**CONGRATULATIONS** ON YOUR GRADUATION!
AS YOU STEP INTO THIS NEW CHAPTER OF YOUR LIFE, WE
WISH YOU A FUTURE FILLED WITH BOUNDLESS OPPORTUNITIES
AND ENDLESS SUCCESS. CHERISH THE MEMORIES YOU'VE
CREATED DURING YOUR YEARS AT IIUM, AND LET THEM SERVE
AS A REMINDER OF YOUR INCREDIBLE CAPABILITIES.
MAY YOUR JOURNEY BE BLESSED BY ALLAH!

وَمَن يُطِعِ ٱللَّهَ وَرَسُولَهُ ۥ وَيَخْشَ ٱللَّهَ وَيَتَّقْهِ فَأُو۟لَـٰٓئِكَ هُمُ ٱلْفَآئِزُونَ

"And whoever obeys Allah and His Messenger and fears Allah and is conscious of Him
– it is those who are the successful ones."
[Surah An-Nur; 24:52]

# STAFF ACTIVITIES

Our staff enjoying MCT Family Day with hiking activity at KL East Park on 6th Sep 2023

## ALUMNI CONTRIBUTION

To all IIUM alumni, you are indeed the pride of IIUM and the ummah. We hope you can continue making a positive impact locally and globally. If you wish to give something back to your alma mater by investing in the success of others, we welcome regular monthly, annual or one-off donations, **eligible for Malaysia tax exemption**. You contributions will be used for improvement of teaching and learning, department maintenance, student's welfare etc. To donate:

**IIUM Operating Account**
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**14070000004716**
**Ref: MCT ALUMNI**
**email: koe_mct@live.iium.edu.my**

We also welcome company sponsorship for International Conference on Mechatronics Engineering (ICOM) held by the department every other year; where the next conference will be held in 2024. Sponsorship packages are available, for more information, please contact us: koe_mct@live.iium.edu.my

# RISALAH

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## CONTACT US: