# E CARRIER

## THE OFFICIAL MAGAZINE OF ENTC

**Transformed Through a Research Project**

**Circuit Breakers World Championship**
p.06

ENTC
Electronic and Telecommunication Engineering

EC

# CONTENTS

## TECHNICAL



**SILICON TO DNA**

Learn more about the novel solutions for data storage and retrieval



**TRANSFORMED THROUGH A RESEARCH PROJECT**

## NEWS



**TALKS AT ENTC**

The series of knowledge sharing sessions organized by the Electronic Club

**CIRCUIT BREAKERS WORLD CHAMPIONSHIP**

World champions of IAS CMD Student Robotics Demonstration Contest 2021



## SPOTLIGHT



**A STUDENT TO SHINE**

Awarded as the most outstanding graduate from the Faculty of Engineering 2021

# Transformed Through a Research Project

by Dr. Ranga Rodrigo

Can one project at the university be life-changing? A multitude of projects that transformed lives have proven this is truly possible. What are such phenomenal projects? What key component in the project makes this wonder happen? How to reach there? What should the aftermath be? All these questions mimic the line of questions a researcher would ask. The way to make the project change your life is to discover something worthwhile and publish it in the right forum. Such is the nature of a truly influential work---the work that changes the author's life.

Influential researchers in the area around the world must get to know of the work for it to make an impact. A comprehensive dissemination of the work through a publication is the way to reach this audience. If influential people in the area are to read, the publication must be in the right academic forum. How can we select this forum? Researchers in the field (e.g., computer vision, communications, power electronics, computer architecture) know what the foremost forums are---the top conferences and journals. The general metrics for conferences are being listed within the top-twenty in Google metrics, having a high h5-index. For journals, in addition, being within the quartile-one in the field, and having a high impact factor are important. The forum must at least have a field-specific name and be handled by a professional organization. These communities are influential in the field and getting the work published in these forums lead to high impact.

Making our way into such a forum is challenging. A conceptual contribution that applies in a broader context than the immediate problem and surpassing state-of-the-art results (in some form) are two key aspects. In highly ranked conferences, the area chairs make decisions on the paper given the reviews and author rebuttals. Similarly, the associate editors make decisions in journals for submission and (revised) re-submissions. Although the rebuttals and resubmissions are there, it is quite unfortunate if a reviewer misunderstands our submission. Therefore, clear and concise writing and careful review after writing are extremely important practices.

In this context of creating understanding, the most important section is the introduction. It must present related literature, the research gap, the approach, and more importantly, the implications. Equally important is the section on results. The paper must compare the results with state-of-the-art and, hopefully, surpass them. Interpreting the results---figures, and tables---is a must, i.e., we must tell the reader what we want him or her to understand, how significant our contributions are. If the reviewer understands the paper easily, and sees improved results, and a concept that has wider application, the paper will conquer the exclusive forum.

Overcoming the challenge of getting accepted by a top conference or a journal is a part of being impactful; it is important to have the work appreciated by the community and *continue* the winning streak. Citations, in general, speak for the wider appeal of the papers. In addition to getting accepted by a great forum, the easy-to-understand nature, reproducibility of research, availability of supplementary material such as code, proofs, and slides are factors that lure readers to cite the paper . However, the most important task of a researcher is to generate a paper that would lead to many other follow-up papers, creating a snowballing effect, so to speak. I think strong fundamentals, the understanding of a wide area of literature---within and outside the field---collaborations with other groups, and innovative thinking are some factors that open avenues to a series of such valuable contributions.

It is quite an excitement to have a paper accepted by a top journal or a conference. Such an even often transplants a researcher enabling much larger contributions. Being engaged with the right journals and conferences is fundamental. Making conceptually powerful contributions that surpass state-of-the art and continuing the winning streak with innovative contributions makes a great researcher. Projects that capture these traits are, in fact, life-changing.

# Silicon to DNA

by Yasod Ginige

Data storage and retrieval are key problems we are facing today due to the high rate of data production. The Silicon industry faces many challenges in developing high-speed storage that can match the future data storage demand. DNA can be used because of high data density as a solution for that. Storing data in a DNA based medium needs efficient encoding and decoding methods. The use cases of these are spread in various fields.

Two decades before, people used CDs, DVDs and floppy disks for data storing, but they went out of use due to a lack of capacity improvements. Storage capacities were developed to match the exponential increment of data usage and new media came out. Nowadays, even a personal computer containing 1TB hard disks and 128GB flash memories is not hard to find. Servers are upgrading day by day due to the high demand for storage. New data encoding-decoding techniques are implemented to cater to user requirements. In 2018, the total amount of data created, captured, copied and consumed in the world was 33 zettabytes (ZB) – the equivalent of 33 trillion gigabytes. This has become 59ZB in 2020 and it is predicted to climb up to a mind-boggling 175ZB by 2025[1]. Another problem that follows with this is the access speed. The access rate reduces when we increase the number of disks to address the space problem. Ongoing research is trying to manage this problem by introducing more effective techniques. The question is, how long will these Silicon base storage devices hang on? Do we need better media to store data?

Researchers have found a novel method for storing data using DNA (Deoxyribonucleic Acid), the Data storage unit of Nature. DNA is far ahead of Silicon-based storage due to the high data density (the amount of data stored in a unit volume). For example, occupying 1cm3 of DNA can store 455 exabytes of Information[1]. DNA is a universal, everlasting and enduring medium of storing information providing

secure stored data. Power consumption for DNA storage is much less than normal storage because DNA is a very robust material and has a longer shelf life with no attenuation in data. For example, the oldest DNA samples ever recovered are from insects and plants in ice cores in Greenland up to 800,000 years old. This DNA existed without using any means of power from external sources. So, if we can find a method to store data in DNA and read them back with sufficient speed, we can solve the storage problem easily.

Digital data should be transformed into DNA sequences using an encoding technique when storing. Four bases, namely Adenine (A), Thymine (T), Guanine (G), Cytosine (C), are used as base units to form DNA sequences and binary bits, or symbols can be mapped into these bases. As a simple example, we can map 00-A, 01-T, 11-G, 10-C. A lot of research is going on to find more efficient and reliable encoding techniques.



Figure 1: Digital bit stream is encoded into a DNA sequence and the decoder decode it back to the digital sequence.

Next, DNA sequences should be read and transformed to a digital bitstream when reading stored data. This is called decoding. One of the major problems we have in DNA based storing is reading data to a compatible speed compared to the existing digital processing systems. This is a real challenge and research is conducted to improve the performance of DNA decoding. To do the task, Nanopore technology is one of the widely used decoding techniques at present. In this technique, a DNA is untight into a single strand and pulled out through an electric gate. As mentioned before, DNA is formed using

four bases that have different sizes. As shown in figure 2, when bases pass through the gate, different voltage levels are generated according to the base size. These voltage levels depend on the neighboring bases as well, hence the electric signal is highly correlated.
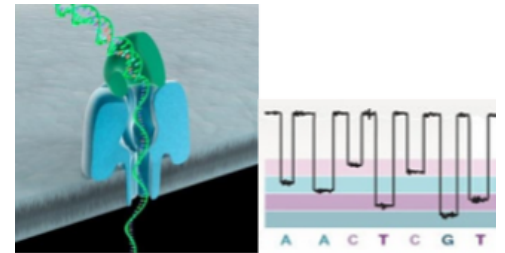


Figure 2: Current signal generated when different bases pass through the gate.

Also, the time period for a particular base in the current signal varies, because the passing time of bases differs with their molecular sizes. So, it is challenging to predict the DNA sequence by looking at the current signal and it is necessary to get this step correct to make a reliable decoding technique. Research is carried out to optimize this identification process and most of them use machine learning techniques. The results obtained so far are quite impressive. Research done using Hidden Markov models [2] has succeeded up to a considerable level in answering this problem. Constant research in this field will break all the barriers and hopefully revolutionize computer science.

References
- Siddhant Shrivastava and Rohan Badlani, "Data Storage in DNA", 2014

- Schreiber, J., & Karplus, K. (2015). Analysis of nanopore data using hidden Markov models. Bioinformatics, 31(12), 1897–1903. https://doi.org/10.1093/bioinformatics/btv046

# Combating COVID-19: The Role of Robotics

**by Shivanka Priyashan**

Doctors, nurses, paramedics work day-in and day-out to treat COVID-19 patients. In case of a new wave arising with each variant, all healthcare workers are burdened with the psychological trauma of overwork and are at the risk of unknowingly infecting family members of patients. Medical robots can play an important role to mitigate the spreading of the disease, identifying diseased patients, and delivering quality treatment to patients. This article discusses how robotics systems are being used for disinfection, screening, diagnosis, and treatment of infectious diseases.

**Robots for disinfection**

Disinfection is one of the key measures against infectious diseases. Health care workers must follow strict rules in wearing their Personal Protective Equipment (PPE) every time they enter an ICU or engage with a contracted patient, even for a simple task. As a solution, robots can effectively disinfect healthcare units and public spaces and mitigate the spreading of the disease.



**LightStrike Germ-Zapping Robot**
**(Xenex, USA)**



**UVD Robot**
**(UVD Robots, Denmark)**



**Li eXtreme Disinfection roBOT**
**(Nanyang Technological University)**

**Robots for screening**

In the case of infectious diseases, early identification is vital for effective treatment. But, direct contact between the doctor and the patient should be avoided to mitigate the risk of spreading the disease. During the pandemic, thermal sensors and vision algorithms have been installed onto remotely operated or autonomous robots to increase the efficiency and coverage of screening. Apart from temperature screening, robots have also been used as a solution for telemedicine.
The main challenges faced in robot-based screening are the accuracy and robustness of sensors. In practice, thermal cameras have failed to detect accurate temperatures when sweat or a mask covers the face of the subject. Further research on improving the environmental awareness of the robots through additional sensors and computational processing will solve these challenges.



**SPOT (Boston Dynamics, USA)**



**SHUYU (Tsinghua University, China)**

**Robots for diagnosis**

For airborne diseases like COVID-19, saliva, oral or nasal swab samples are collected for inspection. This commonly-used typical method of collecting these samples involves interaction between health care workers and potentially infected patients, thus increasing the risk of spreading the disease. Additionally, problems may arise from the handling of collected samples before, during, and after testing. Hence, robotics solutions can be used to collect, handle, test, and dispose of samples reducing the risk of exposure to and transmission of the disease. Apart from the associated risk, the operating skills of the health care workers affect the accuracy and quality of swab results.

Challenges in using robot diagnosis lie in the gaps that remain in the fields of haptics, dexterity, multimodal sensor integration, and autonomy. Training hospital staff to operate existing robotic systems was found challenging, mainly due to the problem of hand-eye coordination. But, with most robotic systems developed to be adaptable for many sectors, the future looks promising.



**Fully automatic throat swab robot
(Lifeline Robotics and the
University of Southern Denmark)**



**Robotic system
(Tsinghua University)**

**Robots for therapeutic purposes**

Endotracheal intubation is one of the most common treatments to allow for mechanical ventilation. Intubation is a complicated procedure with high complication rates that strongly rely on experienced physicians' manual dexterity.. This procedure exposes the physician to a high risk of infection.

The main challenge in developing robots for treatment lies in accurately identifying anatomical features for successful tracheal intubation. Constant progression in the fields of computer vision and AI add significant improvements to these challenges. Visual feedback and force-sensing are vital to enhancing the reliability of robotic systems. Advancements in actuation may derive from future research on soft robotics.
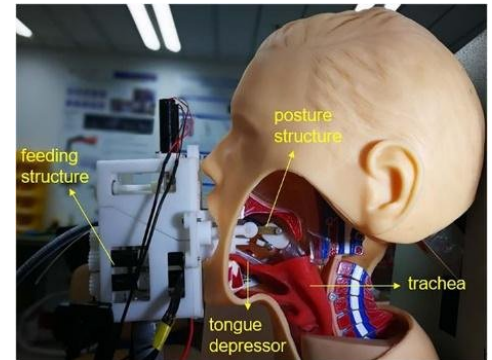


**Remote Robot-Assisted Intubation System**

The world we live in today presents various new challenges due to the pandemic. Robot-based systems are shown to provide promising solutions to many such complications. But, to implement effective solutions, strong communication should exist between the patients affected by the disease and engineers, researchers that develop robotics systems, and healthcare workers. Robotics systems must also be designed with future flexibility to adapt their capabilities to various needs. The possibility to develop adaptable and reliable robotic systems that can be distributed on-demand would allow robotics to play a significant role in combating infectious diseases like COVID-19.

# Research Publications

The Department of Electronic and Telecommunication Engineering is not only renowned to produce top class graduates ready for the industry, but also high calibre academics who dive deep into research. ENTC is also a proud producer of many research and journal articles of abounding top-tier journals. This article focuses on few such papers published from August 2021 onwards.

**Research paper acceptance @ IEEE ICMLA 2021**

The research paper titled **"SwiftLane: Towards Fast and Efficient Lane Detection"** has been accepted to the 20th IEEE International Conference on Machine Learning and Applications (ICMLA), 2021. The research was conducted by Oshada Jayasinghe, Sahan Hemachandra, Damith Anhettigama and Shenali Kariyawasam under the supervision of Dr. Peshala Jayasekara & Dr. Ranga Rodrigo.

In this paper, they propose SwiftLane: a simple end-to-end deep learning-based framework, coupled with the row-wise classification formulation for fast and efficient lane detection. This is significant as many algorithms fail to deliver real-time performance in lane detection specifically with limited computational resources. This framework is also supplemented with a false positive suppression algorithm and a curve fitting technique to further increase the accuracy.

Their method achieves an inference speed of 411 frames per second and their framework together with TensorRT optimization and Robot Operating System (ROS) integration facilitates real-time lane detection at an inference speed of 56 frames per second in an embedded system.

**Research paper acceptance @ IEEE ICCAR 2022**

An autonomous systems & robotics based paper titled "**Design and Development of a Research Oriented Low Cost Robotics Platform with a Novel Dynamic Global Path Planning Approach**" has been accepted to the 8th IEEE International Conference on Control, Automation, and Robotics, 2022.

The research was conducted by Shalutha Rajapakshe and Ramith Hettiarachchi under the supervision of Mr. Paul Flic and Mr. Nick Panitz, who were their supervisors during their internships at CSIRO Data61 Robotics and Autonomous Systems Group.

In this paper, they introduce a system design and integration of an autonomous navigation system based on the Alphabot2 robot platform.In addition, they present development and evaluation of a novel algorithm to achieve global dynamic path planning in ROS.

**Research paper acceptance @ IEEE/CVF WACV 2022**

The paper titled "**CeyMo: See More on Roads - A Novel Benchmark Dataset for Road Marking Detection**" written on the research conducted by Oshada Jayasinghe, Sahan Hemachandra, Damith Anhettigama and Shenali Kariyawasam under the supervision of Dr. Peshala Jayasekara & Dr. Ranga Rodrigo, has been accepted to the IEEE/CVF Winter Conference on Applications of Computer Vision (WACV) 2022.

In this paper, a novel road marking detection benchmark dataset is presented while addressing the limitations in the existing publicly available datasets. The introduced dataset covers a wide variety of urban, suburban, and rural road scenarios with diverse illumination and weather conditions. The multiple annotation formats and the clear evaluation metrics with the evaluation script will promote novel road marking detection algorithms and direct comparison of them. The dataset consists of 2887 total high resolution (1920 x 1080) images with 4706 road marking instances belonging to 11 classes. Furthermore, the authors evaluate the approaches of utilizing instance segmentation-based and object detection-based neural network architectures for the road marking detection task.

**Honorable Mentions**

Apart from the accepted research articles mentioned, there are a number of more achievements mention-worthy. A handful of the most notable achievements are mentioned here.

Team ExpelliCodus' Supun Kuruppu, Biyon Fernando, Dumindu Bandara, Bimsara Perera, and Wikum Jayasanka finished 3rd on the island (world rank 106) in IEEE XTREME 15.0.

Nuwan Bandara, Dilshan Bandara, Sahan Hettiarachchi, and Dasun Premathilaka of Team Stimulus placed second in the 3rd Regional Association of Energy and Power Universities (RAEP) Energy and Electricity Market Business Decision Simulation Competition 2021, which was hosted by Shanghai University of Electric Power (SUEP) in Shanghai, China, and Batangas State University in Batangas, Philippines.

Team DCD's M.M.C.J. Bandara, T.A.D.S. Thennakoon, and H.A.D.G. Hettiarachchi achieved third place in the InnovMind - Ideathon organised by IEEE Industrial Application Society of Sri Lanka Technological Campus.

Team Alpha's Sandani Jayawardena, Dinithi Silva, and Hashini Mithunika placed third in the IEEE Women In Engineering (WIE) Affinity Group of SLTC's InspiHERTech V1.0 tournament.

Team Lumos, comprised of Oshan Jayawardena, Dilmi Caldera, Chamath Shamal, Hasya Hansanganie, and Nisal Jayamuni, took third place in the Innovation Nation Sri Lanka 2021 competition conducted by IEEE Sri Lanka Section.

Supun Kuruppu, Biyon Fernando, Dumindu Bandara, Bimsara Perera, and Wikum Jayasanka of Team Aura made it to the finals of SLIIT RoboFest 2021.

**by Ishan Fernando**

# Circuit Breakers World Championship

by Hirumi Randika

The Department of Electronic and Telecommunication Engineering undergraduates have achieved numerous victories not only in the local context but also at the international level. Team Circuit Breakers, a team of final year undergraduates from the Department of Electronic and Telecommunication Engineering, University of Moratuwa, emerged as the world champions of IAS CMD Student Robotics Demonstration Contest 2021 organized by the IEEE Industry Applications Society. The competition was done virtually, and the final round of the competition was held on the 10th of October 2021 at the Annual General Meeting of IEEE Industrial Applications Society with the participation of the final three teams.

The aim of the competition was to develop a robotics application that can be used in an industrial environment, with the freedom for competitors to give a solution for a specific problem encountered in the industry.
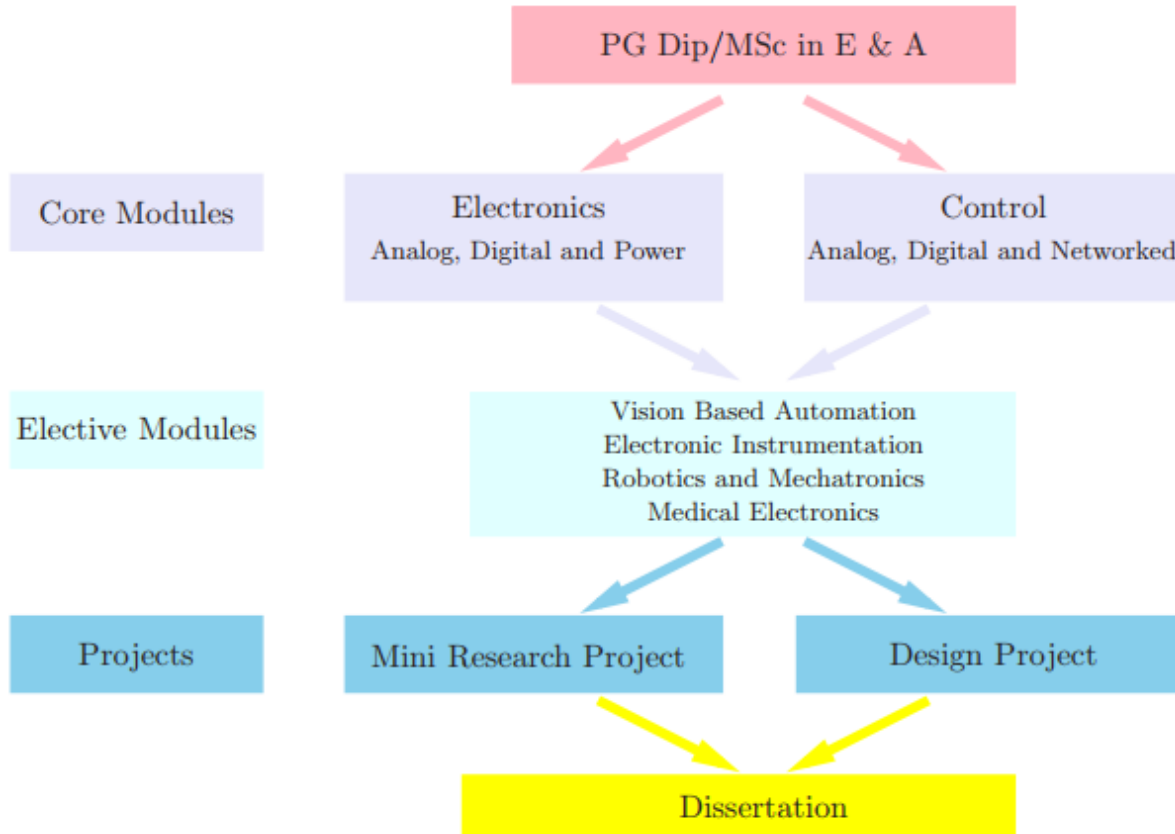
The team CircuitBreakers succeeded in developing a low-cost robotics solution for warehouse inspection, equipped with a uniquely designed manipulator to perform inspection tasks in industrial environments. They have optimized this solution in warehouse inspection for developing countries based on special features of a warehouse environment to be compatible with cost and the use cases.

This is a really proud moment for the department, and the country as this marks the first time a team representing Sri Lanka emerged as the "Global champion" of this highly challenging competition. Our heartfelt wishes for our undergraduates Deepana Ishtaweera, Shalutha Rajapakshe, and Dilanka Wickremasinghe of team Circuit Breakers for this outstanding achievement.

# PG. Dip./M.Sc. in Electronics and Automation

**by Sachini Chandanayake**

PG Dip/MSc in E & A

| Core Modules | Electronics<br>Analog, Digital and Power | Control<br>Analog, Digital and Networked |

Elective Modules — Vision Based Automation, Electronic Instrumentation, Robotics and Mechatronics, Medical Electronics

| Projects | Mini Research Project | Design Project |

Dissertation

Are you a fresh bachelor graduate or a practicing engineer? Do you aspire to work on electronics and automation? Here is one of the best possible investments on the road to success after completing the bachelor's degree in Engineering. Post Graduate Diploma/MSc in Electronics and Automation offered by the Department of Electronic and Telecommunication Engineering at the University of Moratuwa will equip you with all-round skills and knowledge needed to build a career as an engineer in the Electronic and Automation industry.

The course starts with the PG Diploma; the three-semester program includes the taught courses, assignments, projects, and presentations. Students will gain knowledge in electronic system design, controller synthesis and implementation, embedded systems, signal processing,

robotics and mechatronics with hands-on exercises. After completing the PG Diploma, students are eligible to carry out a research project over one year (part-time) to pursue the M.Sc. degree.

All the studies will be supported by an expert teaching staff, including internal and external resource persons with national and international recognition in their respective fields. This team is one of the key features that provide concrete evidence for the course's efficacy, as they are committed and enthusiastic to support the students. Currently, due to the COVID-19 pandemic, lectures are conducted in a virtual manner building a safe space for students to learn and interact with the lecturer simultaneously. Further, students are allowed to choose whether they want to complete the course in a full-time or part-time manner. The duration of the course may vary

according to the selected option.

The course curriculum is well designed to cover all the essential areas, including analog and digital electronics, power electronics, and digital and advanced control systems. Apart from these, the course facilitates students to select elective modules in machine learning and vision-based automation, signal processing, RF circuit design, robotics and mechatronics, medical electronics, etc., based on their interests. From the 2023 intake onwards, some new modules will be introduced covering internet of things and embedded systems.

PG Dip/MSc in Electronics and Automation offered by the Department of Electronic and Telecommunication Engineering at the University of

## Beyond the Bachelor's Degree

Moratuwa is the only post-graduate course in Sri Lanka that covers conventional and emerging aspects of electronics and control systems within the curriculum. Additionally, the department is committed to providing hands-on experience for students during practical sessions and projects. There are nine laboratories, a PG laboratory, and three industry-sponsored laboratories to facilitate the students. The curriculum tself reflects that the course can prepare the students with the core knowledge and experience needed for the growth of their careers.

Registration for the next intake will be open from mid-January 2022, and the course will start in May 2022 (tentative date). Students can have this exclusive opportunity at a reasonable price which can be paid in not more than three installments. If you are willing to take your career to the next level, undoubtedly, investing your time and money in this course will not be a waste.



Prof. Rohan Munasinghe

Dr. Ajith Pasqual

Dr. Nuwan Dayananda

Dr. Ranga Rodrigo

Dr. Anjula De Silva

Dr. Thayaparan Subramaniam

Dr. Chamira Edussooriya

Dr. Upeka Premaratne

Dr. Mevan Gunawardena

Dr. Chathuranga Weeraddana

Dr. Peshala Jayasekara

Dr. Subodha Charles

Dr. Dulika Nayanasiri

**Teaching Staff:**

**Internal**
Prof. Rohan Munasinghe
Dr. Ajith Pasqual
Dr. Nuwan Dayananda
Dr. Ranga Rodrigo
Dr. Subramanium Thayaparan
Dr. Upeka Premarathna
Dr. Mevan Gunawardena
Dr. Chamira Edusooriya
Dr. Peshala Jayasekara
Dr. Anjula De. Silva
Dr. Chathuranga Weeraddana
Dr. Subodha Charles

**External**
Dr. Dulika Nayanasiri

# C++ for Industrial Applications

by Nerththiga Neminathan



"C++ Concepts for Industrial Applications" is an online course program organized and conducted by Synopsys Lanka (Pvt) Ltd. Synopsys is a company focusing on technologies and innovations, from silicon to software, through using the most advanced technologies for chip design, verification, IP integration, software security and quality testing. They design high-performance silicon chips for autonomous vehicles, smart homes and machines. Also, software integrity tools developed by Synopsys are widely used to develop high-quality secure codes.

The course on 'C++ Concepts for Industrial Applications' was conducted via zoom, for fourth-year undergraduates of the Department of Electronic and Telecommunication Engineering, University of Moratuwa. It was a valuable opportunity for the participants to learn about the industrial applications of C++ such as OOP concepts, pointers and references, templates, estimating the memory footprint, software design, multi-level build systems and applications of data structures and algorithms in detail. The contents of this course program were developed by the company, under the supervision of Dr. Ranga Rodrigo (HoD, ENTC), Mr. Abarajithan G. (Chip Design (RTL) Engineer, Lemurian Labs, Canada) and Mr. Malshan Ranawella (Level 4 Undergraduate, ENTC).

The series organisers of the course are Aabid Rushdi (Manager R&D, Synopsys) and Chanaka Hangilipola (Manager R&D, Synopsys). Pavithra Prasadini (R&D Engineer, Sr II, Synopsys), Ashan Wickramasinghe (R&D Engineer, Sr I, Synopsys), Charitha Senarathne (R&D Engineer, Sr II, Synopsys), Harshana Prasad (R&D Engineer, Sr I, Synopsys), Madusanka PVT (R&D Engineer, Sr I, Synopsys), Janitha Bandara (R&D Engineer, Sr I, Synopsys), Umesh Isuru Dissanayake (R&D Engineer, Sr I, Synopsys) were the resource personnel who conducted the sessions of the course.

The course was a 7-week online course program with two-hour sessions per week. The first session took place on 15th October 2021. To encourage and induce enthusiasm among participants, a hackathon was held and the participants are yet to be awarded with amazing prizes. Participants will be awarded valuable certificates by Synopsys, considering attendance, quiz completion and participation in the hackathon.

# Talks at ENTC

by Rahul Jeyanthan

In this virtual age, knowledge sharing and online learning have become an integral part of our lives. Talks at ENTC, one of the newest initiatives undertaken by the Electronic Club of the University of Moratuwa, aims to build a community based on knowledge sharing sessions conducted by some of the most qualified speakers in the relevant fields.

The target audience for Talks at ENTC is a wide demographic, consisting of current undergraduates at the department and undergraduates from other departments and other universities, past graduates, school students, and tech enthusiasts in general. The sessions focus on five main areas, namely - Electronics, Telecommunications, Biomedical, AI/Machine Learning and Engineering Professional Development. Any interested individual can subscribe to the official Talks at ENTC emails by filling in the circulated forms on the e-club social media platforms and get updates about future sessions. The participants can also indicate the fields they are interested in, through the aforementioned forms, such that future sessions can be organized to curate these interests.

The initial programme of Talks at ENTC was organized on the 30th of October 2021, with Dr. Jeewika Ranaweera as the speaker. As the principal hardware engineer at Oracle, San Jose, California, USA, she spoke on "Fulfillment through technology". Dr. Ranaweera expanded on challenges and obstacles she herself had faced during her career as an engineer. The main objective of her speech was for the audience to take these lessons and to use them to gain personal empowerment and fulfilment from a professional engineering career.

The second session was conducted on the 11th of December, 2021 by Mr. Kalana De Silva, from ST Engineering in Singapore. He spoke on "Journey of Exploring Space Satellite Design". The session was quite informative and went over the entire field, covering new developments as well as the requirements for entering into satellite design.

Both sessions were conducted successfully with enthusiastic participation. Talks at ENTC has several plans for the future. One possible focus is the preparation of ENTC undergraduates from a professional perspective. Talks at ENTC also hopes to expand its current audience. The end goal of the project is to build an audience from multiple professional fields as well as from school students to build an extensive knowledge-sharing community.

# Pi Mora 1.2, the Most Awaited Raspberry Pi Jam

by Sandani Jayawardena



Raspberry Pi is a single-board computer, smaller than our palm. But it is a powerful device that can perform advanced computations within a few microseconds. With the increase in popularity of technologies such as IoT and computer vision, the demand for embedded systems has renewed on a larger scale, greatly benefiting the Raspberry Pi. There are Raspberry Pi Jams organized worldwide for people to come together and learn about what they can do with a Raspberry Pi.

Pi Mora is the first-ever Raspberry Pi Jam in Sri Lanka organized by the Spark branch of the Electronic Club of University of Moratuwa. Pi Mora aims to establish a Raspberry Pi community in Sri Lanka by providing a platform to share knowledge among pi enthusiasts. With the successful conclusion of the first-ever Raspberry Pi Jam, now the second phase of the series, Pi Mora 1.2 has been launched, reaching new heights.

Pi Mora 1.2 consists of four sessions, which includes two guest speeches and two workshops. This time the Jam concludes with an Ideathon where they get an opportunity to showcase their innovative ideas. All the undergraduates of the University of Moratuwa are welcome to participate in this Jam.

The four sessions of Pi Mora 1.2 concluded successfully with the participants receiving hands-on experiences in the latest trends and applications of Raspberry pi related to computer vision and IoT.

The first session of Pi Mora 1.2, held on 6th November 2021, was an inspirational pep talk conducted by Mr. Geeth Udugamakorala, an undergraduate of Electronic and Telecommunication Engineering Department. He is a patent holder and an award-winning electronic designer in computer vision-based robotics at a very young age. Sharing his own experience, he demonstrated a project on computer vision done with the aid of Raspberry Pi.

As the second step, a workshop was organized to guide students through installing Raspbian and OpenCV and setting up a Raspberry Pi board with Mr. Geeth Udugamkorala as the resource person. Students were divided into groups and they were given the task of identifying the steps of setting up a Raspberry Pi board from scratch.

In the third session, Mr. Janith Kodithuwakku delivered a speech on familiarizing the students with IoT based applications. He is a visiting lecturer at Deakin University, a hardware engineer at Jendo Innovations (Pvt) Ltd. and an Electronic Engineer at Effective Solutions (Pvt) Ltd.

The final session of the series was a hands-on session for introducing Node-RED. The session was conducted by Mr. Chandima Weeratunga, an undergraduate of Electronic and Telecommunication Engineering Department. Students were guided to create a weather API. The session was held on 14th November 2021 indicating the completion of four successful sessions of the second Raspberry Pi Jam.

Serving as a final acknowledgement, a LinkedIn badge will be awarded to all participants who completed the given tasks in the workshops. As the perfect finale of the Pi Mora 1.2, an Ideathon is to be held to test the knowledge gathered, and it will be beneficial for all the participants in enhancing their analytical skills. The three best ideas will be rewarded with Raspberry Pi boards.

# SLRC University Finals

by Dilmi Kaldera



**WINNERS**

CIRCUITBREAKERS — UNIVERSITY OF MORATUWA — SLRC 2021

**1ST RUNNER UP**

DOODLE SQUAD — UNIVERSITY OF MORATUWA — SLRC 2021

**2ND RUNNER UP**

BITFINIT — UNIVERSITY OF MORATUWA — SLRC 2021

In the October 2021 issue of the E-Carrier magazine, we brought you our major robotics competition, the Sri Lankan Robotics Challenge (SLRC) 2021, organized by the Department of Electronic and Telecommunication Engineering of the University of Moratuwa. There, we focused on bringing you the information about the school category. Through this article, let us gaze into the SLRC University Finals, the final exciting stage of the University Category.

The SLRC university category competition is a far-reaching platform for young undergraduates to sharpen their skills and knowledge in robotics and learn the latest techniques in designing robots. This year more than 200 robotic enthusiasts, formed as five-member teams, were registered from universities all around the country.

The first stage of the competition consisted of two rounds, namely, the virtual round and the physical round. In the virtual round, the contestants were expected to design a virtual robot in the Webots Open-Source Simulator (WebotsR2021a) to complete the given task within specified limits. The main tasks focused on this round were detecting pillars on the sides of the robot, identifying a colour patch under the robot, line following and wall following. This round accounted for 60% of the total mark for the first stage. The remaining 40% of marks was accounted for completing five subtasks in the physical round. This round required submitting codes that can meet the given subtasks using a physical robot made by the organizing committee. Those five subtasks were white square detection, colour detection, pillar distance measuring, IR sensor panel representation and 90 degrees turn. Based on the total marks obtained for this stage, eight teams were selected for the final stage of the competition.

In the final stage, contestants were expected to design two virtual robots within the specified limits to complete the given task in the Webots Open-Source Simulator. This round accounted for 100% of the total mark for the final round. The main tasks that needed to be accomplished in this stage were line following, box detecting, implementing an arm capable of moving and carrying boxes, detecting the colour of the boxes and communicating between the two robots (optional). Eventually, the winners were selected based on the final marks gained by each team.

The SLRC University Category Finals was conducted on an entirely virtual platform on the 27th of November 2021. After several competitive stages and the judgement from the judging panel, team "Circuit Breakers" consisting of the members Punsara Mahawela, Senal Mihiru, Hasantha Nadeeshan, Rahal Perera and Poorna Gunathilaka representing the University of Moratuwa, ranked at the top of the list, emerging as the winners of the University Category of SLRC 2021. Team "Doodle Squad" with Husni Faiz, Maneesha Gunathilaka, Lahiru Akmeemana and Chamodya Attanayake was able to achieve the first runner-up trophy while the team "Bitfinit" comprised with Vinura Wanniarachchi, Sadith W.M.L., Dumindu Perera, Yasith Perera and Sithuruwan Prathapasinghe was placed as the second runner-up of the competition. Amidst the challenges and new-normals that took place due to the pandemic, the SLRC University Finals 2021 successfully concluded, leaving a remarkable milestone in the robotics field.

# A Win-Win Relationship
## Industry Collaboration

by Kajhanan Kailainathan

A special mention should be made to the industrial collaborators who had been a tremendous help to our department. Following are some projects carried out by ENTC with industry collaborations.

**Ear-EEG and Ear-PPG based sleep monitoring system** in collaboration with **Aarhus University, Denmark**

We spend around a third of our lifetime sleeping. Therefore, an accurate judgement of the different stages while sleeping could be beneficial.

The conventional sleep stage scoring approach is labour intensive, time-consuming, prone to human errors, and costly. During a typical sleep study, patients will be wearing multiple sensors and electrodes in their bodies. This compromised sleep quality is detrimental to the study's diagnostic quality, leading to treatment errors. These two critical issues in sleep studies explain the necessity for an automatic sleep stage classification algorithm and a comfortable signal acquisition system.

A group of final year students of the department, supervised by Dr. Anjula de Silva and Dr. Chamira Edussooriya, have undertaken this challenging task of sleep monitoring using ear-EEG and ear-PPG methods.

Ear-EEG based sleep stage classification is an emerging trend in the area of sleep study. Most previous works have focused on designing signal acquisition systems to acquire Ear-EEG and validate that Ear-EEG can replace scalp EEG in sleep studies. Apart from EEG signals, heart rate also plays a significant role in sleep stage classification (PSG) studies. Ear-PPG sensors can be used for this purpose as they are accurate, non-invasive, and time-efficient.

Realising this has become a possibility under the supervision of Dr. Simon Lind Kappel, former lecturer at the Department of Electronic and Telecommunication Engineering, University of Moratuwa and Postdoctoral Researcher at the Department of Electrical and Computer Engineering - Biomedical Engineering, Aarhus University, Denmark. His proficiency in the field helped to bridge the knowledge gap that was initially present.

This ambitious undertaking would require a lot of data from laboratory equipment and other resources. Since Aarhus University has an ear-EEG lab, it was possible to obtain support from the lab through the collaborator. The industrial collaborator also provided the students with vast datasets required to take on this task.

**Real-time Asset monitoring system** in collaboration with **Sri Lankan Airlines**

Real-time assets monitoring system is a project for Sri Lankan Airlines and aims to locate the equipment such as generators and forklifts in real-time. To achieve the task, the students hope to develop localization techniques using tags mounted on each piece of equipment that emits wireless beacons. Anchor nodes placed at known positions in the neighbourhood act as reference points by which the localization algorithm estimates the equipment's location.

The same asset monitoring approach is currently being used across all different kinds of locations. The varying environmental conditions affect the acquired data, rendering this approach inefficient as far as high accuracy real-time asset monitoring is concerned, which is a critical requirement for the airline industry. Our students provide a unique value proposition for their project using different techniques for different areas depending on the need rather than using the same system.

By the end of this project, the students are hoping to develop a suitable anchor placement strategy in a given area, providing a graphical user interface to view current location and location history, to deploy a prototype system for a given pilot area of Sri Lankan Airlines, and to integrate the positioning system to the existing asset management system in Srilankan Airlines.

This project, supervised by Prof. Dileeka Dias and Dr. Samiru Gayan, requires dealing with a variety of actual equipment that are heavy and expensive and working in the actual location. Sri Lankan Airlines, the industrial collaborators for this project, has given the students access to the pilot area for tackling the challenges in this project. They also were generous enough to have faith in our students and fund the project.

# SPARK:
# Making the Impossible, Possible

by Dinithi Dissanayake

It only takes one spark to light a fire inside ourselves. Thus "SPARK" is the newest initiative that is put in place to create a small yet powerful spark within the undergraduates in hopes of making a significant contribution to the nation and the world at large. As Project SPARK is nearing the completion of its one-year pilot journey, there's a lot to commemorate and a lot to put into action.

"SPARK is investing and supporting innovators, dreamers, and change-makers who are determined to tackle the global climate crisis, developing solutions that will deliver an impact today for all the tomorrows, whilst introducing and teaching innovation to the students of tomorrow." Having this vital mission carved into our minds, the department and the Electronic Club have accepted the challenge of undertaking this project. The project is currently led by Dr. Ajith Pasqual, Dr. Ranga Rodigo, and Dr. Jayathu Samarawickrama, along with the support of the academic staff and the officials of the Electronic Club. We now have a separate branch in the Electronic Club specifically focused on managing the SPARK project.

It is considered a luxury to own a Raspberry Pi in the first year of university in Sri Lanka. Challenging this culture, the first step we took in the project was to gift a Raspberry Pi to each student of first and second-year batches in the department with a complete user guide and a care guide. This allows them to get hands-on experience with a world-class Single Board Computer at the early stage of university life. Without stopping there, we have taken it further to conduct virtual Raspberry Pi Jams in the name of PiMora focused on Raspberry Pi projects. We have developed an RPi community on Facebook with 400+ members sharing their projects and questions related to Raspberry Pi.



You can visit and join the community through this link and contribute to this worthy cause.

The primary entity of project SPARK is the Spark Challenge, a year-long, fully funded project proposed and driven by undergraduates, giving solutions to real-world problems. We are proud to say we have 50+ teams working on many exciting ideas, and they are developing their final products. We support the teams with exclusive training conducted by three professionals who train the teams on generating, evaluating, selecting, and pitching ideas. Twenty-five facilitators comprising senior and junior lecturers have volunteered to support these teams in their journey to victory. We hope to organise an open day in June 2022 to feature these great ideas and efforts.

SDGs provide a shared blueprint for peace, prosperity, people and the planet while acting as a call to action for all nations. Project SPARK focuses on improving the standard of education, which falls in the 4th SDG, "Quality Education". The world will inevitably have to face more complicated hazards than the pandemic with global crises such as the climate crisis.

*"It's so close; I can feel the heat big time*
*And you can act like everything is alright*
*But this is probably happening in real time*
*Celebrate or cry or pray, whatever it takes*
*To get you through the mess we made*
*'Cause tomorrow may never come"*

*-Quoted from Don't Look Up-*

SPARK is an effort to ignite a spark in young talented individuals to create a significant impact by making the impossible possible. Yes, we can still find our way to gift a better world to the coming generations, rather than ignore the real problem and waste resources that are meant to be theirs.

*"We the next generation will save tomorrow today!"*



*Making the Impossible Possible*

# Exclusively for Tech Enthusiasts

by Yohan Abeysinghe

## PiMora Phase 2

Following its immense success last August, Sri Lanka's first-ever RaspberryPi Jam, E-club launched the second phase of the "PiMora" series, bringing the concept of RaspberryPi much more accessible for all the enthusiasts. This became a valuable opportunity for the participants to enhance their hands-on experience and knowledge on getting maximum out of a RaspberryPi. The participants went through four sessions on November 6th, 7th, and 13th, 14th.

In the first week, the skills in utilising a RaspberryPi for computer vision applications were targeted. The introductory lecture was done by Mr. Geeth Udugamakorala, an undergraduate at the Department of Electronic and Telecommunication Engineering, a patent holder, and an award-winning designer in computer vision based robotics. In the workshop, Mr. Udugamakorala demonstrated a vision-based indoor navigation robot that he made to help the COVID-19 patients without causing any personal physical contact. The next day at the workshop, the participants were given their first-ever hands-on computer vision task to build a face detection algorithm using OpenCV.

The second week prioritised the IoT applications. Mr. Janith Kodithuwakku, a leading person in the Sri Lankan IoT sector, gave a lecture on his approach and the experience. At the end of the workshop series, the participants were asked to develop a tracking system of the air purification system using Node-RED.

## Embedded Systems Workshops at Kelaniya

A four-day training workshop series on PCB design, PIC, FPGA and VHDL was conducted by the Department of Electronic and Telecommunication Engineering with the collaboration of the Engineering Technology Students' Association of the University of Kelaniya in October 2021. The sessions were conducted with the help of Mr. Sahan Sanjaya, Mr. Tharindu Samarkoon, and Mr. Hasindu Kariyawasam, who are undergraduates at the department. This became a golden opportunity to share friendship and knowledge with a peer university.

A constant reminder of Dr. Ranga Rodrigo, the Head of the Department of ENTC, is that knowledge is power. And the ones with knowledge should always try to do something for society, which is the ultimate selflessness. Following this advice and lead, Electronic-club has been conducting workshops and webinar series to give something to the community and will continue this practice for the foreseeable future with the aim of uplifting the technical and practical engineering skills of the tech enthusiasts.

by Diluksha Rukmal

**Dr. Pujitha Silva** rendered his services as a Senior Lecturer in the Department of Electronic and Telecommunication Engineering at the University of Moratuwa from April 2014 to December 2021. Dr. Silva holds a Bachelor's degree in Biomedical Engineering and a PhD in Mechanical Engineering. His research interests include biomechanics of soft tissues, gait analysis, finite element modeling, biomaterials and engineering education. As a senior lecturer within the Department of Electronic and Telecommunications Engineering, Dr. Pujitha has been a key figure in the development of the biomedical engineering curriculum, teaching and research in the area of biomechanics and gait analysis.

Dr. Silva is also the Founding Director of the Center for Biomedical Innovation (CeBI); a multidisciplinary research center at the university focused on biomedical device development and commercialization. Under his leadership, CeBI grew to attract both local and foreign projects, with research funding in excess of LKR 55 million, employ upto 20 full time and part time employees on various commercialization based projects. He was also instrumental in developing and commercializing WalkSense, Sri-Lanka's first 3D motion capturing system for clinical and rehabilitation gait analysis, through his startup, Kairos Sensing (Pvt) Ltd in 2021. He has co-authored 5 (Q1-Q2) Journal publications, 15 peer reviewed conference papers, 8 conference abstracts, 1 magazine publication and 1 patent, in the fields of biomechanics, biomaterials and wearable sensor based applications during his time at the department. He also supervised 1 MSc, 2 MPhil and 1 PhD students.

He also engages in courses aimed at the personal and professional development of engineering graduates to be well rounded in industry and leadership. Dr. Pujitha Silva is a certified professional coach (PCC) with the International Coach Federation. He is the head of the research and development team at Full Life Coaching, through which he has conducted numerous mentoring, coaching, leadership development, community development, and organizational strategy development initiatives. Dr. Silva is the proud author of the P3 Growths Coaching Model, which takes a holistic approach towards growth and development in individuals, teams and communities. Also he is the co-author of RockStars- Growing Stellar Performers in Organizations ISBN 9781717737106 (2018).

# Dr. Ajith Pasqual

**by Dinithi Silva**
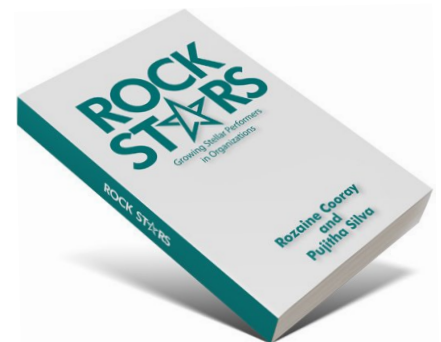
Dr Ajith Pasqual has been with the Department of Electronic and Telecommunication since 1993. He is also a proud product of the department and holds a Ph.D. in Computer Vision from the University of Tokyo in 2001. He has contributed to the department immensely as the Head of the Department for three consecutive years from 2012. The commencement of the Biomedical Engineering Degree program in 2013 offered by the department can be seen as a highlight of his time as the head of the department. He also served as the Director of Center for Information Technology Services (CITeS) at the University of Moratuwa for ten consecutive years from 2005.

Dr Pasqual is known for his exceptional deliverance of academic content with a precise relation to practical applications. He has always been keen on bridging the gap between academia and real-life implementations and has organized many programs to develop practical skills among undergraduates.Being a person with expertise in many different fields such as computer vision,image processing, intelligent transport systems, e-commerce, human visual system and genomic signal processing, Dr Pasqual has a plethora of publications under his name in many recognized journals and conferences.

Taking a step further from his academic career, Dr Pasqual ventured into the electronic industry in Sri Lanka as the founder of Paraqum Technologies (Private) Limited in 2016 and currently serves as the company's CEO. Paraqum Technologies offers services in two domains; network traffic visibility and control and high-end electronic design services. Under his leadership, Paraqum Technologies provides services to both local and foreign clients while broadening the horizon of the electronic industry in Sri Lanka.

The department has immensely benefited from the leadership and expertise of Dr Pasqual for 20 straight years, and he is undoubtedly a leading figure in the successful journey of the department.

# Dr. Kasun Hemachandra

Dr Kasun Hemachandra is a senior lecturer rendering his service to the department since 2017. He received his B.Sc.(Hons.) degree at the department during his undergraduate years and M.Sc. and Ph.D. degrees in electrical and computer engineering from the University of Alberta, Canada. He was a Postdoctoral Fellow at the Department of Electrical and Computer Engineering, University of Calgary, Alberta, Canada.

Dr Hemachandra is one of the adept researchers in the department. His research interests include UAV assisted wireless networks, device-to-device communications, cache-enabled wireless networks, vehicular networks, and the application of machine learning techniques in wireless communications. As proof of his expertise and knowledge, Dr Hemachandra has a multitude of publications in recognized journals and conferences and is the proud recipient of the Alberta Innovates Graduate Student Award in 2011 and the Outstanding Research Award awarded by the University of Moratuwa in two consecutive years, 2018 and 2019. Currently, he serves as the Director of the newly established UoM-Dialog Axiata 5G Innovation Center.

His vast knowledge and years of experience have made him an imperative resource person among undergraduates in Digital communications, wireless and mobile communications areas.

**by Dineshika Karunarathna**

# Mr. Nadarasar Bahavan

**"Opportunities Only Come If You are Looking for Them. Stay Hungry"**

Usually, people say, "Be good at one thing, not average at everything". But on rare occasions, we come across all-rounders who have excelled in several fields. Nadarasar Bahavan of the 2016th batch of the Department of Electronics and telecommunication engineering of the University of Moratuwa is a prime example.

At the General Convocation 2021, he secured the gold medal for biomedical engineering and also the convocation award for the most outstanding graduate from the faculty of engineering. All of these he attributes to years of silent accumulation and steady progress, backed by favorable circumstances and the helping hand of many individuals.
Nadarasar has top notch academic achievements. He led the team which won second place in the IEEE Signal processing club. He was also part of many victories in several hackathons/datathons.

Another proof of him being an all-rounder is his amazing career in sports, where he has many international and national achievements in rowing. Among them are the bronze medals in both M4- and M8+ events at Varsity Boat Race 2018, held in Malaysia and Silver Medal in the Intermediate Men's Coxed Fours at Sri Lanka Intermediate Rowing Nationals. As an undergraduate, he has also won many university games. Representing the Road Race team in Inter-university Games in 2018; which made into inter-university record-books for the fastest A4+ timing. Furthermore, securing the Gold Medal for A4+ in Sri Lanka University Games, being the Best Novice Oarsman in University Colors Ceremony 2018, winning SLUSA Colors for Rowing 2019 and University Colors for Rowing 2018, 2019 are some outstanding achievements of him as a sportsman. Also represented the University in Road Race after being selected on the basis of an excellent performance in the annual road race 2019. Excelling in academics and sports, he brings reality to the quote, "Sports do not build character. They reveal it".

He founded and chaired the IEEE Signal Processing Society Student Branch Chapter of the University of Moratuwa. The society was behind many successful endeavors, such as many workshops/webinars conducted by esteemed professionals from diverse fields for the benefit of the undergraduates. The success of his tenure was verified by winning the Best Emerging IEEE Student Branch Chapter at the IEEE BOOST 2021.
He has been an active member in the Gavel Club and Debate Club at the University of Moratuwa. In the Gavel Club he chaired the Speech Olympiad 2020, which is an intra-university public speaking competition. He won the Enliven public speaking competition held in Colombo university and also won second place in the Hulftsdorp international debates held at the Sri Lanka law college displaying his talent in public speaking and debate.

At the present moment, he is aspiring to be a researcher in biomedical engineering so that he can add value to society.

> "Individually, We Are One Drop. Together We Are an Ocean"

- RYUNOSUKE SATORO -

**Dr. Ranga Rodrigo**
Head of the Department

**Dr. Subodha Charles**
Staff Editor-in-Chief

**Dr. Samiru Gayan**
Coordinator - ENTC Alumni Connect

**Heshani Munasinghe**
Student Editor-in-Chief

**Yohan Abeysinghe**
Student Editor-in-Chief

**Sandali Liyanagoonawardana**
Student Editor-in-Chief

**Thushara Sampath**
Head of Public Relations

**Ajeeth Chandrasekaran**
Head of External Relations

**Vidura Erandaka Karunarathna**
Design Coordinator

**Ravidu Harshana Munasinghe**
Designer

**Kithdara Hansamal**
Designer

**Sahan Gunasekara**
Designer

## Authors

Dr. Ranga Rodrigo

Yasod Ginige

Shivanka Priyashan

Ishan Fernando

Hirumi Randika

Sachini Chandanayake

Nerththiga Neminathan

Rahul Jeyanthan

Sandani Jayawardena

Dilmi Kaldera

Kajhanan Kailainathan

Dinithi Dissanayake

Yohan Abeysinghe

Diluksha Rukmal

Dinithi Silva

Dineshika Karunarathna