IEEE Sri Lanka Section NEWSLETTER

July - 2021

Evaluation of Medical Technology

BIG DATA

Suffering Blue Planet

Do You Worry About Your Fuel?

Technology and Covid-19

First Experience in Virtual Section Congress

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IEEE Sri Lanka Section

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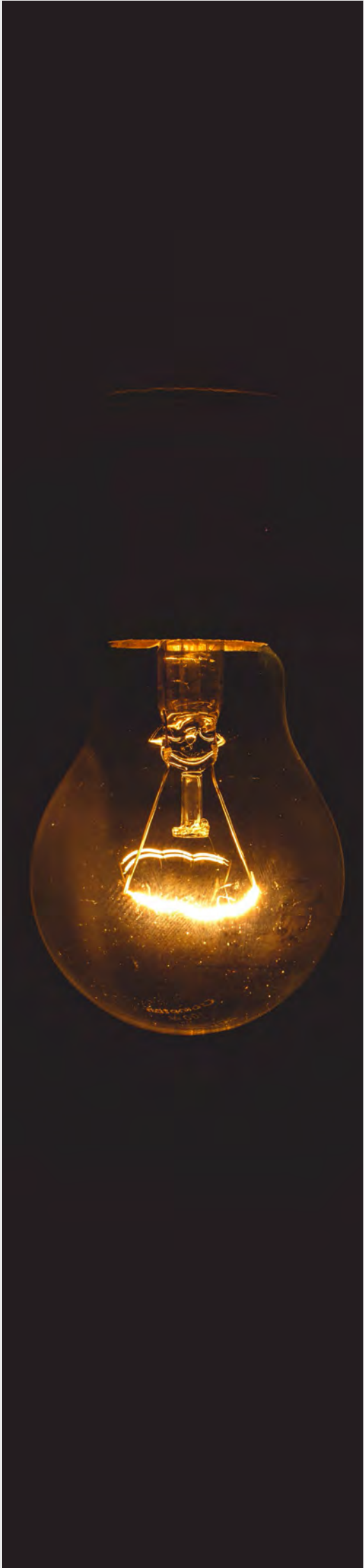


Message From The Chairman

Hello Readers,

I, Maheshi Dissanayake, the Chairperson of IEEE Sri Lanka Section for the year 2021/22 warmly welcome all our readers to the 2nd e-newsletter of the section for the year 2021.
I hope that everyone reading this newsletter, their loved ones and friends are well and safe.

Although we as IEEE members are accustomed to and favoured physical member engagement activities, due to the Covid-19 pandemic, many physical events were cancelled or postponed. Yet, with the spirit of volunteering, following the IEEE guidelines, IEEE volunteers from student branches to section level have adopted the new norms and organised many events using the online platform. The significant number of news items shared in this e-newsletter, is a display of the determination, courage and the resilience of IEEE and its volunteers in Sri Lanka.

The 2nd newsletter of the year consists of technical briefs of advances in technology, news items and event reports related to many events carried out through out the country by our volunteers. As a section we have completed our annual officer training workshop in May as a virtual event with participation of nearly 200 officers from IEEE student branches, chapters and affinity groups. The section hosted 5 webinars with the scope of disseminating technical knowledge among the membership. We have opened the call for the Electronic Design Competition 2021 as well. With nearly five technical co-sponsorships already awarded, and some more under consideration, the section hopes to deliver a significant service and recognition to the conference organisers and the participants.

I would like to thank all who have contributed to this issue of the newsletter, especially
Dr. Ahilan Kanagasundaram, the section editor, and his team for editing and organizing the information to get the newsletter out to our members. As we all are waiting for the pandemic to be over, I hope all our readers will enjoy the newsletter while sharing, recognising and appreciating the efforts put forth by IEEE volunteers for the betterment of the membership and the society.

Let us as IEEE, use our knowledge and skills to enhance the healthcare system and support the society in these difficult times through creativity and innovations, when and where necessary.

Stay safe.

Dr. Maheshi Dissanayake
Chair/IEEE Sri Lanka Section

Message From The Editor

It is my pleasure to serve as an editor for IEEE Sri Lanka Section'sfirst edition of newsletter for the year 2021. We were overwhelmed and delighted to see the response we got from all of you through your submissions.

IEEE Sri Lanka Section has been established to share the knowledge among members and to spur technological innovations for the benefit of the country. This edition of newsletter is sharing expert knowledge among members and interested communities and sharing members' memories and achievements.

Thank you for all your support and cooperation and looking forward to the next edition of newsletter. Also, I must thank Chairperson of IEEE Sri Lanka section Dr. Maheshi Dissanayake and executive committee for supporting me. I wish to place a special thanks to Mr. Anuraj and Mr. Heshan for their efforts behind this edition. Your feedback is of great help to us, do send us your comments to ahilan@ieee.org.

Dr Ahilan Kanagasundaram
Editor / IEEE Sri Lanka Section

Editorial Committee

What is Medical Technology?

by Prof. Ruwan Gopura

Figure 1: Source: https://www.roboticsbusinessreview.com/health-medical/medical-robotics-exciting-future/

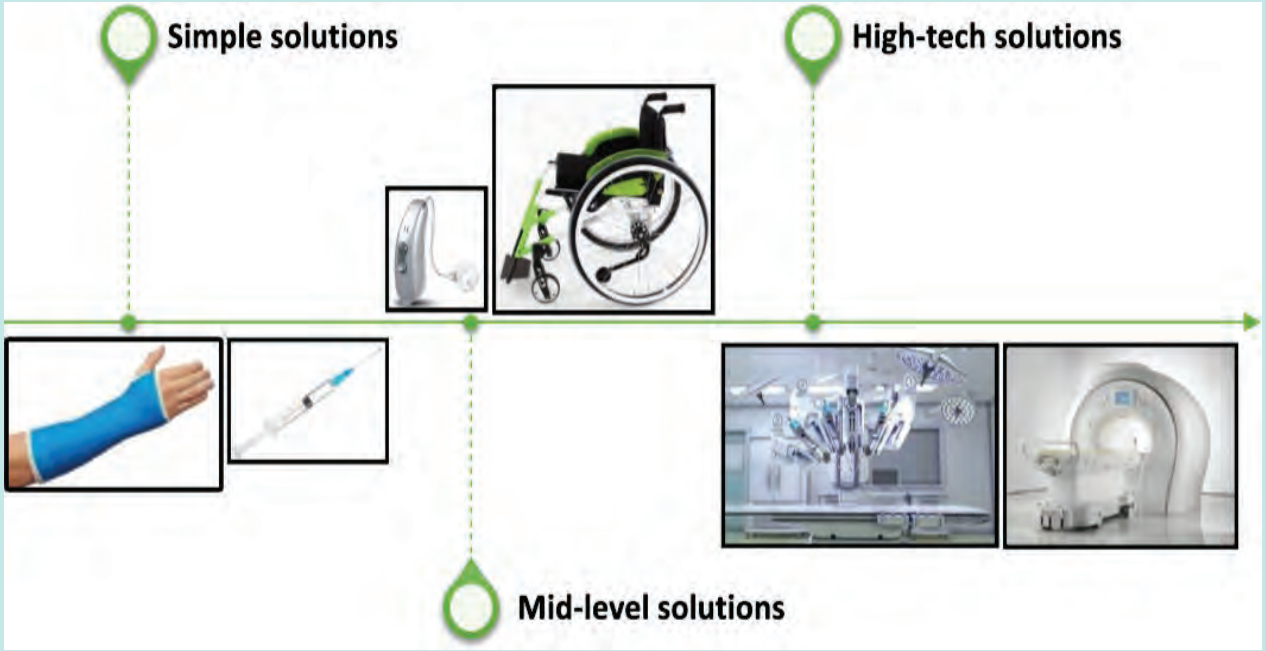
Medical technologies have been applied from the most severe medical case to the simplest case. Starting plaster casts to robotic surgery, technological innovation was always present and certain. With every single medical technology, there is a patient in mind. The application of technological knowledge, tools and systems to protect organisms from disease, damage or death can be identified as Medical Technology. In medical technology, scientific knowledge is practically applied to solve health problems. It offers prevention, diagnosis, monitoring, treatment and care.

ScienceDirect, a leading source for scientific, technical, and medical research has defined Medical Technology in The New Public Health (Third Edition) in 2014 as the application of science to develop solutions to health problems or issues such as the prevention or delay of onset of diseases or the promotion and monitoring of good health. Asia Pacific Medical Technology Association Ltd defines Medical Technology as the technologies that diagnose, treat and/or improve the health and wellbeing of a person, encompassing both low-risk and high-risk medical devices used to save the lives of patients. https://www.medtecheurope.org/ identified medical technologies as products, services or solutions used to save and improve the lives of individuals.

Medical technologies can save lives, improve health, and contribute to sustainable healthcare. The technology produces value to patients, healthcare professionals, healthcare systems and society from innovative devices and diagnostics. These technologies are used to save lives in individuals suffering from a wide range of conditions, and they all share a common purpose: improving and extending the lives of individuals. To develop these technologies, highly skilled individuals and many years of studies are required. In its numerous forms, medical technology diagnoses, monitors and treats virtually every disease or condition.

Essentially, medical technologies may span across a wide spectrum of applications. Simple solutions include medical plasters, syringes or latex gloves or solutions that may benefit the users on a day-to-day basis such as spectacles, wheelchairs and hearing aids. At the high-tech end, more sophisticated solutions such as total body scanners, prosthetic devices and implantable devices such as heart valves and pacemakers are included.

The embracing of technology in healthcare over recent years has led to improved diagnosis and treatment of patients. It is beneficial to enhance the health and quality of life, and it has already saved many lives. Information Technology (IT) enables the medical practitioner to collect, store and retrieve data of patient's health records. Ultimately, it is easier to retrieve health records of a patient from a database and monitor patient wellbeing effectively.



Some of the most advanced medical technologies in recent years include Medical robotic systems, virtual reality (VR) and augmented reality (AR) applications in medicine, 3D printing, health wearables, artificial organs and telehealth. In most of these technologies, Artificial Intelligence (AI) is applied.

- Medical robotic systems: Robotic surgery is one of the common applications of robotics in medicine. It assists in precision, control and flexibility while keeping the surgery minimally invasive. It is likely to be used simply to assist and enhance the tasks of the surgeon. While carrying out a robotic surgery, the surgeon can perform complex procedures that are otherwise either highly difficult or impossible.

- VR and AR: VR and AR can help medical professionals to get nearly real-life, learning experience using technology. The VR devices can also provide support for patients, helping with diagnosis, treatment plans, preparing them for their procedures and in their rehabilitation and recovery.

- 3D printing: 3D printing technology can create implants and prosthetic devices. These prostheses are very popular since they are custom made and can allow exceptional levels of comfort and mobility.

- Health wearables: Wearable technology in healthcare includes electronic devices that can be worn.They are called health wearables and can detect cardiovascular anomalies earlier and prevent severe conditions.

- Telehealth: This is a fast-developing technology to receive patient medical care through their digital devices. This eliminates face-to-face appointments with medical officers. Telehealth can provide patients with different access points to healthcare when and where it is required.

Moreover, several other technologies such as artificial organs, smart inhalers that can better manage the condition of asthma patients, wireless brain sensors that can be positioned in the brain and dissolve when they are not required, precision medicine that allows physicians to select medicines and therapies for the treatment of diseases based on the genetic make-up of an individual have been developed to make the life of the patient more comfortable.

Innovation in medical technology improves the quality of life of people and brings the benefits of treatment to persons whose conditions may previously have been challenging or even impossible to treat. Such innovations are not only improving products but also improving availability and accessibility to healthcare and making healthcare systems more efficient and more sustainable. Innovations in technologies in the areas such as surgical procedures, disease prevention, improved information access, and medical telecommunications, continue to benefit the patients and the entire medical industry.

The increase in global life expectancy and the ageing of populations make a very demanding opportunity for innovation in medical technology. The transformative power of technology cannot be absent from medicine. Medical professionals should work with advanced medical technologies for the well-being of all living beings. Technology and medicine should go hand in hand for many years, as they have continued in the past.

Prof. Ruwan Gopura
Immediate past chair, IEEE Sri Lanka Section,
Head, Department of Medical Technology,
Faculty of Medicine,
University of Moratuwa

Awards in SLSYWC'20

IEEE Sri Lanka Technological Campus Student Branch

IEEE SLSYW Congress, the flagship event of the IEEE Sri Lanka Section promotes fostering technological innovation while providing opportunities for the undergraduates of the country, to network, and brainstorm. Our IEEE Student Branch of Sri Lanka Technological campus was nominated for two awards in congress and won the "Best Student Chapter Activity Award for Green Innovation Sri Lanka 2020" and "Membership Retention Award" in the SLSYW Congress.

The award of Best Student Branch activity Award has emphasized the importance of initiatives that have uniqueness, quality and productivity, in order to inspire other Student Branches to organize similar distinctive initiatives. In addition, the 'Membership Retention Award' was presented, under the domain of the IEEE Sri Lanka Section to recognize the Student Branches which contribute most towards enhancing IEEE Sri Lanka Section's membership recruitment performance and retention. It was a great achievement for our IEEE student branch, as we were able to receive two prestigious awards out of a total five awards in the IEEE SLSYW Congress which was held on 17th of January 2021.

SHECODERess BACK ON STAGE!

by IEEE Uva Wellassa University Student Branch

SHECODERess <V4.0>, Sri Lanka's most prominent and most anticipated girls only hackathon, took place successfully on 30/04/2021 and 01/05/2021.

SHECODERess is currently the most famous algorithm hackathon competition organized exclusively for female student coders in Sri Lanka. The Women In Engineering Affinity Group of IEEE Uva Wellassa University Student Branch initiated this competition in 2017 with the aim of encouraging women in the IT field to reach greater heights by coding more. All these years, the competition had been a super hit among female undergraduates all government and private universities and IEEE student branches across Sri Lanka. The preeminent potential SHECODERess possessed was able to grab attention of leading IT companies and franchises, thus paving way for more enthusiastic sponsors to come hand-in-hand with the WIE Affinity Group of IEEE UWU SB.

Due to the sustained pandemic situation worldwide, this year, for the 1st time in SHECODERess history, the fourth episode of the hackathon took place entirely online. Organized by the Women in Engineering (WIE) affinity group of the Institute of Electrical and Electronics Engineers (IEEE) UWU Student Branch hand in hand with the IEEE UWU Student Branch, for the fourth time, this event was highly anticipated by many female undergraduates. About 180 participants representing well reputed universities island wide took part in this cutthroat competition, battling in 60 teams for the esteemed winner title. The hackathon, which lasted 12 hours straight, challenged the contesting teams to hone their analytical and logical abilities via coding to solve real life conundrums. Female coders had the opportunity to work together, learn, compete, request songs and most importantly, cherish their cognitive abilities during this hackathon.

At the end of the exciting neck-and-neck competition, Team LadyGhostCoders of Uva Wellassa University emerged as winners, while Team Invalid and Team Xception, both from University of Colombo School of Computing became first and second runners up respectively. All three winning teams secured monetary prizes. SHECODERess V4.0 was sponsored by ISMAPACK (Platinum), London Stock Exchange (Gold), ICTA(National Partner), and Ascentic (Knowledge Partner).

Climate Crisis and Clean Energy

by Ms Anjali Piyumali

The greatest natural environmental concern confronting the globe now is the climate crisis, which essentially refers to environmental changes and their implications. The sun, wind, earth, rain, snow, air, oceans, deserts, and forests are all natural components that have a direct impact on the ecological climate. Although natural elements have helped the earth maintain its equilibrium and existence, it is now on the verge of crumbling owing to the impact of human actions. Climate change is affecting everyone on the planet, including humans, animals, and environment. All of today's natural calamities, such as desertification, wildfires, landslides, hurricanes, tsunamis, floods, droughts, and glacier erosion, are caused by climate change. Nature is being destroyed as a result of human industrialization, which began with the industrial revolution and continues to this day. Global warming is the primary cause of the climate problem. The term "global warming" simply refers to an increase in the average temperature of the earth's atmosphere over time. The greenhouse effect is the ability of gases in the earth's atmosphere to maintain the temperature of the atmosphere while allowing the sun's energy to escape. The greenhouse effect is a phenomenon that aids in maintaining an appropriate temperature in the atmosphere. Greenhouse gases such as carbon dioxide, methane, nitrous oxide, and fluorinated gases are used in this procedure.

The greenhouse effect is a vital phenomenon for the survival of life on Earth, and it serves a variety of roles for the planet. This greenhouse gas contributes to the Earth's surface maintaining a steady temperature. Make the earth warmer and more habitable by preventing it from freezing. They also act as a shield against dangerous radiation. When the sun's destructive rays strike the earth directly, they can cause harm to life on the planet. However, these gases form a protective ring around the globe, shielding us from the damaging rays. Despite the fact that it is necessary for life to survive. Global warming as a result of growing greenhouse gas levels is the most pressing issue today. . As greenhouse gas levels grow, the atmosphere heats and the world warms by keeping more heat than is required. As a result, there are numerous negative outcomes. Because nature is built to function as a single system, any alteration in one part has an impact on the others. Extreme heat can trigger forest fires, wildfires, and the extinction of the earth's biodiversity. Deforestation depletes the oxygen essential for creatures' respiration and disturbs plants' natural food production. It also results in deserts. It also has a negative impact on the earth's natural water cycle. Oceans cover a large portion of the globe. As a result of the severe heat, more water evaporates from these oceans, resulting in heavier condensation clouds. Hurricanes and flooding can occur as a result of these clouds, as well as significant rainfall. On the other hand, the extreme heat melts glaciers and Snow Mountains, raising the sea level. Low-lying islands are being submerged as a result. Human actions are to blame for all of the aforementioned negative climatic changes. Human activities that contribute to the increase of greenhouse gases include the burning of fossil fuels for electricity, heat, transportation, deforestation, and irregular farming. Even seasonal rhythms have shifted as a result of the climate catastrophe.

Many environmental organizations are now attempting to resolve the current climate issue. The usage of clean energy sources is the main focus. Renewable energy is another term for clean energy. “Endless energy of use” is the definition of clean energy. These energy sources are natural resources. Wind energy, solar energy, hydro energy, tidal energy, geothermal energy, and biomass energy are currently the most common forms of clean energy. There are no harmful emissions from these energy sources.

Wind energy, often known as wind power, is utilized to generate electricity through the utilization of mechanical power generated by wind turbines. The conversion of the sun's energy into thermal or electrical energy is known as solar energy. The sun is arguably the most abundant and environmentally benign renewable energy source now available, and solar energy is the most ecologically friendly and abundant renewable energy source now available. Solar energy is becoming increasingly popular. Solar-powered machines, including automobiles, have been developed. One of the most financially viable renewable energy sources is hydropower. By creating a dam or barrier, a big reservoir can be used to create a regulated flow of water that will drive a turbine and generate electricity. Tidal energy is a type of hydropower that generates electricity by using tidal waves to turn a turbine twice a day. The natural heat underneath the earth's surface is known as geothermal energy. This energy is utilized to create power and heat homes.

The energy obtained from the conversion of plant fuels into electricity is known as biomass energy. Today, this type of sustainable energy is cleaner, more efficient, and less expensive.

These sustainable energy sources contribute significantly to the reduction of global warming. Many countries are becoming accustomed to using this energy as a means of avoiding catastrophic climate change. . I believe that using natural alternative, clean energy sources is the best answer to the problem of fossil fuel burning. All of the clean energy sources listed above are readily available. On a modest scale, we can use them for household consumption. No single person can be held responsible for the current climate problem. To a lesser level, all of the world's benefactors are complicit in that crime. Finally, everyone must do all possible to keep the planet a safer place while avoiding future environmental changes. That is something that all of us in the world need to immediately.

Anjali Somasiri
Uva Wellassa University of SriLanka

LAUNCHPAD

by IEEE Sri Lanka Institute of Information Technology Student Branch

"LaunchPad" organized by the WIE Affinity group of IEEE Student Branch of SLIIT was an impressive event on Arduino which was held for 3 consecutive days (26th – 28th January 2021) in order to provide a full course experience to the participants. "LaunchPad" won the best idea at the pitching competition organized by WIE Sri Lanka section at the IEEE SLSYWC 2019 which was the inspiration for this webinar series.

As the Arduino is a basic building block which can be used to easily build hardware and software, it is the perfect electronic platform for beginners. The event was held on a virtual platform along with lab based practical sessions using "Tinkercad" classroom activities for each and every participant. As from outset, the series piqued students' curiosity because those who participated to the whole series continuously by doing all the classroom activities accurately were awarded with an Arduino completion certificate at the end. It built the students' confidence and motivated them to engage in many more such projects in the future.

Some of the goals of LaunchPad were,

- To guide the beginners into Arduino programming.
- To help the participants to learn and over come the fear in coding.
- To Spark the interests into embedded programming.
- To support the participants to achieve academic excellence in projects.

Launchpad was an Island wide Webinar series followed by a competition. Therefore, the webinar announcing process was quite a challenge for the Publicity team. As a result, LaunchPad was brought to the concern of the targeted crowd with some attractive as well as interesting series of introducing posts which contained various facts about Arduino. We shared the posts via social media, and we could gather about 170+ registrants by the first day of the series. As we always tried to share a little curiosity among the audience, we got lot of requests as well.

The three days of the Webinar series were conducted by three guest speakers who had a vast knowledge on Arduino. Day 1 was conducted by Mr. Anjana De Silva, an instructor for the Department of Electronic and Electrical Engineering at the Sri Lanka Institute of Information Technology. He completed his BSc. (Hons) in Electrical and Electronic Engineering in 2020 from SLIIT and is currently following his MSc. In Electronic Automation from the University of Moratuwa. With the experience and the knowledge of Mr. De Silva, the audience got a clear introduction to the digital computer world together with a better understanding and also the first step to Arduino was also given to the participants. At the end of the session many curious participants got the opportunity to clarify their doubts with Mr. De Silva. The participants were glad about this opportunity they got the very first day.

The Day 2 was conducted by Mr. Rajitha De Silva an assistant lecturer at the Department of Computer Systems Engineering at the Sri Lanka Institute of Information Technology. He completed his BSc. (Hons) in Electronic and Electrical Engineering from the University of SLIIT in 2018 with First Class Honors.

LAUNCHPAD

by IEEE Sri Lanka Institute of Information Technology Student Branch

He specializes in teaching subjects related to the Electronic Engineering and Robotics Domains. Therefore, Mr. Rajitha nourished the audience of Day 2 with the importance of simulations, "Tinker-Cad", How to use sensors and also the difference between sensors and actuators. At the end of the day 2 a Kahoot session was held which is an interactive, fun filled online platform that can be used to answer a question series more likely an interesting quiz. This also took a considerable attention of the audience who actively participated in the quiz. The winners of the quiz were rewarded with monetary prizes.

LaunchPad Day 3 was conducted by Mr. Praveen Kehelella a Research Assistant at the Computer Systems Engineering Department of Sri Lanka Institute of Information Technology. He has completed BSc. (Hons) in Electronics and Electrical Engineering and is currently pursuing his MPhil in Robotics and Intelligent Systems. Logic levels in Arduino, Arduino programming, ADC and PWM applications and Arduino libraries were the content covered by Mr. Praveen at the final day of the webinar series. Finally, during the Q and A session all the participants could clear their doubts about Arduino before concluding the webinar series.

The feedback obtained from the audience was really favorable and according to the participants the webinar series was so interesting and useful. Furthermore, there were nearly equal number of participants for all the 3 days including 4th year researchers of several universities as well. The workshop consisted of learning materials, explaining sessions, practical sessions with lab class activities, and Q&A sessions so that the foundation for the competition was also given during the webinar.

At the end of the workshop series, participants were able apply for the competition as teams of 3 members or individually and come up with an Arduino project of their own. The projects at the competition were evaluated by a qualified panel of judges. Prizes worth 10,000 LKR were awarded to the winners. The teams were advised to submit a simulation as well as a technical report about their project on a given deadline. Finally, upon 18 teams which contained both individual and team-wise only 3 teams were selected. According to a marking criteria, the best 3 projects were selected. LaunchPad 2021 competition was concluded by announcing the results as follows, Winner of the competition Ravinath Gunawardhana, Runner up team Randeepa lakshan, Gihan Jayamanna, Ashan Maduwantha and the 2nd Runner up was Thiwanka Cholitha all the three teams were from Sri Lanka Institute of Information Technology. With the announcement of the winners of the competition LaunchPad 2021 was concluded successfully, with many requests as to continue the workshop annually.

International Research Conference on Smart Computing and Systems Engineering (SCSE) – 2021

International Research Conference on Smart Computing and Systems Engineering (SCSE) - 2021, organized by the Department of Industrial Management, Faculty of Science, University of Kelaniya will be held on the 16th of September 2021, on a virtual format.

The conference which was launched three years ago, has during a short period of time gained wide recognition for the depth and quality of the papers being presented by both local and international participants. This is reinforced by the number of experienced academics and professionals who serve on the Programme Committee of the conference. The Programme Committee has representatives from United States of America, United Kingdom, Japan, Australia, New Zealand, Netherlands, Czech Republic, Malaysia, Saudi Arabia and Sri Lanka.

Significantly, papers published in previous SCSE conferences are SCOPUS indexed and available at the IEEE Xplore Digital Library. The conference aims to bring together learned delegates from corporates and academia, and provide a forum to discuss recent innovations and trends as well as practical challenges encountered in the industrial and service sectors in the areas of Smart Computing and Systems Engineering. The conference will be technically sponsored by SLASSCOM and Chartered Institute of Transport and Logistics (CILT). Information and Communication Technology Agency (ICTA) will be the National Partner. The Keynote Speakers will be Dr. Mats Issakson (Swinburne University, Australia) and Professor Nirmalie Wiratunga (Robert Gordon University, United Kindgom).

The conference will have two main tracks, namely “Smart Computing” and “Systems Engineering”. The broad areas under these two tracks are indicated in the website. The deadline for submission is 30th of June 2021. Please refer to the conference website at https://conf.kln.ac.lk/scse/ for further details.

Big Data Industry

by Ms Yugani Gamlath

Big data is a field that treats ways to analyze, systematically extract information from, or otherwise deal with data sets that are too large or complex to be dealt with by traditional data-processing application software. Data with many fields offer greater statistical power, while data with higher complexity may lead to a higher false discovery rate. Big data analysis challenges include capturing data, data storage, data analysis, search, sharing, transfer, visualization, querying, updating, information privacy, and data source. The analysis of big data presents challenges in sampling, and thus previously allowing for only observations and sampling. Therefore, big data often includes data with sizes that exceed the capacity of traditional software to process within an acceptable time and value.

Current usage of the term big data tends to refer to the use of predictive analytics, user behavior analytics, or certain other advanced data analytics methods that extract value from big data, and seldom to a particular size of data set. Scientists, business executives, medical practitioners, advertising and governments alike regularly meet difficulties with large data-sets in areas including Internet searches, healthcare analytics, geographic information systems, urban informatics, and business informatics. Scientists encounter limitations in e-Science work, including meteorology, genomics, biology, and environmental research. Now I discuss about main industries based on big data.

● Banking and Securities

Investment and retail banks shows that the challenges in this industry include: securities fraud early warning, tick analytics, card fraud detection, archival of audit trails, enterprise credit risk reporting, trade visibility, customer data transformation, social analytics for trading, IT operations analytics. Use Big Data to monitor financial market activity. They are currently using network analytics and natural language processors to catch illegal trading activity in the financial markets. Retail traders, Big banks, hedge funds in the financial markets use Big Data for trade analytics used in high-frequency trading, pre-trade decision-support analytics, sentiment measurement, Predictive Analytics, etc.

Communications, Media and Entertainment

Since consumers expect rich media on-demand in different formats and a variety of devices, some Big Data challenges in the communications, media, and entertainment industry include: collecting, analyzing, and utilizing consumer insights, leveraging mobile and social media content, understanding patterns of real-time, media content usage. Applications of Big Data in the Communications Industry Organizations in this industry simultaneously analyze customer data along with behavioral data to create detailed customer profiles that can be used to create content for different target audiences, recommend content on demand.

Healthcare Providers

The healthcare sector has access to huge amounts of data but has been plagued by failures in utilizing the data to curb the cost of rising healthcare and by inefficient systems that stifle faster and better healthcare benefits across the board. This is mainly because electronic data is unavailable, inadequate, or unusable. Additionally, the healthcare databases that hold health-related information have made it difficult to link data that can show patterns useful in the medical field. Some hospitals are using data collected from a cell phone app, from millions of patients, to allow doctors to use evidence-based medicine as opposed to administering several medical tests to all patients who go to the hospital. A battery of tests can be efficient, but it can also be expensive and usually ineffective.

Education

From a technical point of view, a significant challenge in the education industry is to incorporate Big Data from different sources and vendors and to utilize it on platforms that were not designed for the varying data. From a practical point of view, staff and institutions have to learn new data management and analysis tools. On the technical side, there are challenges to integrating data from different sources on different platforms and from different vendors that were not designed to work with one another. Students has deployed a Learning and Management System that tracks, among other things, when a student logs onto the system, how much time is spent on different pages in the system, as well as the overall progress of a student over time. In a different use case of the use of Big Data in education, it is also used to measure teacher's effectiveness to ensure a pleasant experience for both students and teachers. Teacher's performance can be fine-tuned and measured against student numbers, subject matter, student demographics, student aspirations, behavioural classification, and several other variables.

Insurance

Lack of personalized services, lack of personalized pricing, and the lack of targeted services to new segments and specific market segments are some of the main challenges. Big data has been used in the industry to provide customer insights for transparent and simpler products, by analyzing and predicting customer behavior through data derived from social media, GPS-enabled devices, and CCTV footage. The Big Data also allows for better customer retention from insurance companies. When it comes to claims management, predictive analytics from Big Data has been used to offer faster service since massive amounts of data can be analyzed mainly in the underwriting stage. Fraud detection has also been enhanced. Through massive data from digital channels and social media, real-time monitoring of claims throughout the claims cycle has been used to provide insights.

Transportation

In recent times, huge amounts of data from location-based social networks and high-speed data from telecoms have affected travel behavior. Regrettably, research to understand travel behavior has not progressed as quickly. In most places, transport demand models are still based on poorly understood new social media structures. Some applications of Big Data by governments, private organizations, and individuals include Governments use of Big Data traffic control, route planning, intelligent transport systems. Private-sector use of Big Data in transport revenue management, technological enhancements, logistics and for competitive advantage. Individual use of Big Data includes route planning to save on fuel and time, for travel arrangements in tourism etc.

As the conclusion I think that now all of you can understand how Big Data plays a role in these industries. Big Data is actually an effective thing for future industries as well.

Yugani Gamlath
Wayamba University of Sri Lanka

LetMeHack V2.0 - A Step Towards Greener Hackathons

by IEEE Sabaragamuwa University of Sri Lanka Student Branch

LetMeHack eco v2.0 was the first-ever eco-friendly product-oriented inter-university hackathon in Sri Lanka organized by the Society of Computer Sciences of the Sabaragamuwa University of Sri Lanka with the collaboration of the Department of Computing & Information Systems, and the IEEE Student Branch of the Sabaragamuwa University of Sri Lanka in continuation to LetMeHack v1.0 in 2018 which was the first-ever product-oriented hackathon. The primary goal of this hackathon was to build up an open-source project which can be used by everyone, to help save the green, and to make the community around us better.

This was a two-day hackathon and successfully held on the 1st and 2nd of February 2020 at Sabaragamuwa university premises. The event was a 16-hour product implementation hackathon with 20 teams which consisted of 80 undergraduates from universities all over the country.Participants were focused to implement a product according to the platform given by the organizing team and the product that was implemented would have to have a useful outcome and it was judged by a team of technological experts.

The main intention was to focus the young talented undergraduates to reach out to the new technologies and apply them in the product implementation, and to give them an uncommon experience more than a typical hackathon.

Encouraging and empowering the community to preserve and spread green was the main intention of choosing the theme eco. The focus and the objective were to spread out the word of conserving the green through this event which will be a commitment to reduce environmental pollution. Therefore, this event was with zero percent plastic and polythene use. Only eco-friendly materials were used throughout the event to encourage participants to use eco-friendly products. And there was an event to plant trees within the university premises which was a small contribution to spread green.

LetMeHack was a remarkable experience for participants more than a typical hackathon. The hackathon consisted of a social media photography competition, entertainment programs, and at the end there was a campfire with music, food, and dancing for the amusement of participants.

LetMeHack V2.0 - A Step Towards Greener Hackathons

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The 1st place of the hackathon was secured by the team Brogrammers, from the University of Moratuwa. The 2nd Place was awarded to Team WiMAx from the University of Moratuwa. And the 3rd place was claimed by Team </green> from Vavuniya Campus of the University of Jaffna. They were awarded cash prizes, certificates, and souvenirs. And all the other participants also got certificates and souvenirs for their commitment.

Omobio (Pvt) Ltd the Gold Sponsor, Silver Sponsor CodeGen (Pvt) Ltd, Bronze Sponsor Live-Room (Pvt) Ltd, the official mentoring partners 99X Technology, Arimac, and Sysco LABS Sri Lanka, and also Mozilla Sri Lanka, Elephant House Cream Soda, Bhasha and FOSS Sri Lanka gave their hands to make this dream a reality.

LetMeHack marked its success with IEEE SLYWC'20- The Best Industry Collaborative Project Award, IEEE Darrel Chong Student Activity Award 2020-Bronze Winners, and IEEE Boost 2020-The Best Student Branch Activity award.

As the IEEE Student Branch of the Sabaragamuwa University of Sri Lanka, we're eagerly looking forward to the initiation of the next chapter of LetMeHack with more unique experiences than ever.

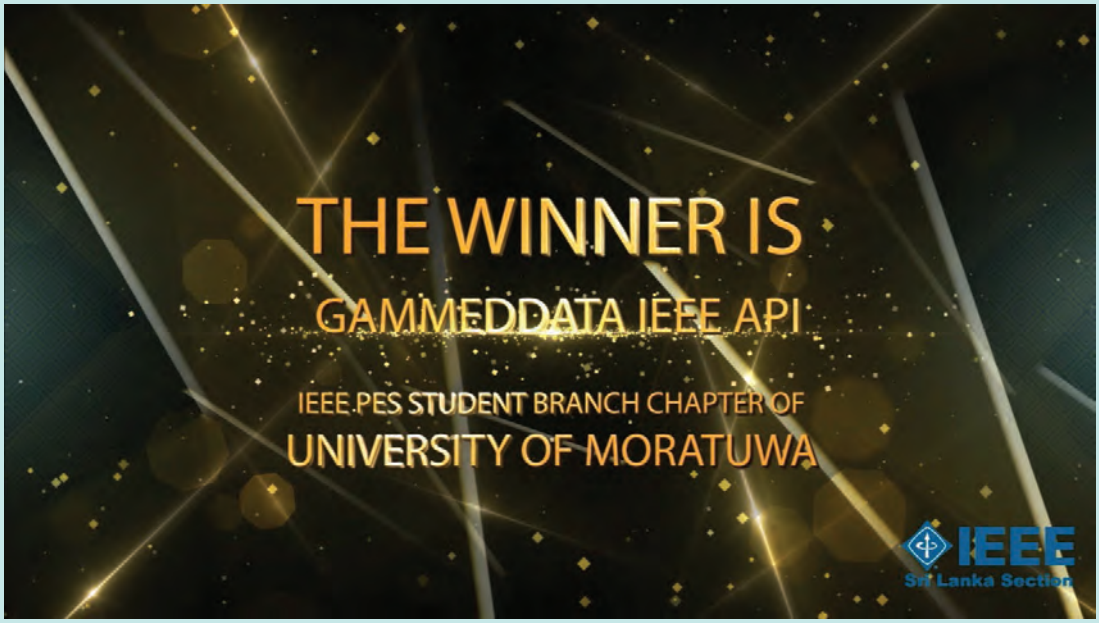
Best Technical Chapter Activity Award – 2020

IEEE University of Moratuwa Student Branch

IEEE PES Student Branch Chapter of University of Moratuwa has been awarded the "**Best Technical Chapter Activity Award"** at the IEEE Sri Lanka Section Awards Night 2020 for the project **"Gammaddata IEEE Api"**.

The project "Gammaddata IEEE Api" is a collaborative initiative of the IEEE PES, IAS and RAS Student Branch Chapters of University of Moratuwa joining hands with the IEEE Student Branch of University of Moratuwa. The project was organized with the intention of motivating and lending a helping hand to the enthusiastic school children from rural areas of the country by addressing their areas of interest in the field of technology so that they can pursue their dreams and bring the maximum out of their potential.

Over 70 school children of Anuradhapura Central College from Grade 7 to 12, had the opportunity to enhance their knowledge through the introduction to Robotics, Arduino Programming, and Introduction to Sensors & Actuators.



Towards Futuristic Exoskeletons:
Unexploited Potential of Biomechanical Energy

by Dr. R.K.P.S. Ranaweera

Exoskeleton systems are conceived as wearable devices that can be closely fitted to the human body, and work in concert with operators' movements. The notion is to combine human intelligence with machine power to provide support, control and strength to the upper and/or lower limbs or other parts of the body of the wearer. In this context, lower-limb exoskeletons (LLE) are composed of mechanisms to emulate natural movements of the lower limbs using mechanical and/or electromechanical systems. In general, LLE finds uses in assistive and augmentative application domains. Both mobile and stationary classes of commercial-level LLE robots are used in the medical industry for motion-assistance of physiologically and/or neurologically affected individuals. Figure 1 shows some examples of commercially available LLEs for paraplegic patients.

However, the research findings show that wearer's performance with most externally powered (or active) locomotion assistive devices requires major improvements. Most of the active devices struggle to reduce human effort or reduce the energetic cost-of-transportation due to non-compliant mechanisms and limitations of the complimenting technologies. This necessitates not only the development of efficient electro-mechanical actuators and control systems but also novel powering methods. Recent research studies show that passive-dynamic powering systems are effective at metabolic cost reduction and reducing muscle activity during locomotion. The body-powered (passive) exoskeletons found in the literature were energetically autonomous and soft/lightweight transmissions provided better ergonomic conformity. The heart of the system is the power harnessing and releasing mechanism that uses ingenious approaches to capture actively generated and/or passively accumulated energies in the human body.

Essentially such systems are tuned to follow human limbs, and required joint power is supplemented by releasing the stored mechanical energy through artificial muscles working in parallel.

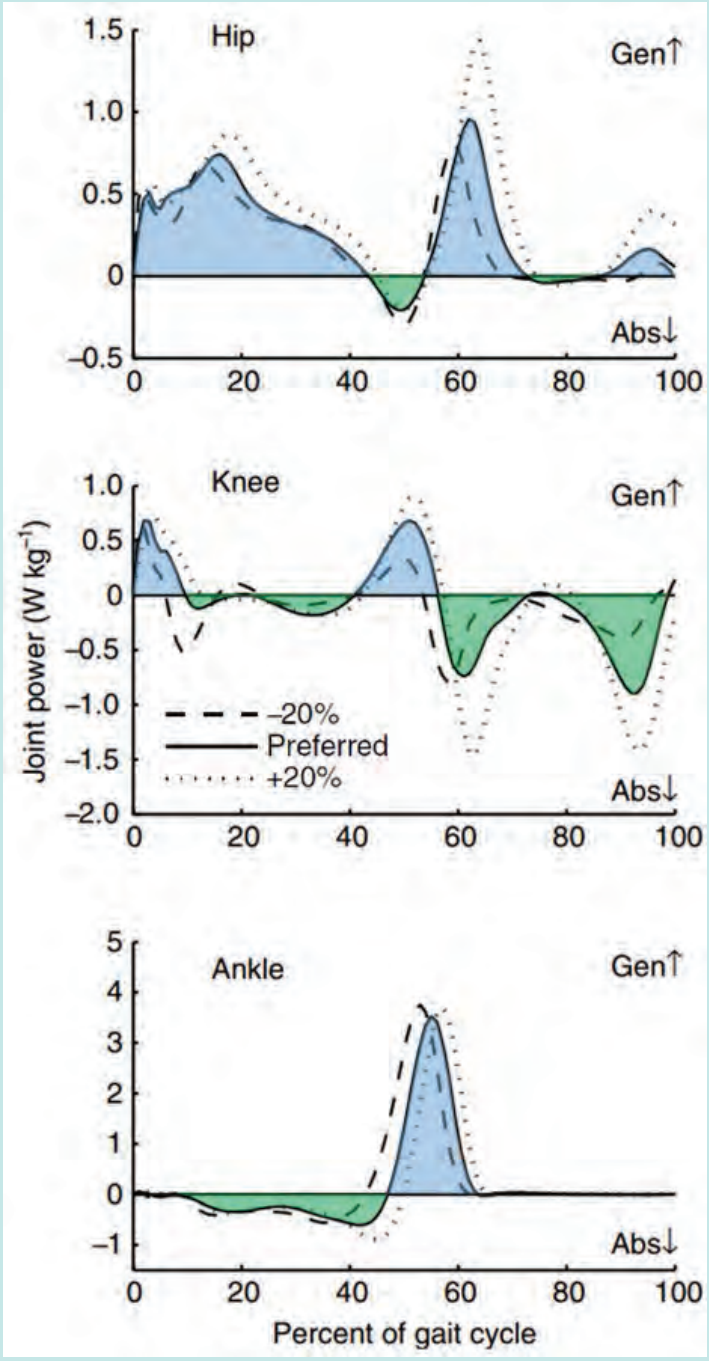


Figure 2. Absorption and generation of energies during negative and positive phases of the walking-gait cycle. (Adapted from B. R. Umberger and P. E. Martin, "Mechanical power and efficiency of level walking with different stride rates," J. Exp. Biol., vol. 210, no. 18, pp. 3255–3265, Sep. 2007)

Figure 2 shows the mean net joint powers over the sagittal plane for the hip, knee and ankle while walking with stride rates above (+20%), below (−20%), and at the preferred rate of 1.3 m/s. The areas under the curve represented by the green and blue colour codes denotes the magnitude of energy either generated or absorbed at each of the joints during locomotion. In other words, the limb muscles are not only responsible for creation but also for dissipation of the biomechanical energy. The end result is the controlled movement of the human body. The proposed techniques in the literature involve harvesting or scavenging human power from the negative (absorption) phase of the walking-gait cycle, followed by storing and then releasing energy during the positive (generation) phase.

The notable issue revealed from this analysis is the unavailability of sufficient amounts of passive-energy (i.e., area coloured in green) at a selected joint to recycle. Note that the passive energies available at the ankle and knee joints are notably higher in comparison to the hip joint. On the other hand, energy can be harvested using the inertia of human body while being unloaded on the ground. Energy can be even extracted from active work performed by joints. The notion is to generate the active energy using underutilized muscles and transfer it to the joints with overburdened muscles. The extracted energy can be amalgamated, and stored for subsequent use, or directly infused in real-time to power selected joint(s) in the lower limb.

The situation necessitates the study of alternative approaches to capture biomechanical energies from different sources during all possible cyclic events in the human gait. However, performance and endurance augmentation through artificial management of harvested biomechanical energy remains an open challenge, suggesting the urgent need for investigation of its unexploited potential.

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Figure 1. Commercially available lower extremity exoskeletons for locomotion assistance and/or rehabilitation of paraplegic patients

RE-AWAKE Webinar

by IEEE University of Ruhuna Student Branch

Re-Awake was a beneficial webinar organized by IEEE Industry Applications Society, University of Ruhuna for people who are significantly eager to start their careers and get the maximum out of their potential. This webinar was focusing not only the final year students whom are to jump in to the industry but also the first years or the freshers who has just begun the journey. This was held successfully on **9th May 2021 through zoom platform** with a participation of **more than 120 participants.** Theme of the webinar was **Upskilling the career from an undergraduate to a well-recognized professional.** In order to discuss this timely topic as the undergraduates are downgraded with the motivation thought of bringing well experienced speakers for the webinar. The keynote speakers of the Re-Awake webinar were among the proud products of mother Ruhuna whom are well-established and long driven personalities with vast experience in the academics and industry and have succeeded their career lives.

The first keynote speaker was Dr.Najath Akram who has graduated from Faculty of Engineering University of Ruhuna. He is currently serving as an FPGA Design Engineer at Jabil in New Jersey. And also, he has done a Doctor of Philosophy (Ph.D.) in Electrical and Computer Engineering in Florida International University. And some of his key areas as selecting a panelist for this webinar were as follows.

- ★ Institute of Engineering and Technology (IET) Global Challenge 2015 First runners up (London, UK) among teams consisted of members from 150 countries for the innova tive design of intelligent laptop cooler (i- Cooler).
- ★ Authored and co-authored articles in Multi dimensional Signal Processing and Hardware Complexity Reduction Schemes for 5G and beyond.
- ★ IET Global Challenge 2017 Placed in top ten (London, UK) Among teams consisted of members from 150 countries for the innovative design of vehicle load detector.
- ★ MathWorks Intern Hackathon (Fall 2019) Winner with two awards, (Natick, MA)

These were few of his career achievements and accomplishments. And with all his experience of his career and academic life he addressed the audience and most of the participants were motivated and inspired (with respect to the feedbacks). He showed how to build up the career and even find the opportunities that suits best for a person with the experiences he has gained by working in overseas.

RE-AWAKE Webinar

by IEEE University of Ruhuna Student Branch

The second keynote speaker was Eng.Ms Zahra Marzook whom also a graduate from the Faculty of Engineering, University of Ruhuna. She currently works as an Electrical Engineer (Substation Construction & Maintenance)-Projects and Heavy Maintenance Branch, Distribution Division 1 of CEB. This woman Icon was one of the inspirational and motivational character among the alumni members of the Engineering faculty and even became an icon to the entire community by winning the IET Young Woman Engineer Award, Sri Lanka in 2019.And the reason for selecting her as a panelist,

- Assistant Secretary - YMS, IESL, Assistant Treasurer - Women Engineers Forum, IESL.
- Member of Toastmasters International, IET, and Women Engineering.
- Master of Business Administration - Open University of Sri Lanka

Her accent of speaking could attract the audience throughout the session. And also, being an iconic woman character and also a well experienced personality in the industry could deliver the key areas that needed to be fulfilled to upskill to a well-recognized professional.

The ultimate conclusion of the webinar is that the message that is intended to be delivered by the Industry Applications Society could be successfully achieved. And also, the mission of foster the enthusiasm of upskilling the career of the undergraduates.

LEO – IEEE Sinhalen DOCS Grand Finale

by IEEE Sri Lanka Technological Campus Student Branch

'LEO - IEEE Sinhalen DOCS' was a six months' Mega-project which is organized by the IEEE Student Branch of Sri Lanka Technological Campus (SLTC) and the LEO Club of Sri Lanka Technological Campus (SLTC), with the aim of providing solutions to the notable and substantial issues in the country by using the potential reach of the two voluntarily involved organizations which are IEEE Student Branch and LEO Club Sri Lanka. The motive of this wide scope endeavor was to empower the Sri Lankan nation, especially the young generation by directing their attention towards the emerging and most useful technological and economic trends in today's world. The brand name of "LEO – IEEE Sinhalen DOCS" was consisted of three major initiatives namely as "Watch & Learn", "Track & Reboot" and "Move & Xplore". The project started with the concept of "Move & Xplore" with an induction ceremony. Its main motive was to empower ambitious youth of the country by paving the path to their dreams with aid of workshops of Fiverr, Startup and YouTube content creation. Its sub initiative "Watch & Learn" aimed on educating Sri Lankan community on all there is to know on four sub groups of Microsoft Office Suite. The project was far ending its commitment towards the people, for its second exertion "Track & Reboot" has decided to donate a Laptop and dongle for a well – deserved person by physical surveys.

However, then as the conclusive remarks of this remarkable project, a finishing weekend along with a closing ceremony was conducted on 21st of March 2021 at Leo Youth Center, Colombo 07. There, Leo Praminda Vindika (District President - Leo District 306 A2), Mr. Mithushan Jalangan (Webmaster- IEEE Young Professionals, Asia Pacific Region), Leo Raseema Sugandhi (District Secretary - Leo District 306 A2), Ms. Maheshika Madubhashini (Co - Chair-person - IEEE Techno Meetup Sri Lanka), Mr. Vidura Dhananjaya (Chairman - IEEE Innovation Nation Sri Lanka) were participated as guests.

As LEO – IEEE Sinhalen DOCS was mainly consisted with three categories, the project hosted a video series on You Tube in order to educate the people about Microsoft Office Package and as a result of that, it was able to conduct an examination to award a scholarship of Rs. 10,000 to the winner. So the Scholarship was given to the winner by Mr. Mithushan Jalangan at the closing ceremony. Also under the "Track & Reboot" category, we hold surveys to find a person with the requirement of a Laptop. So the donation was taken place to the relevant party at the closing ceremony by Leo Praminda Vindika.

LEO – IEEE Sinhalen DOCS Grand Finale

by IEEE Sri Lanka Technological Campus Student Branch

Further, the Organizing Committee of the project was also awarded with certificate for their immense contribution towards the success of the project. The Mobile Application of LEO –IEEE Sinhalen DOCS was also launched in that gracious occasion by the Chairman of the IEEE Student Branch of SLTC, Thimeth Perera and the President of Leo Club of SLTC, Leo Nisal Samarasinghe. Due to this prevailing situation on Covid - 19 pandemic around the country, we were unable to conduct the closing ceremony with more than 50 people.But we could celebrate the success of the project "LEO –IEEE Sinhalen DOCS" at that moment in immense pleasure. It is without a doubt that for the entire duration of this project, a great impact has been felt by the Sri Lankan citizens. The" LEO – IEEE Sinhalen DOCS" was not merely a mega project by its name, it was a mega project by its actions, its undying dedication and by its humanitarian nature.

Chose the Right Fuel for Your Car?

by Dr. Saliya Jayasekara

You can always use the lowest octane fuel that allows you to ride without the engine detonation, and fueling your car with right Octane may reduce your traveling cost. However, many new passenger vehicles, including three-wheelers and motorcycles are fueled by octane 95 gasoline when octane 92 gasoline (petrol) is available at a lower price.

Otto engines known as spark ignition internal combustion engines or simply the petrol engines can burn most of the hydrocarbon fuels (including hydrogen and ethanol) that can mix with air by evaporation (low boiling point). But the combustion characteristics of different hydrocarbons are not the same when burned inside an engine. If an Otto engine is designed for a particular fuel, it would not perform similarly with a fuel that has a different chemical composition.

In a well-tuned Otto engine run on gasoline for which the engine is designed, the combustion of the gasoline / air mixture will continue smoothly from the spark plug to the piston head by igniting successive layers of the mixture as shown in Figure 1 (a).

If low grade gasolines are used, the combustion of some of the air/ fuel mixture in the cylinder does not result from propagation of the flame front initiated by the spark plug, but one or more pockets of air/fuel mixture explode (Detonate) outside the envelope of the normal combustion front as shown in Figure 1 (b). This detonation can cause severe damage to the piston and the head of the engine while deteriorating thermal performance of the engine (low efficiency) .

Gasoline is a petroleum-derived product comprising a mixture of different hydrocarbons ranging from 4 to 12 carbon atoms in a carbon chain with the boiling point ranging of 30 - 225°C. It is predominantly a mixture of paraffins, naphthenes, aromatics and olefins. Additives and blending agents are added to improve the performance and stability of gasoline. The engine designers learned that straight-chain paraffin have a much higher tendency to detonate than do branched-chain paraffin.

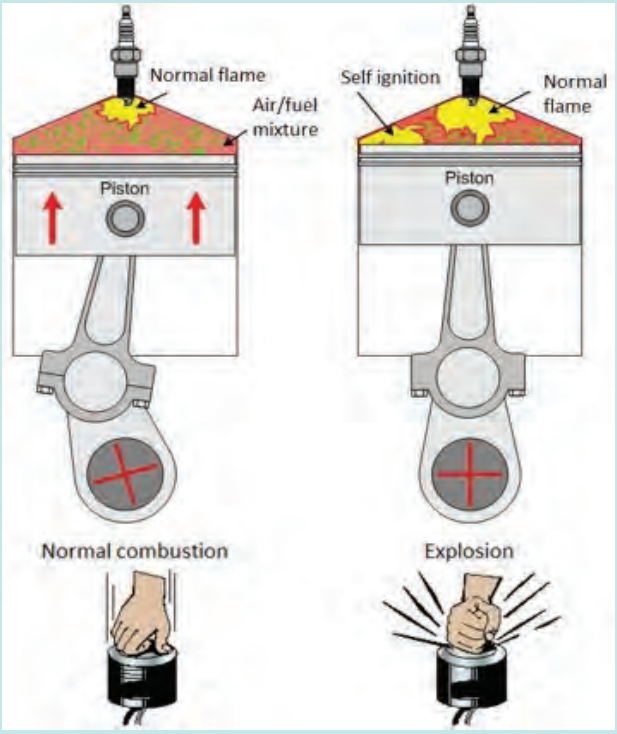

Figure 1: Combustion characteristics of fuel/air mixture under compression: (a) Normal combustion, (b) explosion/detonation

The tendency of a particular gasoline to detonate is expressed by its octane number (ON). Arbitrarily, tri-methyl-pentane, C8H18 (iso-octane) is assigned an ON of 100, while the straight-chain paraffin n-heptane, C7H16 is given an ON of zero. Hence, a fuel sample with the same anti-detonation quality as that of a mixture containing 90% iso-octane and 10% n-heptane is said to have an ON of 90. Gasoline is made up of a mixture of mostly branched-chain paraffin with suitable additives to give an ON in the range 90 –100. It was also learned through experiments that the ON of a gasoline blends (e.g. gasoline and ethanol) can be calculated by using weighted average ON of each component of the compound. Most importantly, the octane number has nothing to do with the heating value (Calorific value) or the purity of the fuel.

Engine thermodynamics show that engines with a high compression ratio offer higher thermal performance than engines with a low compression ratio. These engines having high compression ratio require high octane gasoline (for example octane 95) to avoid detonation.

However, using gasoline having higher octane ratings for the engines designed for a low octane rating (for example, 92 octane) would not provide an additional benefit or loss, other than increased fuel cost.

Therefore, it is important to know the designed octane number of the engine before fueling (refer owner's manual of the vehicle). For example: the minimum ON requirement for two and three wheelers in south Asia is 87 (The World Bank). Most of the Toyota, Honda and Nissan models including hybrid engines recommend 92 octane gasoline.

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IEEE Innovation Nation Sri Lanka 2020

Continuing its glorious streak for the 3rd time last year the IEEE Innovation Nation Sri Lanka commenced in May 2020. All the IEEE INSL events conducted throughout the year were held online due to the ongoing pandemic the world is facing.

Following up to the IEEE INSL Pre-Accelerator main competition, 2 events were conducted to inspire and encourage the young undergraduates. The Hustle Story was held online via Zoom on the 21st of July 2020 where Mr. Aloka Gunasekara, Program Manager, StartupX Foundry Mr. Hirishegan Karuneswaran, Business Partner, Cuckoo Eats and Mr. Pavithra Perera, Co-Founder Bear Appeal graced the event by sharing their success stories as entrepreneurs of homegrown startups and their stepping stones into success.Learn How to Pitch Workshop was organized to enlighten Sri Lankan undergraduates on how to pitch and it was conducted on the 29th of August 2020 online via Zoom. Mr. Mohammed Mafaz, Co-Founder and Chief StoryTeller, Show and Tell was the speaker for the event where 43 participants were present in the Zoom session.

Applications were called for teams to submit proposals outlining their idea and their execution plan. Following the submission of proposals, 17 teams were chosen out of 75 teams who submitted their product ideas. Thereafter, those teams underwent a training program to hone their skills until the finals. The training comprised two main components. The program helped them reshape their initial proposal and come up with a comprehensive business idea addressing all relevant aspects.

At the end of the training, the selected contestants will graduate as “IEEE Innovation Nation Fellows”. A digital badge usable in their profiles (eg.-: LinkedIn), a transcript and a certificate will be issued to the selected contestants. Mentoring sessions were conducted between the initial evaluation process and semi-final evaluation process. The mentors were, Mr. Isuru Abeywardana, Software Engineer, Hmlet Singapore, Mr. Mohammed Mafaz, Co-Founder and Chief StoryTeller, Show and Tell, Mr. Aloka Gunasekara, Program Manager, StartupX Foundry and Mr. Charith Wickramasinghe, Senior Software Engineer, 99X.

After the semi-final evaluation, 5 teams were selected for the IEEE INSL Grand Finale which was held on the 27th December 2020 via Zoom where 92 participants were present. An esteemed judge panel which included both local and international judges evaluated the 5 teams to select the winners and they were Dr. Eddie Čustović, Director, La Trobe Innovation and Entrepreneurship Foundry, Mr. Pasindu De Silva, Biz Lead, IdeaMart, Mr. Ned Lomigora, CEO apeann Tech and Mr. Harsha Dinendra, Head of Advisory-Software Solutions and Services, John Keells IT. The winners of IEEE INSL 2020 were Winners - HYDROS, 1st Runner-up - Dr. X and 2nd Runner-up – Pluton. The first three places will receive special prizes while the top 4 to 10 teams will receive consolation prizes. The prize pool includes USD 5,000.

Mathematics Webinar Series for Students in SOS Children's Village 2020

by IEEE University of Ruhuna Student Branch

WHAT IS SOS?

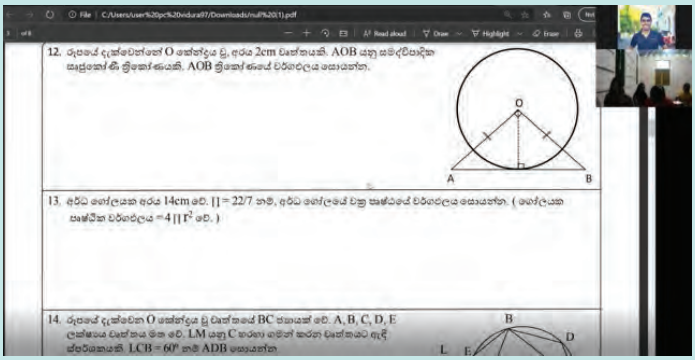
SOS is a non-government and non-denominational organization focused on supporting children without parental care and families at risk. They have been working to ensure that children grow up in a loving family environment and have their rights fulfilled. The SOS village situated in Galle is the third village in Sri Lanka. Today, 103 children are living in SOS families in Galle.

MATHEMATICS SEMINAR SERIES

Mathematics seminar series for students in SOS children's village is one of the major events organized by IEEE Student Branch University of Ruhuna with the collaboration of Industrial Application Society (IAS) Student Branch University of Ruhuna. The event has been conducted for three consecutive years and it has been very inspirational for the children and also for the members.

In the last two years, society members visited the SOS Children's Village every Sunday and conducted the session inside their classrooms. The aim of the sessions was to make the subject interesting and to face and earn good marks on their GCE Ordinary Level Examination. Students were very enthusiastic about the sessions as well.

They were very corporative and got cleared their doubts on the math subject. The last day was celebrated parallel to the IEEE Day in both years and a program was organized by the IEEE SB with fun games and musical events. In the end, a donation was given to the head of the children's village by the chief guest of the event on that particular event.



MATHEMATICS WEBINAR SERIES

As the country faces the continued threat of Covid-19, IEEE Student Branch of University of Ruhuna, organized the new webinar series for the students in SOS Children's Village for math subject.

The event had to be conducted via Zoom. The initial day was held on 15th of November 2020 from 2.00 pm to 5.00 pm.

All the technical requirements were supplied for students by the administration of SOS children's village. The opening day was graced by the Village Director Ms. Reheni Mawitagama. Students were also very excited about the new series of workshops as it was a new experience for them as well. IAS and IEEE members have conducted the seminar for around 3 hours. The students' feedback and also the administration had a very positive. The series is planned to conduct on every Sunday with many different activities. For the students who face GCE Ordinary Level Examination, some model paper discussion sessions are planned to conduct.

Yttria Stabilized Zirconia Ceramics:
From teeth to space

by Dr (Ms) U Sutharsini

We are starting our morning with ceramics and it dominates our day-to-day from bathroom to office. Generally known application of ceramics are cookware, window glass, cement, bricks and watches, etc. Advanced or engineering ceramics have an amazing range of applications in aerospace, biomedical implantation, automotive, and telecommunication. Ceramic materials are also used in electronics because, depending on their composition, they may be semiconducting, superconducting, ferroelectric, or an insulator. Sri Lanka is well endowed with industrial minerals such as graphite, ilmenite, rutile and zircon. Zircon is known as synthetic diamond a popular substitute for diamond around the world. Zirconia is first found from Sri Lankan beach sand (Zircon). Moreover, these zirconia ceramics show a self-healing mechanism called transformation toughening which prevent these ceramics from developing cracks and structural failures.

Zirconia has a metastable crystallographic structure shown in the Figure 1. Monoclinic structure is stable at room temperature up to 1170°C. When the zirconia is heated, monoclinic zirconia transformed into the tetragonal zirconia. This structural transformation associated with volume shrinkage 3-5% and powdery loose particles transformed into solid structure. Tetragonal structure is stable up to 2370°C. Further heating results in cubic zirconia, it is stable between 2370° to 2700°C. Zirconia crystal structure is a reversible transformation. Upon cooling, cubic zirconia transformed into tetragonal zirconia and at room temperature, back to monoclinic zirconia. Due to volume change it creates stress in the structure, resulting in severe cracking. Therefore in pure form, zirconia has very low appeal for use as engineering ceramic, due to reversible transformation. Zirconia is stabilized by some impurities such as CaO, MgO and Y2O3 to retain its metastable phase at room temperature. Yttria is most commonly used as a dopant.

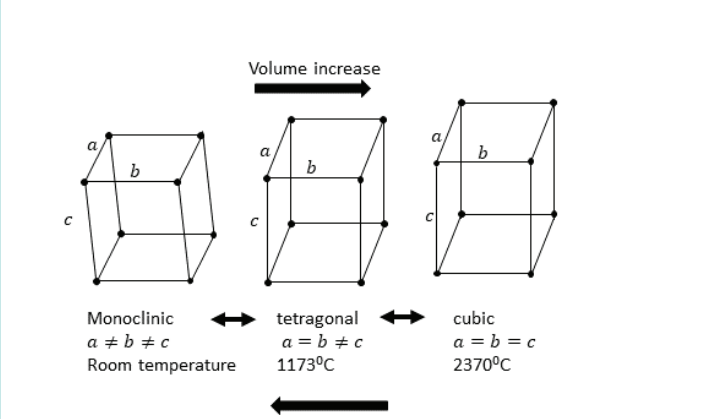


Figure 1: Pure zirconia crystal structures

Transformation toughening mechanism of tetragonal zirconia is shown in the Figure 2. Tetragonal zirconia grain distribution is shown in Figure 2 (a). Small crack may be propagated due to grinding. Growth of crack tip is shown in Figure 2 (b). Tetragonal zirconia grains near the crack tip will transfer to monoclinic zirconia under stress. Tetragonal to monoclinic transformation around the crack is shown in the Figure 2 (c). Tetragonal to monoclinic phase is associated with volume expansion. The consequent volume increase, results in a favorable compressive stress, which close the crack tip and hinders its propagation. This process known as transformation toughening and it will increase the fracture toughness and hardness of the material. This property leads to the applications in grinding media and cutting tools. Zirconia balls are used in high performance bearings, pumps, and valves, flow meters, grinding media, and measurement instruments. Mechanical properties of tetragonal zirconia are very similar to those of metals hence it is also known as ceramic steel. Zirconia is used as heating element in high temperature furnace, fuel cell membranes and oxygen sensors, due to its chemical inertness, corrosion resistance, wear resistance, high temperature resistance and thermal shock resistance. It also used as medical prosthesis due to its biocompatibility and aesthetic nature.

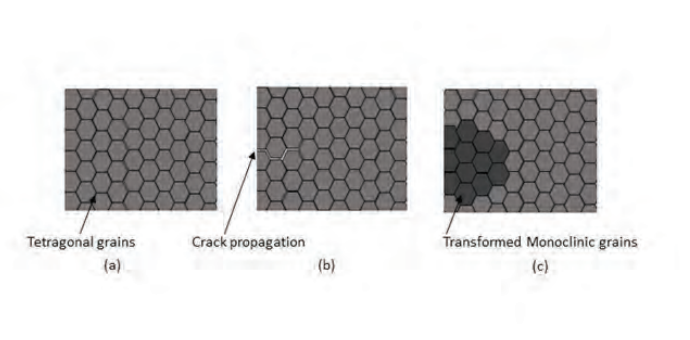


Figure 2: Transformation mechanism (a) as sintered pure tetragonal

Dental Zirconia

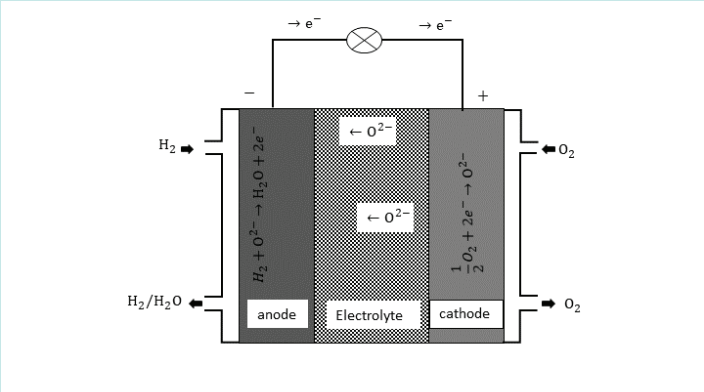
Zirconia monolithic crowns are very popular these days due to its excellent biocompatibility, strength, durability and aesthetics nature. It considered to be the strongest of the prosthetic crowns. Since it is a monolithic, minimal preparation is required. Moreover, Zirconia based dental prosthetics is entirely a metal free restoration.

Electrolyte for and Solid oxide fuel cell and Oxygen sensor

Solid oxide fuel cell is an electrochemical device that produces electrical energy by oxidizing fuel. Working principle of solid oxide fuel cell (SOFC) is also same as oxygen sensor. In the case of SOFC, hydrogen gas is used as fuel and air or oxygen as reference gas. Block diagram of SOFC is shown in the Figure 3. In this device fuel oxidize at the anode while the reduction of oxygen takes place at the cathode. Zirconia is act as electrolyte it can conduct O2- at higher temperatures (500°-1000°C). Hydrogen gas reacts catalytically with the oxygen ions, releasing electrons that are transported through an external circuit, producing electricity. Higher operating temperatures make SOFCs suitable candidates for application with heat engine energy recovery devices or combined heat and power, which increases overall fuel efficiency.

Oxygen sensors are designed to measure the quantity of oxygen in the air or in an indoor closed environment. Oxygen ion sensor is also an electrochemical device. Zirconia membrane is placed between gas permeable membranes and it heated by a heater.

When exhaust air has lower oxygen concentration than reference air, oxygen ion started to flow through higher oxygen concentration to lower oxygen concentration through the zirconia membrane. It creates a potential difference between two electrodes. Oxygen sensors does not directly sense the oxygen, but rather the difference between the exhaust gas and reference air. Zirconia oxygen sensors are most commonly used in cars to control air-fuel ratios.



Despite fulfillment of wide range of application, zirconia undergoes reversible tetragonal to monoclinic transformation at low temperature it is known as low temperature degradation (LTD) or ageing. This phase transformation associated with volume expansion, which leads to micro cracks, grain pullout and eventually leads to property degradation. This reversible transformation observed in the presence of moisture, at temperature from 65 to 500°C and most pronounced between 180-300°C. Ageing increase with increasing grain size and decreasing stabilizer concentration. In order to maintain its tetragonal phase, grain growth must be controlled. Our research group at the Department of Physics, University of Jaffna is working towards improving the hydrothermal ageing resistance of these ceramic material. So far, we found that the sintering conditions and sintering environment can slow down this ageing process. As it is one of the mineral that is abundantly available in Sri Lanka, researches on zirconia could help to value addition to the raw mineral and more foreign exchange.

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University of Jaffna

IEEE Sri Lanka Section Student/ Young Professionals/ Women in Engineering Congress (IEEE SL SYWC)

IEEE Sri Lanka Section Student/ Young Professionals/ Women in Engineering Congress is one of the momentous events in Sri Lanka which creates platform to enhance and acquire more exclusively for the IEEE and non-IEEE undergraduate students who are in the professional community with interest in IEEE, to have a blast with a lot more. In the midst of all the crises with 2021, the IEEE Sri Lanka Section is ready to present a grand event SL SYWC 2021 for young undergraduates related to the engineering fields across the country. This year's congress will be held as a physical event or a virtual event considering the situation of the country. SL SYW Congress 2021 is a unique and tremendous experience that gives opportunities to the undergraduates to get inspired.

The long journey of this congress embarked in 2012, and now it has reached the level where everyone is amazed, as well as, the section looks forward to obtaining more and more with each year. Last year's congress marked its ninth consecutive year which was conducted over 4 days, on the 9th, 10th, 16th and 17th of January 2021 via Zoom and live-streaming on Facebook.

Though the event was originally planned to be conducted as a physical event as in previous years, the Section leadership decided to hold the congress virtually considering the pandemic situation. With the whole world having to go through an unprecedented crisis in 2020, the theme selected for the Virtual SL SYW Congress 2020 was "Rebuilding with Resilience". One of the main objectives of organizing the congress was to inspire the delegates to explore new opportunities and move forward in advancing technology in a post-pandemic environment. Out of quite an enthusiastic number of initial registrations, about 400 delegates were shortlisted for the participation from numerous universities all over Sri Lanka.

SL SYWC 2020 was mainly focused on some key points such as, personal branding, IEEE awareness, moving forward with cutting edge technologies and tackling the job market during the pandemic. In addition, sessions were conducted covering those areas with the collaboration of both local and international speakers.

The IEEE SL SYW Congress 2020 featured one-of-a-kind sessions, discussions, and experiences designed to help educate and excite attendees. These sessions were presented by some of the top personalities in the respective fields. This congress included the following sessions.

- **Opening Ceremony**

The IEEE Sri Lanka Section Chairman welcomed the participants of the event, following him, Prof. Ruwan Gopura described SL SYWC as a networking, experience sharing space.

IEEE Sri Lanka Section Student/ Young Professionals/ Women in Engineering Congress (IEEE SL SYWC)

Networking sessions

Last year's congress was able to bring up the largest number of IEEE members and non-members to the event with the benefit of going virtual. The delegates were randomly separated into teams and given the opportunity to connect with each other. This allowed to foster a much stronger web of networks at various OU levels. Interactive mini-games such as the treasure hunts and puzzles were planned to add some fun to the event. With the team spirit and newfound connections, the delegates were enthusiastic.

Student Track

This session was conducted by IEEE Student Activities Committee Chair Mr. Peshan Sampath and IEEE Sri Lanka Section Student Representative Mr. Chamika Sudusinghe. It included a detailed presentation on student membership benefits, national projects and student activities subcommittee. Also, volunteers who reached out to high positions in the international committees were brought to the spotlight.

IEEE WIE Track

The event was executed as a group discussion with experienced personalities in the IEEE WIE Sri Lanka Section and volunteers from WIE Affinity Groups. The main goal of this session was to discover ideas from participants on the topic of "What do you expect from IEEE and WIE?"

Panel Discussion

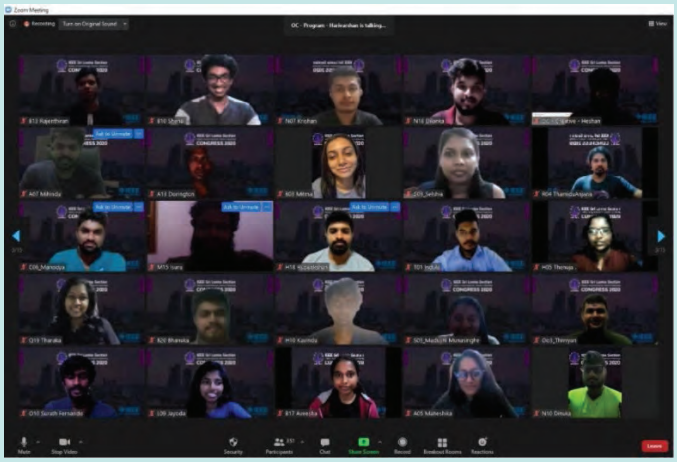
It was focused on the topic "Pandemic and the Job Market" by the experienced panellists. They discussed the current situation in the job market and the impact of the pandemic to the professionals in detail. This discussion was one of the significant segments in SL SYWC'20 with 1000+ views in the Facebook Live streaming.

IEEE Young Professionals Track

This session focused on Leadership and its values by Mr. Lasantha Wickramasinghe, the Executive Chairman at MILCO (Pvt) Ltd. He explained deeper into the topic explaining the values of Leadership and why one should protect those while moving forward as a leader. According to that, it was followed by a presentation by IEEE YP Chair, Mr. Chandana Munasinghe.

IEEE Awards Night

This awards night was followed by the closing ceremony of the congress. The student branches and affinity groups with exceptional achievements and outstanding contributions were honoured and awarded in this event. The best activity organized by each sector was chosen and acknowledged by the IEEE Sri Lanka Section.



Information Technology's Role During Covid-19 Pandemic

by Ms Gangadara Athukorala

With the beginning of the year 2020, all people got ready to begin their life with a fresh start. They thought to start new businesses, learn new things, go for more travels, start new education journeys, etc. People believe that starting new chapters in life at the beginning of the new year guides them to become successful at most of the new steps. But unfortunately, 2020 was not a good and happy beginning for anyone. We all got lockdown at homes and the whole world got stuck at the beginning with the spread of the COVID-19 pandemic.

From the beginning of 2020, still we looked in our homes and this procedure may continue further. Still, people are waiting to hear the news, "the pandemic is now controlled and people can do their daily routines as they did before without any fear". From 2020 and until now we are struggling the life with the fear of the COVID-19 pandemic and uncomfortable with wearing a face mask for 24 hours.

As mentioned above our daily work course got stuck with the pandemic and people try to find a solution to continue their workload as before. The most of solutions are aligned with Information Technology and during this pandemic time, Information Technology plays a main role and fulfills its duty.

Before move on to discuss the role of Information Technology through pandemic time, Let's see the meaning of Information Technology. When browse "What is Information Technology?" through the internet it gives many definitions as this information technology is a vast field. Simply we can say this is a study of how to store, retrieve and send information in computer-based systems through different networks including the internet. Not only this is the study or use of hardware and software components, computerized information systems, databases. Operating systems etc.

During this pandemic situation, Information Technology plays a major role, offering many services for users mainly in the healthcare system, transferring information, in businesses, in communication, in education, getting connected with others easily, etc.

First, let's see how IT helps healthcare systems in this pandemic. It improves the standards and provides quality services in World Health Organization, hospitals, laboratories. From this, digital health services started in the world. Most health care facilities become digitalized and this is the beginning of virtual healthcare. Most of our healthcare needs now are available on our smart devices. With the improvement of virtual healthcare now doctors or consultants can check the patients who have coronavirus symptoms or any other patient without being physical with the patient.

All the data, health instructions, and guidelines store in a computerized system, and from this system it is easy to track a patient's current condition. Whenever a doctor wants to get any information of any patient like the patient's current condition, symptoms, medical reports, and any need health information, now it is easy to access them. Doctors, nurses, and all health officers are battling in this COVID-19 to give correct and timely care for people without thinking about their lives. All medical devices give great support for them in this battle. So we have to configure this medical device also playing a major role in this pandemic. IT provides a great service as it helps to store all the data and manipulate them in can access them in every need time without delay.

Not only in healthcare Information Technology plays a major role in transferring accurate information quickly to people. Like the World Health Organization creates their website, applications and spread news relate to the COVID-19 virus, update new stories of Coronavirus, publish necessary health guidelines that to have to follow to people. And also many organizations share news, latest updates related to COVID-19 through their social media to aware people of how critical is this situation and how to get safe from it. Some organizations provide a service to track COVID-19 symptoms via symptom checker and assist the user virtually.

With the lockdowns many businesses fall apart as they lost their customer base, so many businesses signed off and employees lost their jobs. Some companies shift to work remotely. With this remote working, another major problem arises. That is how to measure the daily work updates of employees and their commitments to the business and also have to make sure that the employees are incorrect track in working like whether they are using correct technology, tools, are they work with correct information systems and also from company side they have to make sure that the sensitive data of the company is secured or not while the employees work remotely. So employees and employers have to adjust to new technology, information systems, and situation and have to do their best to develop their business.

With remote working employees should have strong communication links with the company. If any defect occurs in any business operation, then there should be an easy and accurate way to communicate with managers. For this communication, the company need to up to date their employees with the decisions takes from the company, if the policies in the company changed the employees and stakeholders should update with those changes, it is must to have remote working rules and regulations and online assist for employees while using the online tools to perform operations of the business. Employees work alone at home with this remote work and to perform many business operations they have to work together with their departments. So it is necessary to set up a good communication link between employees and their departments. Information Technology provides all the solutions for all these issues.

Not only companies' schools also closed all over the world. This closing of schools does not mean this is the endpoint of education. All the schools and education institutes are doing the teaching process online with Information Technology. They use video calls, online file transferring to continue the education process. These days' teachers, masters, tutors meet their students online and continue to teach.

With lockdown people became alone. Many people got depressed with this loneliness. For good mental health, people have to get connect with others. But with this COVID-19 people can't meet physically. Information Technology guides people to meet online and get connect as they were. So people can make video and audio calls can text with friends. And also people got chance to get entertainment also via online. They can watch a number of videos from the internet like YouTube, Netflix, can play video games, and also can go for virtual tours over the internet where tours are available

Obviously, information technology has assumed an immense part in making this worldwide pandemic more endurable. Organizations and individuals have accepted all that it offers and uses it to keep a feeling of ordinariness during this pandemic time. Technology has become a part of our day-to-day lives. As it makes lives simpler, it likewise makes us subject to it for our daily routines.

Gangadara Athukorala
Secretary of IEEE NSBM Women in Engineering Student Branch Affinity Group
Assistant Secretary of IEEE Student Branch
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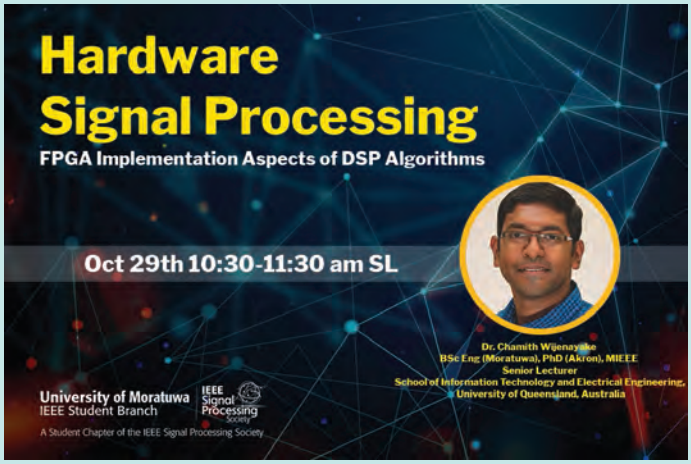
Towards Enriching the Signal Processing Knowledge of the Community

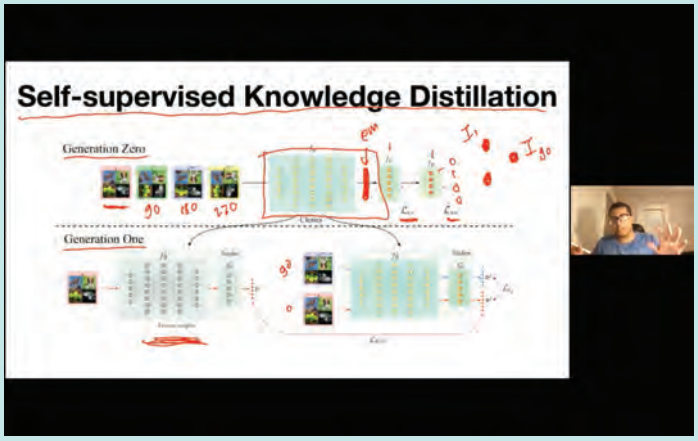
by IEEE University of Moratuwa Student Branch

As the newly established IEEE Signal Processing Society Student Branch Chapter of University of Moratuwa, we have done an amazing job throughout the past year, sharing knowledge and providing networking opportunities to signal processing enthusiasts, amidst a global pandemic. We achieved this by organizing a series of webinars on cutting-edge research topics in the field of signal processing.

The series launched with a webinar on "Hardware Signal Processing – FPGA Implementation Aspects of DSP Algorithms" which was conducted by Dr. Chamith Wijenayake, a Senior Lecturer at the University of Queensland, Brisbane, Australia. It was held on the 29th of October 2020, focusing on key concepts in DSP algorithms and methods used when implementing them on FPGA based embedded

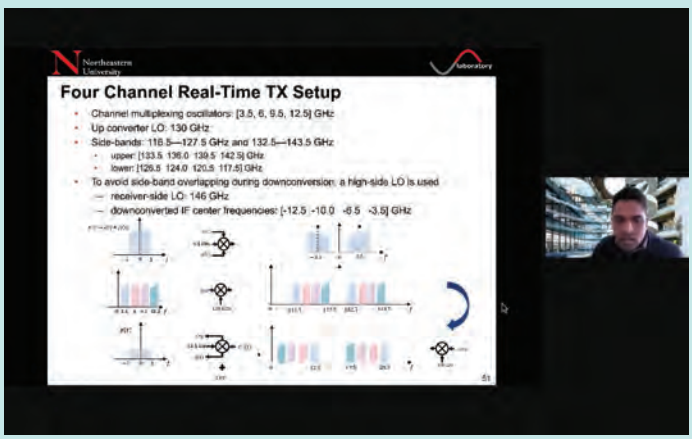


The second webinar titled "Advances in Deep Learning" where Dr. Sadeep Jayasumana, a Senior Research Scientist at Google Research, New York was the speaker, was held on the 28th of November 2020. Recent advances in convolutional neural networks, transformer networks, language models, deep reinforcement learning and generative adversarial networks were discussed. It was one of the most successful webinars we had with over 500 registrations.



The first webinar for the year 2021 was held on the 31st of January. It was titled "Meta Learning" and was conducted by Mr. Jathushan Rajasegaran, a PhD candidate on Artificial Intelligence at the University of Berkeley, California, USA. The speaker proceeded with the webinar by intuitively explaining basics on continual learning and few-shot learning, and how the above learning methods could be unified via meta-learning.

"6G Communication Systems", held on the 28th of February 2021 was the next webinar. The speaker was Dr. Viduneth Ariyarathna, an Associate Research Scientist at the Institute for the Wireless Internet of Things at the Northeastern University, Boston, USA. Starting off the discussion by briefly introducing the state-of-the-art wireless systems experimentation platforms above 100 GHz, he presented an overview on Xilinx RFSoC-based multi-channel, multi-GHz back-end.



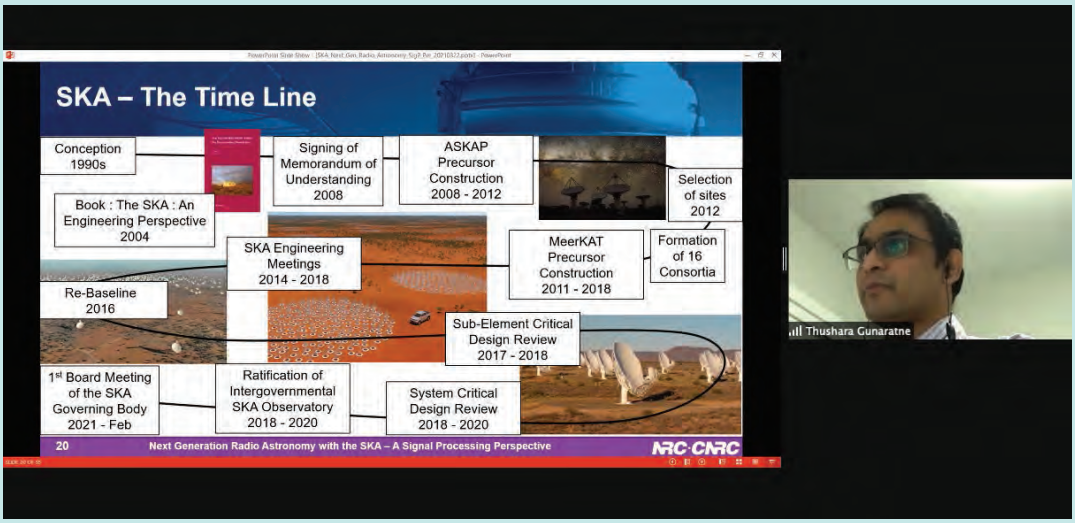
Towards Enriching the Signal Processing Knowledge of the Community

by IEEE University of Moratuwa Student Branch

Dr. Thushara K. Gunaratne, a Research Council Officer – Signal Processing at the Hertzberg Astronomy and Astrophysics Research Center, National Research Council Canada, delivered a webinar on "Next Generation Radio Astronomy with the Square Kilometer Array (SKA)". It was held on the 27th of March 2021. The attention was focused on the SKA and its features and signal processing aspects of the Low-Frequency Array and Mid-Frequency Array.

Our most recent webinar was on "Chromatic Derivatives and Applications" by Prof. Aleksander Ignatovic, an Associate Professor, at the School of Computer Science and Engineering, University of New South Wales, Sydney, Australia. Held on the 26th of April 2021, this webinar focused on chromatic derivatives, which provides better local approximations by accurately capturing local features of a signal, compared to classical Taylor series and Shannon expansions.

At every webinar, the audience was benefitted with a 30-minute Q&A session. As the IEEE SPS SBC of UoM, we wish to continue our efforts to spread knowledge and network with signal processing enthusiasts globally in the upcoming years as well.



Thank You!

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Thank You!

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