IEEE SL SECTION NEWSLETTER

Fast and Electronic detection of COVID-19 (Corona virus 2)

Women To Rise Above The Pandemic

First Floating Solar Pilot Plant in Sri Lanka

Make this year count, seniors!

IEEE

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MESSAGE FROM THE CHAIRMAN

Welcome to the first e-newsletter of the IEEE Sri Lanka Section in the year 2021. We are glad to receive continuous support from the various organizational units of the IEEE Sri Lanka section for the newsletter despite the prevailing pandemic situation. This version of the newsletter consists of timely related technical articles and the news articles of activities carried out by the IEEE Sri Lanka section and its other organizational units. I am pleased to present the different activities carried out by the members of the section towards the betterment of the society during the COVID 19 pandemic period. The newsletter provides clear evidence of the untiring efforts of the community of the IEEE Sri Lanka section. They have done excellent contribution to the section by carrying out different activities through virtual modes.

I make this an opportunity to thank the hard work of the editorial team of the newsletter. Furthermore, I congratulate and thank the efforts of Prof. Pradeep Abeygunawardhana, editor of the section.

While thanking you all I invite you to read the complete newsletter. I am sure that you will enjoy reading it. Please continue your good work toward advancing technology for humanity and stay safe.

Ruwan Gopura
Professor

Chair/IEEE Sri Lanka Section

MESSAGE FROM THE EDITOR

I am happy to present our second newsletter for the year 2020. This version of newsletter includes several technical articles which were wrote to improve the technical knowledge of members and inform recent technical advances by members. It also includes some of the key event done by Sri Lanka section, its chapters and student branches.

As the editor, my ambition was to produce something valuable to read. It should include knowledge, information section and our achievements. Other objective of IEEE newsletter is to strengthen the bond between Sri Lanka section and its members by providing a valuable thing. Though there are many areas that we can serve the membership, I believe the effort I took with newsletters is successful.

I would like to thank Chair- IEEE Sri Lanka section Prof. Ruwan Gopura and all committee members who supported me by producing this newsletter. My sincere thanks goes to my editorial committee members, Ms Sasini Wellalage and Ms Ann Fernando for helping me to edit the newsletter.

Main theme of IEEE is advancing technology for Humanity and our newsletters also aligning with that theme. Technology is best when it brings people together.

IEEE Sri Lanka Section Newsletters will bring its members together and will serve it best to the society and its member.

Thanks you

Prof. Pradeep Abeygunawardhana

Editor – IEEE Sri Lanka Section Newsletter

EDITORIAL COMMITTEE

Editor

Prof. Pradeep Abeygunawardhana

Editorial Committee Members

Ms. Sasini Wellalage
Ms. Ann Fernando

FAST AND ELECTRONIC DETECTION OF COVID-19 (CORONA VIRUS 2)

By Dr Thanihaichelvan Murugathas

COVID-19 pandemic is the global challenge as of today and scientist are working on developing therapeutics and fast diagnosis techniques. Since the therapeutics are delayed, fast diagnosis techniques might be helpful to restore the normalcy. At present, the most reliable diagnosis method for COVID-19 is reverse transcription polymerase chain reaction (RT-PCR). Again, it is time consuming and needs experts and expensive machines. In recent past, many techniques including field effect transistor-based sensors, have been reported for detection of bio-molecules at very low concentrations. These molecular sensing techniques can be effectively used for fast detection of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1]. Moreover, the testing can be done within a minute time with extremely high selectivity.

The basic of COVID-19 detection is detecting the presence of the virus, or part of the virus including the viral RNA, or the antigen, and antibodies developed by our immune system in our blood or saliva sample as shown in figure 1. The antibody/antigen tests are much faster, but they will be developed in our body in the final stages of the infection. Moreover, the antibodies can be developed by any viral infection which is not limited to the SARS-COVID-2. Due to the above mentioned disadvantageous, the antibody test is not considered as a reliable test for COVID-19 detection. RT-PCR technique detect the viral RNA using an optical technique. However, the optical technique does not have enough sensitivity. Hence, we need to multiply the viral RNAs in the nasal swab before detecting it.
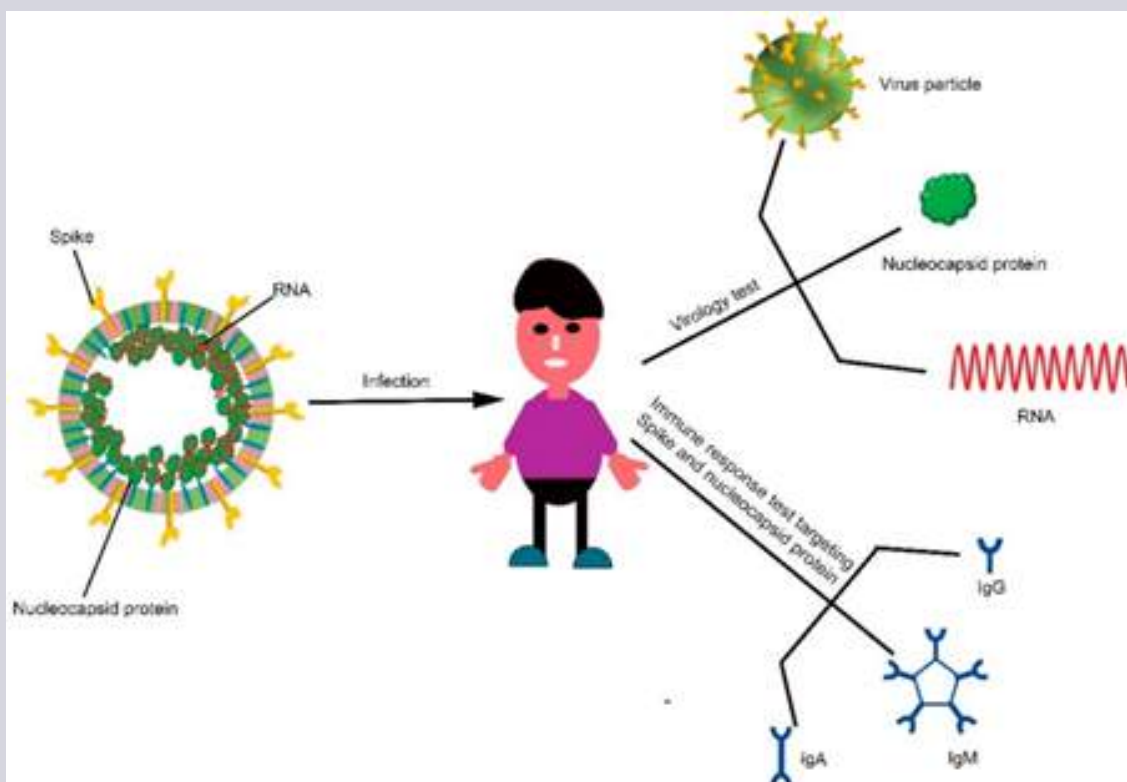

Figure 1: Schematic illustration of strategies for the detection of COVID-19 patients [1].

The multiplying (amplification) step is the longest step (take up to 2 to 4 hours based on the machine used) that involved in the currently used RT-PCR diagnosis. However, few recent works have reported the detection of COVID-19 virus using these molecular sensing techniques. These molecular sensors are capable of detecting the physical or chemical changes that occurs in a target when it binds to the biological probe.

In university of Jaffna, we recently developed an electronic biosensor to detect the COVID-19 virus at extremely low concentrations using carbon nanotube FETs (CNT FETs). The CNT FETs are highly sensitive to its immediate environment and detect any changes to its close proximity [2]. The CNT FET sensor uses the electrical change occurs in an RNA sequence when it binds to the portion of the viral RNA. The sensors with RNA as a probe were successfully used in biosensor applications to detect analytes at extremely low concentrations [3,4]. The RNA probe with a sequence of 5'-CCATA ACCTT TCCAC ATACC GCAGA CGG- 3' which is used to differentiate the SARS-CoV-2 and SARS-CoV-1 was chosen as the primary detector. One end of the aptamer was modified with an Amine group for functionalization. The RNA probe was successfully functionalized onto the CNT channel using linker a linker molecule ascribed in ref [5]. The Figure 2 illustrates the sensor response of the aptamer immobilized CNT FET biosensors for the synthetic positive (SARS-CoV-2) and negative (SARS-CoV) sequence. A clear dose dependent electrical response to the positive sequence and the response for the negative sequence is relatively lower.

This confirms the selective detection of Corona virus 2. The current work is done on synthetic sequences and the test must be confirmed with the full RNA sequence from the virus. The results need to be compared with the RT-PCR results for validation before the device design.
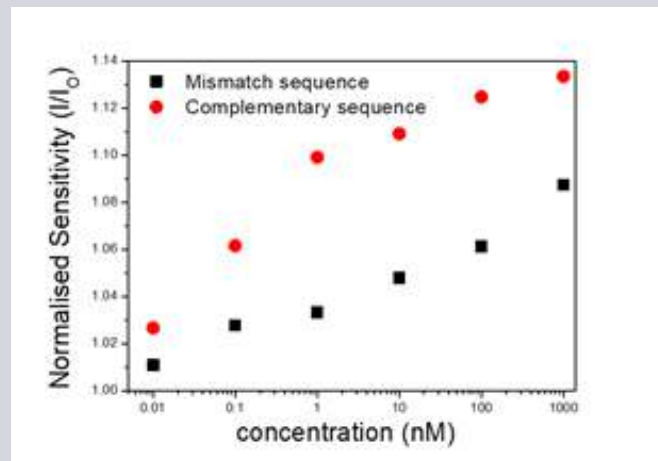

Figure 2: The dose dependent sensing response of both complimentary and mismatch sequences for the oligo functionalized CNT FET

The mechanism of the sensors is simple and explained in Figure 3. CNT is a quasi 1D material with extremely high surface to volume ratio. Most of the CNT are semiconducting materials. Their electrical conductivity is highly depending on its immediate environment. Here, the probe sequence immobilized onto the CNT channel have a negative charge. And when it is binding with its complementary strand, it removes the negative charge of the probe. This will subsequently affect the conductivity of CNT. Meantime, the negative sequence does not bind to the probe and hence the conductivity does not affect significantly.
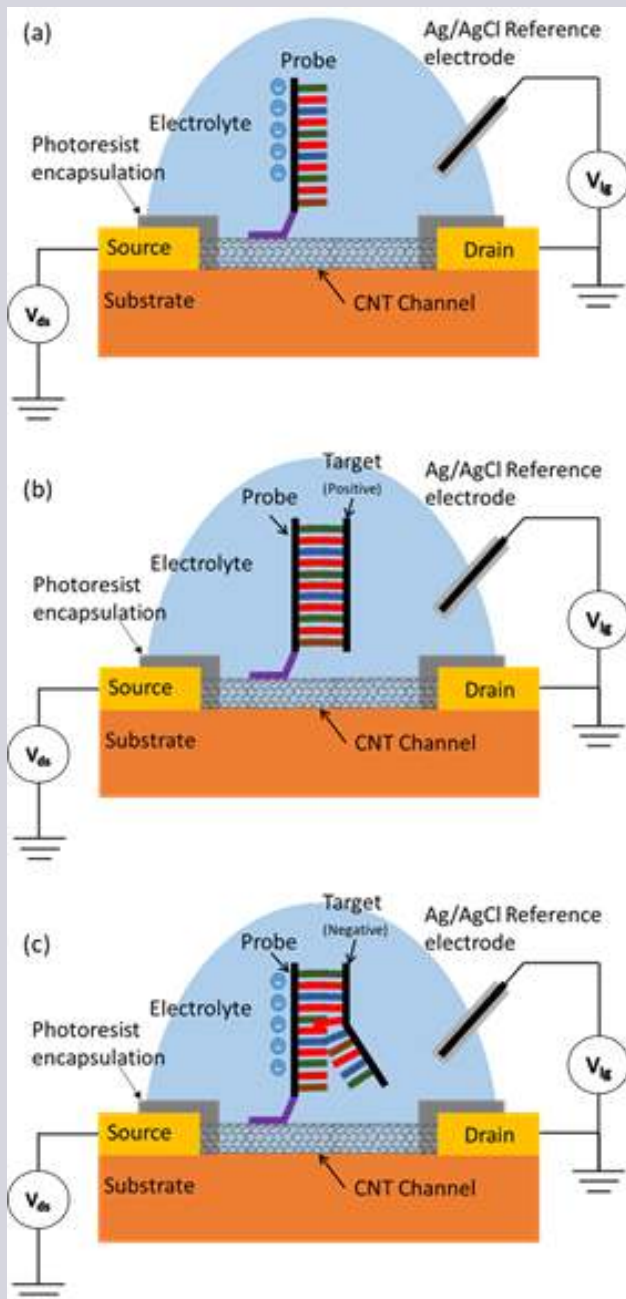
Figure 03: Mechanism of sensing action in a probe immobilized CNT FET device (a) Probe immobilized CNT FET with a liquid gate connections (b) the formation of double helix structure upon adding the positive (complementary) sequence and removal of the negative charge and (c) the partial formation of helical structure during the addition of the negative sequence. (in the figure, the same colors used for indicating the sequences in probe and target. But in real case, it is not. for further details can be obtained about the DNA hybridization and RT-PCR in ref. [6])

After the promising results from the proof-of-concept work, now we are to built a real time biosensor with real viral RNA and to validate our sensor along with the most popular PCR technique. The present test was done on the devices fabricated in the lab. The tests have to be done on the mass-produced devices and the results must be validated. The work is supported by the NSF grant (RG/COVID/2020/HS/02) and we are to collaborate with the Faculty of Medicine, University of Jaffna and Teaching hospital, Jaffna for the validation tests of our devices.

Reference:

[1]. Tianxing Ji, et al (2020) Detection of COVID-19: A review of the current literature and future perspectives., Biosensors and Bioelectronics 166:112455. https://doi.org/10.1016/j.bios.2020.112455
[2]. Thanihaichelvan M, et al (2019) Biosensing with Insect Odorant Receptor Nanodiscs and Carbon Nanotube Field-Effect Transistors., ACS Applied Materials and Interfaces, 9, 11, 9530–9538. https://doi.org/10.1021/acsami.8b19433
[3]. Zheng HY, et al (2015) Carbon nanotube field effect transistor aptasensors for estrogen detection in liquids. J Vac Sci Technol B, Nanotechnol Microelectron Mater Process Meas Phenom 33:06F904. https://doi.org/10.1116/1.4935246
[4]. Zheng HY, et al (2016) Electrostatic gating in carbon nanotube aptasensors. Nanoscale 8:13659–13668. https://doi.org/10.1039/c5nr08117c
[5]. Thanihaichelvan M, et al (2019) Metallic-semiconducting junctions create sensing hot-spots in carbon nanotube FET aptasensors near percolation. Biosens Bioelectron 130:408–413. https://doi.org/10.1016/j.bios.2018.09.021
[6]. Coronavirus Test: Real time RT-PCR - Animation video, Biology with Animations., https://www.youtube.com/watch?v=ThG_02miq-4&t. Accesses on 06.12.2020.

By Dr Thanihaichelvan Murugathas, Department of Physics, University of Jaffna, Sri Lanka

IEEE ELECTRONIC DESIGN COMPETITION 2020

Objective - This activity is aimed at popularizing IEEE among the student community as well as to boost the electronic design interest and capabilities of Sri Lankan university students.

38 REGISTERED

For the Final Round

8 SELECTED

First Floating Solar Pilot Plant in Sri Lanka

By: Dr. K. Ahilan

The projected energy demand and environmental issues have directed the global community to focus on strategic plans for clean energy technologies. The president's also manifesto indicated that the 70% of electrical energy to be produced from the RE and Hydro power technologies by 2030.

Solar power is the most popular and widely used one among all the renewable energy resources. The installation and integration of solar plant plays an important role in the modern power system. Two main factors which negatively impact the solar power plants are the vast land area needed for the installation and efficiency of the solar panels. The installation of floating solar plants has been considered as a viable solution.

Sri Lanka's first floating solar power plant with a total capacity of 46 kWp had been installed recently in Killinochchi premises, University of Jaffna with the support of the Current Solar AS, a Norwegian developer of floating photovoltaic solar systems. This project is a collaboration between the Western Norway University of Applied Sciences and

University of Jaffna and it is supported by the Royal Norwegian Embassy in Colombo.A 44 kWp east-west facing floating system with 2.5 kWp land-based reference plant was officially opened on 24th January 2020 by the Ambassador of Norwegian Embassy, Colombo.

The novel floating system is established as an experimental plant in the pond with the depth about 2m. The innovative floating frame was designed by Current Solar AS, the Norwegian developer of floating PV solutions. Floating pipes used in the design are made of high-density Poly Ethylene in order to lift the solar panel sets, upon the water surface.The beams are made of glass fiber, which is steady and well adapted to the water environment. Further it also provides the slope required for the solar panel installation.

This floating solution is specifically based on low cost and easy installation.This installation was very simple and it does not require any heavy machineries. The installation of floating solar plant is shown in Figure 01

Figure 01: The installation of floating solar plant

50 kW SMA inverter was installed in this plant, which contains 6 MPPT units. 72 rec solar panel (TP 295 Wp) were mounted in east-west direction and connected to MPPT A and MPPT B. Another 72 rec solar panel (N-Peak 315Wp) were mount in east-west direction and connected MPPT C and MPPT D. Land-based reference system was connected MPPT E.

The data logger and the sensors are placed to collect the data and the data is being recorded at 10 minutes' interval. Solar irradiation sensors and module temperature sensors are placed on east west orientation.

Humidity, water temperature and ambient temperature have also been measured separately.Data have been collected continuously to analyze the performance and the environmental effects of both the floating and land-based system. The collected data have been used for research studies.

The innovative floating frame design has advantage that when the water level reduces in the dry session, the floating system also moves with water and it will on the land for some period when there is no water. When the water comes back during rainy season, it will automatically lift up. Those conditions are shown in Figure 02

Figure 02 -The floating solar plant during the dry and rainy season

The floating solar system is expected to have 5% to 10% of more power yield (kWh/kWp) comparing to the land - based system. The energy generation in May 2020 is shown in Figure 03
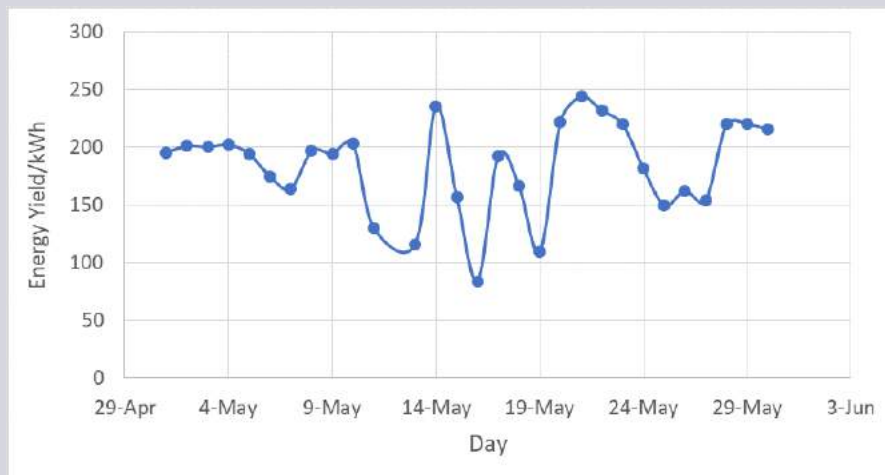

Figure 03: Energy yield in May 2020

In summary, The Northern Province is blessed with huge Renewable Energy Sources. Therefore, the faculty of engineering, University of Jaffna is developing a Renewable Energy Park for demonstrating the new technologies to the business developers and community.

The floating power plant has proven that :

(i) the operational efficiency of the solar power plant is increased due to cooling effect when it is floating,

(ii) land use is effectively utilized as it was placed on top of the free water surface

(iii) evaporation of water is expected to be reduced – studies are carried out on this matter to be proven

(iv) environmental effect are expected to be in satisfied level – studies are carried out on this too.

The RE technologies or any proven technologies, if they are installed in a right way, then it will definitely be beneficial to the human life. I would like to thank Current Solar AS, the Norwegian developer of floating PV solutions for donating the equipment. I would also like to thank Mr. Torgier, Prof. Atputharajah, Prof. Ravirajan, Prof. Dhayalan, Ms. Vinothine and Mr. Sankar who work in this project.

By: Dr. K. Ahilan, Senior Lecturer & Coordinator of Renewable Energy Park,
Faculty of Engineering, University of Jaffna

Molecular Communication

Cell like communication for Internet of Bio- Nano things.

By Maheshi B Dissanayake

The Internet of Things (IoT) has emerged as an important research topic in the last decade, where group of physical devices are connected together through the Internet. This concept opened up many application domains, one of such been Internet of Nano Things (IoNT). Recent advances in miniature scale devices led to IoNT, where intelligent nano scale machines of few square milli-meter size, integrates together to perform a pre-defined task.

Despite IoNT being an enabler for many miniature scale applications, the artificial nature of these devices can cause detrimental impact at deployment. A sub class of IoNT, Internet of Bio-Nano Things (IoBNT), which comprise of machines built using either real or artificial biological materials, has emerged as a solutions this problem.

One of the key challenges in deploying IoBNT is the communication and networking settings, as traditional electromagnetic wave modulation with which information is transmitted between physical devices fails under nano scale environments. Yet, biological system such as cells, tissues, organs and micro scale insects, leverages biological particles to communicate between each other.

What is Molecular Communication?

Inspired from inherent communication system in biology, communication engineers have pioneered molecular communication (MC) paradigm, which employs molecules as information carrying messengers in micro/ nano scale networks, which span a short distance (tens of micrometers) communication network. Networks where communication is achieved through chemicals and micro level particles, such as sprays of ethanol, hormone signals, calcium signalling, find applications in environments which are difficult monitor in traditional methods. Such as monitoring functions in human body, predicting and controlling spreading of diseases, pollution control through environment monitoring.

Basic components in MC:

Very similar to traditional communication system, MC system also consists of a transmitter base station, receiver station, information carrier and transmission medium. More precisely, MC system consists of nano transmitter machine and nano receiver machines with antennas (such as bacteria), molecular information carriers (such as DNA cells) and the transmission environment (such as blood vessels in human body). The transmitter and the receiver in MC are capable of performing the very simple tasks of signal generation, signal modulation, computation, signal sensing and simple decision making. These basic building blocks can be integrated to form complex operation or task.

How they Work? Basic Principle of Working

MC system will operate in 5 stages, namely, encoding, emission, propagation, adsorption (binding), and decoding. These biologically inspired senders and receivers are created in such a way that they have the capability of emitting and capturing the information molecules. In most scenarios information is signalled similar to on off keying in optical communication, by signalling bit '1' using presence of molecules and bit '0' by absence of molecules, within a defined time duration.

Once emitted to the transmission medium such as blood vessels carrier molecules undergoes random walks, following Brownian motion concept. Depending on the dimensionality of the environment, carrier molecules may or may not experience drift or collisions. For instance, significant number of molecules in a smaller space may experience collision between molecules, causing loss of information in the transmission. These defusing molecules will be absorbed by the receptors (antenna like structure) on the receiver surface. After simply counting the number of received molecules, the receiver decodes the received information by checking the collected number of molecules against a predefined threshold value.

Research challenges;

This field of study is a much richer and broader area with cross-disciplines such as natural and artificial systems biology, nanomedicine and pharmacology, microfluidics with electro chemicals, nanotechnology, chemistry to name but a few.

Current work in MC is limited to design and analysis of small-scale networks with few bio-nanomachines, such as Lab-on- a chip (LOC) designs. Yet, one of the major constrains associate is the inability to exactly model the communication environment for theoretical studies which leads to successful validation of practical implementations. Hence, potential research area in MC still remains as channel modelling. Considerable amount of research is undergoing to find solutions to molecular interferences within the system, due to constrained nature of the transmission environment. An emerging research area in MC is design and development of large-scale networks with robust and scalable features with practical applications. It should be notes that the tools and theory available for traditional communication systems, need special tuning to cater micro level infrastructure associated in MC.

With time MC will become an irreplaceable technology in many different domains, such as pharmacology, synthetic biology, environmental analysis, nanotechnology.
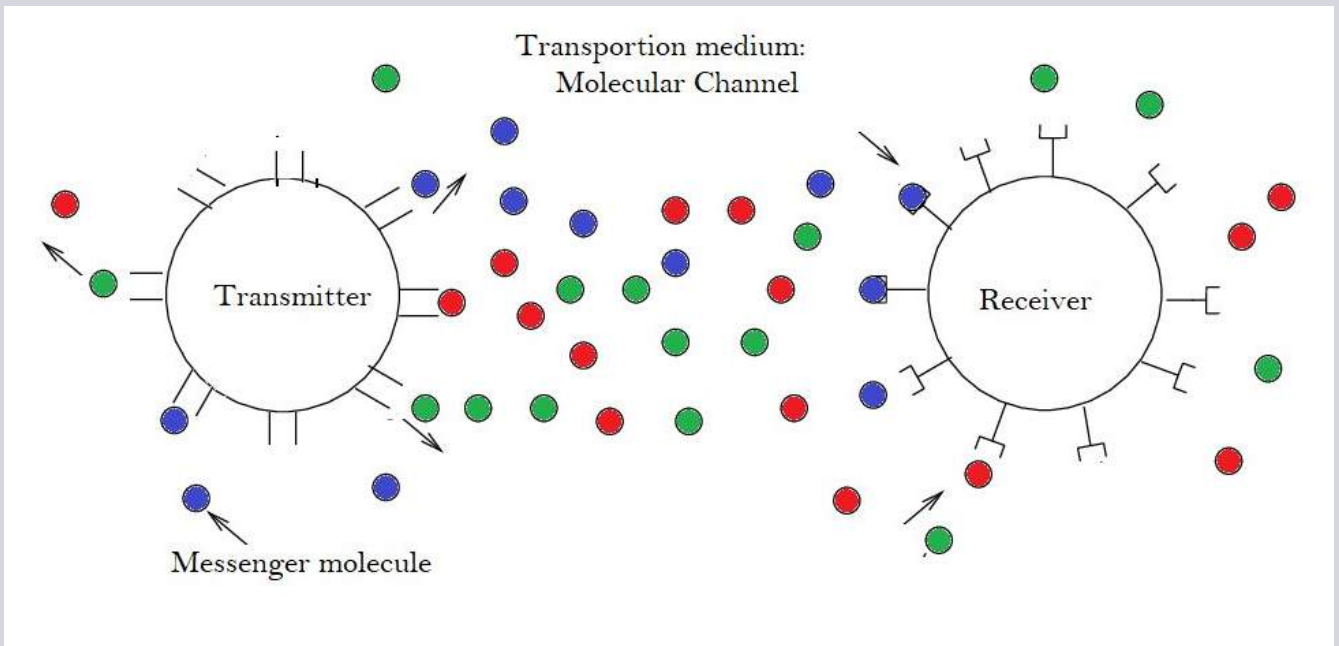
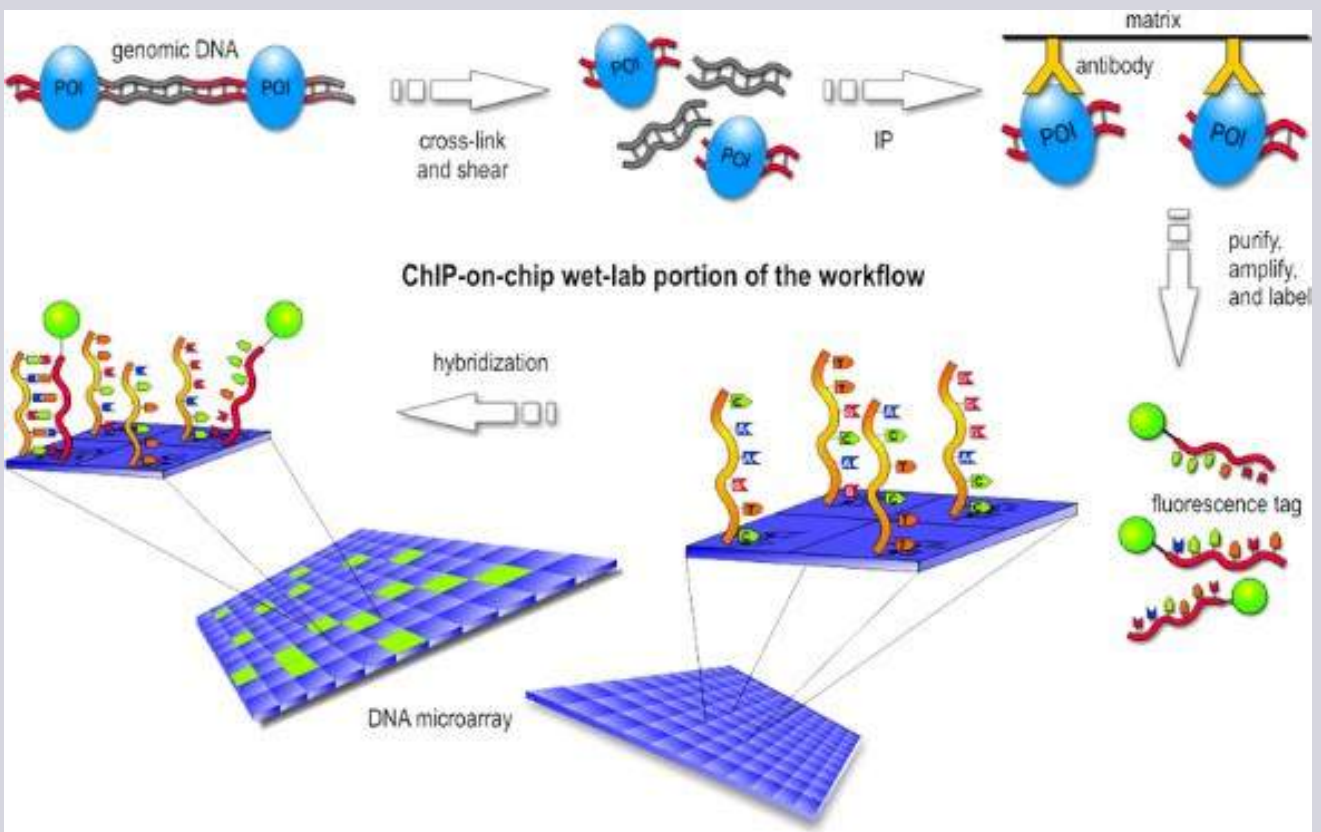*Figure 1: Molecular Communication System*

Figure 2: Application of MC, Lab on a Chip

EVENTS AND AWARDS OF SLTC

AWARDS

IEEE branch of SLTC is one of the most emerging and award winning branch and one of the outstanding performer, **Yashodara De Alwis** was nominated as the winner of the kahoot session "How Well You Know the Awards" in the IEEE BOOST 2020.

AWARDS

IEEE branch of SLTC was **Best emerging student branch** for GISLA 2020 and for the Knowledge Hub 2019 at the **IEEE BOOST 2020.**

Sinhalen Docs

sinhalen DOCS' is a virtual workshop series organized in collaboration with the Leo Club of SLTC and the IEEE Student Branch of SLTC and it is an ongoing project..

Main Objective - To improve the interest of youngsters, middle-agers, and senior citizens on desktop publishing word processing, spreadsheets,database management and IT as a whole and to introduce the concept of productivity and effective communication.

Next target is to **conduct the second webinar of the series on Fiverr online marketplace.** It will be held on 19th December via Zoom online platform. The rest of the workshops are planned to be held in January and February.

By Thuwaraha Suntharalingam

Workshop

IEEE "**How to Write a Research Paper" Workshop** was done in collaboration with the School of Postgraduate Studies & Research of SLTC. The session commenced on saturday,21st of November, 2020 from 6.30 p.m. onwards with well over 1000 concurrent participants who were joining the workshop from all over the world via Zoom online meeting platform and Facebook Live Streaming.

By Shehan Assan (Department of Civil Engineering Sri Lanka Technological Campus)

Orator' 20

ORATOR' 20" - an Online Speech Contest has organized by the Media Club of SLTC in collaboration with IES IEEE of SLTC is an attempt to encourage the public speaking skills of the undergraduates in SLTC.

The Facilitator was Mr. Shahan Fernando, who received his secondary education from the universities of Moratuwa and London and founder of Mr. Compere & founder - CREE-DA Sports network.

Main Objective - Providing prior knowledge about public speaking in order to deliver an effective speech for an undergraduate student to move on with their career opportunities.

Knowledge Hub-2

Knowledge Hub is an event organized to increases the problem-solving abilities of the electronic and technology students in the school of engineering and school of technology to improve their performance for the examinations in their respective courses. This was organized by 2019 section 7 (Logistic team) of IES chapter of IEEE student branch, Sri Lanka Technological Campus for SLTC students only.
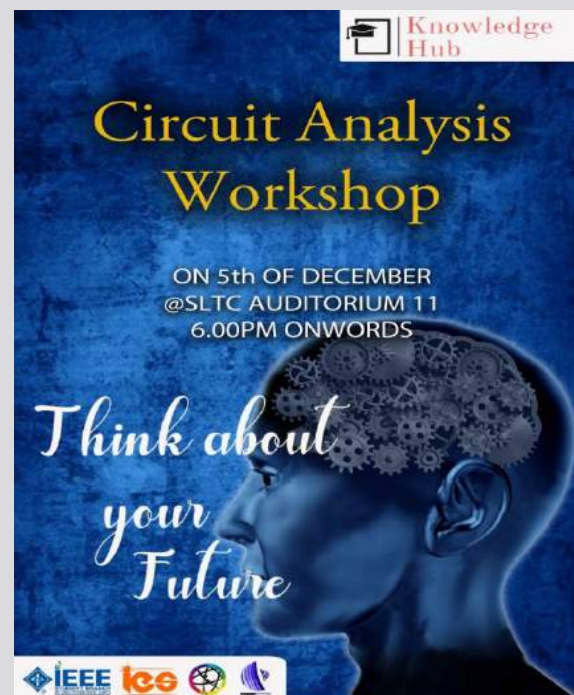
The facilitator was Mr. Ashen Lakshitha Dharmasiri alongside the support of Mr. Ushan Sakuntha. Mr. Jananga Sooriyaarachchi contributed as a student advisor by guiding and sharing his wisdom.

Project Ardioflo

Project Ardioflo, **organized by the IEEE Industrial Electronics Society of SLTC**, was a workshop and competition-based project focusing on the prototype-building software Arduino.

Main Objective - Aiming on educating and encouraging students on all there is to know on Arduino

The project completed its first initiative with the hosting of its workshops, via online zoom platform and was conducted by **Engineer Automation of MAS KREEDA Mr. R.Dinushan Prabhashitha.**

WOMEN TO RISE ABOVE THE PANDEMIC
"I think a girl can doing anything! She just needs to believe herself"

IEEE Women in Engineering (WIE) Student branch Affinity group of Sri Lanka Technological Campus (SLTC) was held session of "WOMEN TO RISE ABOVE THE PANDEMIC" successfully on 5th of June 2020. It mainly targets to develop the personality of undergraduate female students in Sri Lanka Technological campus (SLTC) and induce their desire to seek a successful career.

Keynote speaker - Mrs. Rasini Bandara

By Elvira Meliksetan
Women's Resource Center-Armenia

GISLA 2020 - Green Innovation Sri Lanka

Green Innovation Sri Lanka (GISLA) was a competition to digitize the ideas and talents of everyone across the country under the theme **"How we build Sri Lanka after COVID-19"** organized by the IEEE Student Branch of Sri Lanka Technological Campus and IES Student Branch Chapter of SLTC collaborated with Media Unit of SLTC which the entire project was done in the months of May and June.

The competition included two sub competitions which were:

• Digital Art Competition
• Video Documentary Competition

Road to Codemania

Introduction to JAVA Webinar Series on Java Programming

"Road to Codemania – introduction to Java".It was officially announced on the 14th of August and named "Road to Codemania" This was the 1st project for the year 2020, organized by IEEE of SLTC.

Mr. Yohan Pandigama, one of the most experienced lecturers in SLTC. He is an expert on natural algorithms, the theory of computation, the philosophy of computer science, and learning theory.

WIN-women in need

The 'WIN-women in need' annual magazine is an ingenious concept which was initiated by the IEEE Women in Engineering (WIE) affinity group of SLTC. Apart from being a great platform for the female undergraduates to express their ideas and showcase their knowledge, WIN will be a magazine where the readers have the access to a lot of creative content, including technical articles, poems, songs and artwork about WIE and other significant topics.

The very first issue of the magazine will be published in December 2020 and the second issue is supposed to be published in the next year.

Graphico'20

IEEE Women in Engineering (WIE) student branch Affinity Group of the Sri Lanka Technological Campus (SLTC) decided to conduct a graphic design workshop on Illustrator called **"Graphico'20".**

Graphico'20 consists of mainly two sections as webinar series and competition.

The three – day webinar series were conducted on illustrator and facilitated by the most unique and talented **Mr. Mohammed Azmeer**, the Head of the Department of Multimedia, SLTC.

LET'S READ

One of the things we miss with technological advancement is reading and writing. "Reading skills serve as a foundation for writing." By writing, we can transfer our creativity and ideas to society. This leads to the enrichment of the knowledge of those who tend to read. The "Let's Read" project gives a great opportunity to those who are interested in both reading and writing. Writers who have creative ideas and who love to write have to lose appreciation because people give up reading. As a solution for this created something interesting that combined technology and reading. It is an app and blog. Through the app and blog organizing committee wish to give support who love to read and write. It also helps students who wish to improve their knowledge.

Here is the link of the blog – Let's Read (ieeeletsread.blogspot.com)

As always, the IEEE Student Branch of Sri Lanka Technological Campus has built a worldwide platform for their commitment as this project gives us the opportunity to share our knowledge globally. The "Let's Read" project will be a global icon. This project is not only for Sri Lankan undergraduates but also for students worldwide. This will be a great opportunity to encourage the writer who has writing skills and promote and motivate people to read. Through this global platform, the student will find articles, researchers, and subject-wise details. The Organizing committee hopes to make a collection of articles that is easily accessible for others.

"Let's Read" project conducted three main parts. The first one is the article competition among the students of Sri Lanka Technological Campus. The competition started on 9th July. At the moment 22 articles were published. Thuvaharani Thayaparan(Chairman -IEEE Student Branch of SLTC), Manodya Nabedawewa(Vice-Chairman IEEE Student Branch of SLTC), Thihara Mallikaratchy(Secretary IEEE Student Branch of SLTC), and Thimeth Perera are doing as judges of the article competition. Winners will be awarded certificates.

The second one is getting articles from 10 IEEE Region branches for the article series. Articles from 10 different IEEE regions worldwide will be published on social media platforms. So, the organizing committee hopes to get worldwide articles for the article series. This project is not just limited to our country, any undergraduate IEEE member from across the world is warmly welcomed to join "Let's Read".
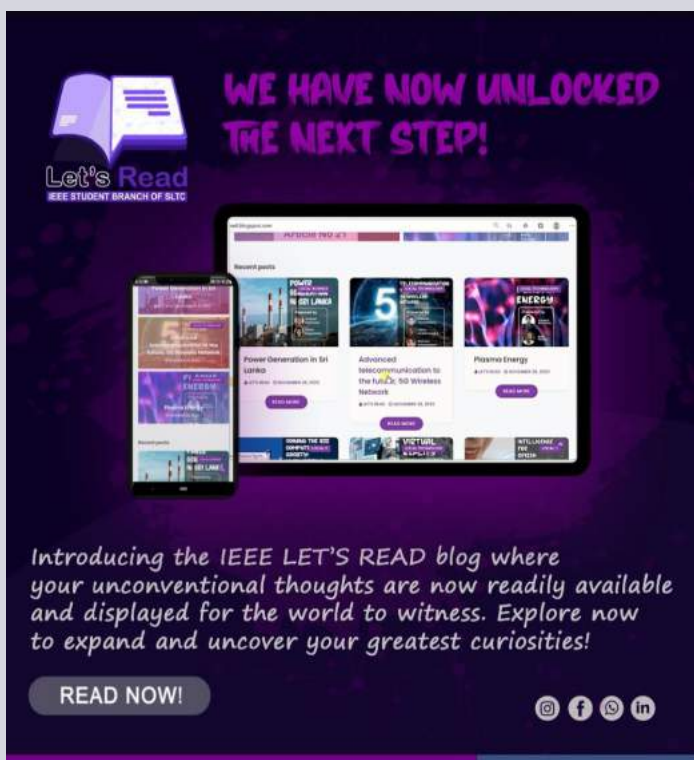
Accepting articles from 10 regions was opened on 22nd November. It will be open till 31st January in 2021. All the participants are honored and awarded with valuable E-certificates.

The third one is the island wide article competition. The organizing committee hopes to welcome competitors of all undergraduate IEEE members all over the island for the competition. The articles are collected by the organizing committee using a google form. The participants should submit their articles through this form. The collected articles are judged by a respected panel of judges. Accepting articles from IEEE students will open from 15th February to 25th February of 2021. The top 20 will be selected and published on Facebook. The posted entries will allow voting. The organizing committee hopes to select the best 03 articles through 70% from the judgment of judgers & 30% of Facebook votes. Final results will be published on 21st March,2021. The organizing committee hopes to give cash prizes to winners. Therefore, Rs.10000/=, Rs.5000/= and Rs.3000/= in order for first place, second place, third place. Top 03 articles will be awarded a cash prize & all the participants are honored and awarded with valuable E certificates.

The organizing committee works with dedication to plan this global platform well with the great advice of Dr. Lasith Yasakethu and Dr. Chandani Dissanayake (staff advisors of SLTC IEEE), Manodya Nabadawewa (Vice-Chairman IEEE Student Branch of SLTC), Thimeth Perera and Jananga Sooriyaarachchi.

The project president is Sasindu Kumarasinghe and the vice president is Amod Sahabandu. The secretary of the project is Thuwaraha Suntharalingam and the vice secretary is Shavindya Senavirathne. The treasure is Hansitha Keerthiratne and the vice treasure is Chamodya Awishka. All the committee members of this project work hard to achieve success.

"Let's Read" is a huge project, which is merged with technology and reading as well as connecting globally. So this will be a great opportunity for all committee members to get a great experience. It will be helpful to them to improve their organizing skills, team working skills, and leadership skills. Congratulations on their success.

CONFERENCES

ICIAFS - 2021

The principal theme of **International Conference on Information and Automation for Sustainability (ICIAFS)** for the year 2021 will be the Sustainable development through effective man-machine coexistence. The 10th ICIAFS is a global forum for sharing new developments in the general areas of automation and sustainability.

For Important dates and submissions:

http://spsr.sltc.ac.lk/events/iciafs-2021/

IEEE EMBS ISC - 2021

It is the first-ever **IEEE EMBS approved International Student Conference (ISC)** in Sri Lanka. ISC 2021, Moratuwa is a scientific symposium dedicated to mathematical, computational and innovative aspects of biomedical engineering across all scales of experimentation with the objective of ISC 2021 establishing an international platform that has an eccentric potential to manipulate the novel gold standards of biomedical engineering.

For Important dates and submissions: *https://isc.embs.org/2021moratuwa/*

ICAC - 2021

ICAC 2020 is organized by the Faculty of Computing of Sri Lanka Institute of Information Technology (SLIIT) with the theme **"Advancements in Computing."** The ICAC 2020 will be an open forum for academics, as-well-as industry professionals, to present the latest issues and trends in the broader domain of computing.

For Important dates and submissions: *https://icac.lk/*

IEEEXTREME 14.0 – 24 HOURS OF COMPETITIVE PROGRAMMING

By Chalani Ekanayake

IEEEXtreme 14.0, the most awaited 24-hour competitive programming challenge in the IEEE calendar was held on the 24th of October 2020 for the 14th time with the participation of more than 9000 competitive programmers from 73 countries all around the world. IEEE Student Branch, University of Moratuwa proudly hosted IEEEXtreme 14.0 in Sri Lanka. Usually, IEEEXtreme is held on university premises; however, due to the prevailing situation in the country, participants had the privilege to code at home while being connected to their team members and proctor through video meetings. Dr Rasara Samarasinghe, Dr Tharaka Samarasinghe, Prof. Ruwan Gopura, Ms S.A.R. Kamalanayana, Mr Kavinga Ekanayake and Dr Uthayasanker Thayasivam acted as proctors for IEEEXtreme 14.0.

Nearly 240 teams, where 73 of them are from University of Moratuwa, participated in the competition representing Sri Lanka. After 24-hours of intensive coding, five teams from Sri Lanka were able to secure ranks within the global top 100.

As IEEE Student Branch of University of Moratuwa, we are proud to say that out of top 100 ranks in Sri Lankan scoreboard, 51 ranks are secured by teams from University of Moratuwa.

We strongly believe "MoraXtreme 5.0" and "IEEEXtreme Awareness Session" organized by the IEEE Student Branch and IEEE Computer Society of University of Moratuwa prior to the competition has been a great help to all those who participated in IEEEXtreme 14.0.

Our heartiest congratulations go out to all winning teams! An award ceremony will be held in the near future to honour all top rankers for their achievements and to encourage other programming enthusiasts to take part in IEEEXtreme programming competition.

- **TeamNameUOM (World 57) – University of Moratuwa**
- **InterGreat (World 74) – University of Peradeniya**
- **Codebreakers (World 77) – University of Moratuwa**
- **FkrBk (World 97) – University of Colombo School of Computing**
- **Ssss (World 100) – University of Moratuwa**

By Chalani Ekanayake, Secretary of IEEE Computer Society of IEEE Student Branch University of Moratuwa

EVENTS AND AWARDS OF UOM

Webinar

"Hardware Signal Processing - FPGA Implementation Aspects of DSP Algorithms "

IEEE SPS student branch chapter of University of Moratuwa proudly presented the webinar on **"Hardware Signal Processing - FPGA Implementation Aspects of DSP Algorithms"** on 29th of October 2020, 10.30 am to 11.30 am. It was approached through the Zoom virtual platform.
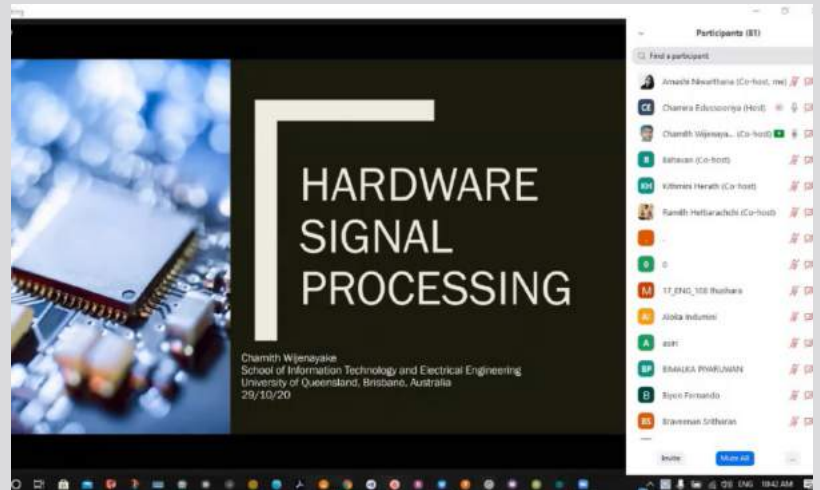
The webinar was conducted by **Dr. Chamith Wijenayake**, a senior lecturer at school of Information Technology and Electrical Engineering of University of Queensland, Brisbane, Australia.

By Charitha Rathnayake
Co-editor IEEE SPS Student Branch Chapter of University of Moratuwa

"Advances in Deep Learning"   ## Webinar
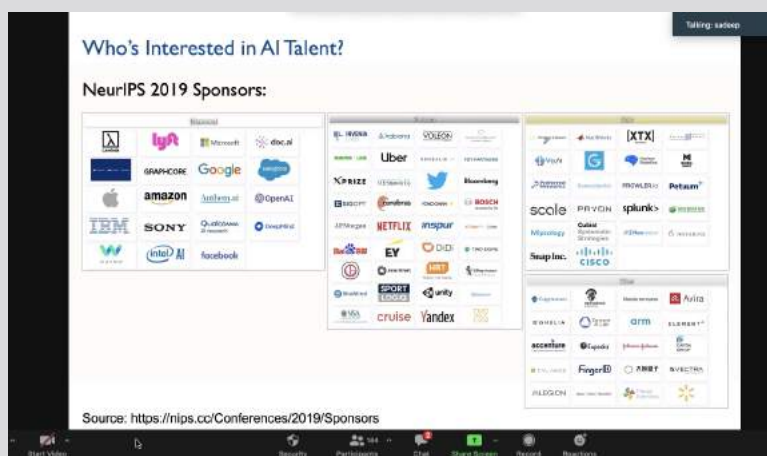
I**EEE SPS Student Branch Chapter of University of Moratuwa** hosted a successful webinar on **"Advances in Deep Learning"** to have a fruitful discussion and share knowledge among Deep Learning enthusiasts from both international and local audiences

Conducted **Dr. Sadeep Jayasumana**, who is a Senior Research Scientist at Google Research, New York.

By Kithmini Herath – Secretary IEEE SPS Student Branch Chapter of University of Moratuwa

The inception of the NPSS odyssey in Sri Lanka   **Webinar**

The webinar **"Introductory Session to IEEE NPSS"** was organized by **IEEE Nuclear and Plasma Sciences Society (NPSS)** Student Branch Chapter University of Moratuwa, on 22nd November 2020 to create awareness on IEEE NPSS. The session was successfully held with an enthusiastic audience towards the field.

Dr. Steve H. Gold, who is the secretary of the NPSS Plasma Science and Applications Committee, IEEE NPSS Chapter Coordinator and a Life Fellow Member of IEEE conducted the webinar.
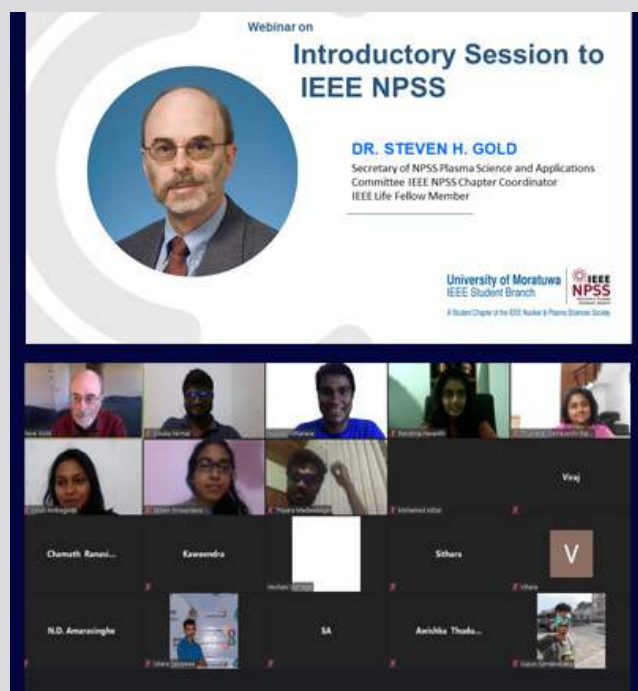
By Sehani Siriwardana
Secretary for IEEE NPSS Student Branch Chapter of
University of Moratuwa

AWARD   Darrel Chong Student Activity Award 2020

Marking another milestone in their journey, IEEE Industry Applications Society Student Branch of University of Moratuwa, received the "Darrel Chong Student Activity Award 2020 in the Silver Category, for their collaborative initiative, "Gammaddata IEEE Api" (IEEE for the countryside).

A Robotics Workshop was conducted for the benefit of secondary school students of Anuradhapura Central College, Anuradhapura. Over 70 school children from grade 7 to 12, had the opportunity to enhance their knowledge through the program. The program included an Introduction to Robotics, Arduino Programming, Introduction to Sensors and Actuators followed by Hands-on experience on programming, and finally a Fun Quiz (Kahoot) to test their knowledge.

By Maheshi B Dissanayake

ROBOTICS IN AGRICULTURE

By Ms. Prabuddhi Wariyapperuma and Prof. Pradeep Abeygunawardhana

Starting with the invention of simple tools such as wooden plows and the use of animals in the early civilizations, usage of technology has become prominent in the field of agriculture. Over the past centuries, farmers have adopted more technologies in the pursuit of greater yields. Eli Whitney's cotton gin which was invented during the Industrial Revolution and lawnmowers and tractors developed in the 19th Century have paved the path to our modern agricultural technologies. Currently, using robotics in agriculture has become one of the fastest growing technologies developed to perform numerous complicated tasks that are difficult for the humans to achieve.

Shortage of human labour is one of the largest issues faced in the agricultural industry. In the year 2017, in United Kingdom, 30-40% of the strawberries could not be harvested due to the lack of workforce. The engagement of youth in this industry has dropped drastically over the past few years spurred by their hatred in carrying out back aching and sweaty field work out in the sun.

*Figure 1 : AI powered and 5G enabled robot that monitors conditions inside a greenhouse
Source : Adapted from [3]*

The world is expecting a 70% increase in food production by 2050 than now. This goal can be accomplished by improving the existing technologies and introducing new technologies to the industry. There is a rapidly growing interest and focus in researchers and industrial manufacturers on developing agricultural robots with sensing technologies. It is believed that by moving on to a robotic agricultural system, an efficient and sustainable crop production can be achieved with less human intervention.

To begin with, what exactly is an agricultural robot? Simply put, an agricultural robot (also known as agribot or agbot) is a robot that is specialized for agricultural purposes. Agbots can be used to carry out tasks such as weeding, fertilizing, harvesting, controlling pests and collecting useful data from the field or greenhouse. This enhances the productivity and reduces the manual labour.

A well known author, Stephen King has quoted that "Sooner or later, everything old is new again". In the olden days, farmers were able to give individual attention to each plant in their small farms. The farmers visited the plant, respected it, removed the dead leaves and took off the caterpillars out of the plant. Similarly, agbots can be used to monitor each and every plant separately even in a farm or field with thousands of plants.

Agricultural robots have shown great promise in replacing human workers in many tasks and there are numerous interesting applications of robotics in agriculture.

Weed is an unwanted plant or enemy plant that competes with crops for resources such as nutrients, sunlight and moisture. It may seem trivial to some, but weeds have an enormous impact on agriculture. There are weeding agbots who are capable of roaming in the fields while inspecting the crop rows and pinpointing the weeds with the help of computer vision. The weeds can be destroyed with the use of chemicals or mechanically or through microwave destruction. Further, the chemicals can be delivered to the right spot in the right quantity needed rather than having to blanket-spray large fields. Weeding agbots can complete this task faster than any human. A weed-mapping robot named "Tom" has the capability of autonomously covering an area of approximately 50 acres per day and identifying and digging up the weeds without using any harmful weedicides [1]. Tom is fitted with two down facing cameras and uses an Artificial Intelligence (AI) program called Wilma to distinguish weeds from plants.

Figure 2 : "Trimbot" robot to trim bushes and prune roses
Source : Adapted from [4]

Timing is everything when it comes to harvesting as the crop losses can be prevented. Harvesting robots for picking vegetables and fruits are widely used in the fields and

greenhouses. "SWEEPER" is a sweet pepper harvesting robot that can pick one fruit in less than 15 seconds. SWEEPER can navigate autonomously in a collision-free path to the fruit with the help of in-built sensors and advancing algorithms. Greenhouse Robotic Worker ("GRoW") is a robot that can harvest tomatoes in a greenhouse. It uses state-of-the-art robotics, machine vision algorithms to identify the ripe fruits and robotic arms. A strawberry harvester developed by Green in United Kingdom can pick a strawberry every two seconds, thanks to the vision from RGB cameras and powerful algorithms. In the future, it is said that crops like corn and oranges will be completely cultivated and harvested by robots.

There are robotic farmers who have the ability to cultivate vegetables, fruits, wheat and rice. "Fendt Xaver" is a seed planting robot developed by Germany that uses satellite-based navigation. Analyzing the amount of nutrients in the soil is very important in crop growth. Taking soil samples by hand is an inefficient method and is error prone. Therefore, an autonomous robot named "SmartCore" is developed to navigate and obtain soil samples from the same specific location each year so that farmers can track how their soil is evolving with time. An AI powered autonomous robot called "Mamut" roams in the fields using a stereo camera and Light Detection and Ranging (LIDAR) to spot diseases and also estimates crop yields. In this way, the use of fertilizers can be reduced as it is one of the largest costs for crop farmers.

AI and robots are used in greenhouse and nursery environments as well. An example is Harvest Automation's container-moving robot named as "HV-100" or "Harvey" which has the capability of spacing out container plants properly [2].

It uses sensors to detect the containers, grasps them with robot arms and carries and places them at the required location. It can place around 240 pots per hour and can work continually even under rain and dust. It is seen that agbots can perform labour-intensive and repetitive tasks without any issue. China has developed an AI powered and 5G enabled robot that detects Carbon dioxide levels, humidity, wind velocity and temperature inside a greenhouse and sends the data to the control room [3].

"Trimbot" is a gardening robot developed by University of Edinburgh that uses 3D mapping technology to navigate autonomously and trim bushes and prune roses with the help of algorithms [4]. Researchers of Cambridge University have introduced a lettuce leaf peeling robot using machine learning and computer vision. "Kompano" is a robot that is used for de-leafing as it removes unwanted leaves from tomato plants. For the process of precision automated watering of the potted plants, a robot called "Aquarius" has been developed.

It roams inside a greenhouse while carrying a automated watering of the potted plants, a robot called "Aquarius" has been developed. water tank and performs 24×7 watering chores with the help of soil moisture sensors.

While greenhouses provide a great way to keep plants safe from the cold weather outside, tending to them is still a largely manual operation. A team led by Prof. Pradeep Abeygunawardhana, Sri Lanka Institute of Information Technology, has come up with the "HexaGrow" robot to help with the job. It measures soil moisture and pH levels, as well as temperature and humidity — all of which can be monitored by its human operators via a Smartphone App.

This robot — while it appears to still be a prototype — is able to navigate using a LIDAR system that scans the immediate environment. When it gets to the vicinity of what it's going to analyze,, it can then use a gripper arm to assess soil moisture by plugging a sensor into the ground.

Figure 3 : "HexaGrow" Robot

pH calculations, however, are a bit more involved, as an end-of-arm scoop picks up soil, and deposits it into a mixing chamber where it is measured with a load cell. The appropriate amount of water is then added depending on weight so that an accurate reading can be attained.

It is clear that agbots know no boundaries. We never imagined that simple, small and fragile robots that look like remote-controlled toys will ever create such drastic changes in agriculture. It is evident that we are witnessing the dawn of the age of robot farmers. Essentially, robotics can transform agriculture overnight.

Figure 4 : "HexaGrow" Robot

References

[1] "Weed-mapping robot cuts chemical usage", Eandt.theiet.org, 2020. [Online]. Available: https://eandt.theiet.org/content/articles/2019/12/weed-mapping-robot-cuts-chemical-usage/

[2] "Small Robot Helps Space Plants for Greenhouses and Nurseries. |AgriTechTomorrow", Agritechtomorrow.com, 2020. [Online]. Available: https:// www. agritechtomorrow.com/ story/2019/10/small-robot-helps-space-plants-for-greenhouses-and-nurseries-/11756/

[3] H. Claver, "Farming robot makes its debut in China", Future farming, 2020. [Online]. Available: https://www.futurefarming.com/Machinery/Articles/2019/8/Farming-robot-makes-its-debut-in-China-457791E/

[4] "Cutting-edge robot 'Trimbot' makes short work of gardening", WUR, 2020. [Online]. Available: https://www.wur.nl/en/Research-Results/Onderzoeksprojecten LNV/ Expertisegebieden/ kennisonline/ Cutting-edge-robot-Trimbot-makes-short-work-of-gardening-1.htm/

Thank You..!!

IEEE Sri Lanka Section executive Committee 2020

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