

IEEE News@UoJ

Newsletter of the IEEE Student Branch, University of Jaffna

Annual Newsletter 2022 - Vol. II

IEEE-SB-UoJ won **6** Awards

IEEE Sri Lanka Section

Outstanding Student Branch Award 2022

The IEEE Student Branch of the University of Jaffna consists of members from the Faculties of Science, Engineering and Technology of the University of Jaffna. The student branch was established in September 2018. Currently, there are six chapters and an affinity group established under the Student Branch, namely Computer Society, Electron Devices Society & Nanotechnology Council, Power and Energy Society, Robotics and Automation Society, Signal Processing Society and Women in Engineering Affinity Group. As a young student branch of the IEEE Sri Lanka Section, it strives among more than a hundred undergraduate students and graduate members from the University of Jaffna. It is an active branch with many activities being conducted throughout a year that focuses on enhancing the professional and technical skills, and knowledge of IEEE and non-IEEE members.

Special Recognition IEEE R10

Outstanding Student Branch Award 2022

IEEE R10 Exemplary Student Branch Award 2022

IEEE Sri Lanka Section

Emerging WIE Affinity Group [Student Branch Category] Award 2022

IEEE Sri Lanka Section

Special Recognition for Membership Recruitment and Retention 2021

IEEE Sri Lanka Section

Outstanding Branch Counsellor Award 2021



University of Jaffna
Student Branch



University of Jaffna
Student Branch

INSIDE THE ISSUE

- ▣ Messages
 - Counsellor
 - Senior Treasurer
 - Chairman (SL Section)
 - Chairman
 - Secretary
 - Joint-Editors
- ▣ Introduction to IEEE-SB-UoJ
- ▣ National/Regional Level Volunteers
- ▣ Chapters and Affinity Group
 - PES Chapter
 - CS Chapter
 - RAS Chapter
 - WIE Affinity Group
 - SPS Chapter
 - CIS Chapter
 - EDS & NTC Chapter
- ▣ IEEE-SB-UoJ AGM 2021/2022
- ▣ Events
 - Workshop
 - Coding Competition
 - Awareness Sessions
- ▣ Industrial Collaborations
- ▣ Articles
- ▣ Office Bearers



Newsletter Designer
Mr. Nageswaran Thileepan
Department of Computer Science,
University of Jaffna

Cover Story

Since its establishment in September 2018, the IEEE Student Branch of the University of Jaffna (IEEE-SB-UoJ) has emerged as a dynamic force, dedicated to securing grants, fostering technological innovation, and promoting excellence for the benefit of humanity. With a diverse membership consisting of students from the Faculties of Science, Engineering, and Technology, the IEEE-SB-UoJ has made significant strides in advancing the theory and practice of Computing, Engineering, and Technologies.

At present, the IEEE-SB-UoJ consists of the Women in Engineering (WIE) Affinity Group and six vibrant chapters, namely, Power and Energy Society (PES) Chapter, Computer Society (CS) Chapter, Robotics and Automation Society (RAS) Chapter, Signal Processing Society (SPS) Chapter, Computational Intelligence Society (CIS) Chapter, and Electron Devices Society and Nanotechnology Council (EDS-NTC) Chapter.

Awards and Recognition

The IEEE-SB-UoJ, despite its status as a young student branch within the IEEE Sri Lanka Section, has received notable recognition and prestigious awards at both national and Asia-Pacific regional levels. These achievements highlight the branch's dedication and impact within the IEEE community.

At the Annual General Meeting of the IEEE Sri Lanka Section held on February 7, 2023, at Hilton Colombo Residences, the IEEE-SB-UoJ received the following awards:

🏆 "Outstanding Student Branch Award": This award recognizes the IEEE-SB-UoJ as an outstanding student branch within the IEEE Sri Lanka Section. It acknowledges the branch's exceptional performance, initiatives, and contributions in advancing the field of Computing, Engineering and Technology.

🏆 "Emerging Affinity Group Award" for the IEEE WIE Student Branch Affinity Group: This award acknowledges the outstanding progress and dedication of the IEEE WIE Student Branch Affinity Group in the student branch category.

In addition to these national awards, the IEEE-SB-UoJ also secured prestigious recognition at the regional level. The branch was honored with the "IEEE Regional Exemplary Student Branch Award" from IEEE Region 10. This award highlights the exemplary performance of the IEEE-SB-UoJ as an active student branch, offering technical programmes, activities, and professional networking opportunities to its members, thus enabling them to develop critical skills.

Furthermore, at the SYWL Congress 2022 held in South Korea from August 11 to 14, 2022, the IEEE-SB-UoJ received the "IEEE Region 10 Outstanding Student Branch Award" for its exceptional activities in the Asia-Pacific Region. This award signifies the branch's significant impact, leadership, and accomplishments within the region.

Moreover, at the "IEEE Sri Lanka Section Awards" ceremony held on January 27, 2022, the IEEE-SB-UoJ was recognized with the "Special Recognition for Membership Recruitment and Retention" award. This accolade acknowledges the branch's outstanding efforts in attracting and retaining members, showcasing its commitment to building a vibrant and engaged IEEE community within the Sri Lanka Section.

During the same event, Dr. A. Ramanan, the former Counsellor of the IEEE-SB-UoJ, was honoured with the "Outstanding Branch Counsellor Award." This prestigious recognition reflects Dr. Ramanan's exceptional guidance, mentorship, and contributions to the growth and success of the student branch.

These awards and accolades serve as a testament to the IEEE-SB-UoJ's dedication, innovation, and impact in advancing the field of Computing, Engineering and Technology, as well as nurturing a strong community of students and professionals within the IEEE Sri Lanka Section.

Grants

The IEEE-SB-UoJ has successfully obtained several competitive grants to execute a range of activities aimed at university and school students. Notably, the branch achieved the following grants:

▶ The IEEE-SB-UoJ won the "60 Second Innovation Contest - 2021" in conjunction with the IEEE Day Celebrations. As a result, we secured a funding of USD 850 from IEEE.

▶ In 2022, the branch received competitive funding of USD 1,968.65 under the IEEE Pre-University STEM Portal Grant program. This grant aimed to promote IT skills among school students. It is noteworthy that the IEEE-SB-UoJ was selected for this funding opportunity from a pool of 143 applications worldwide, and only two projects from Sri Lanka were chosen. Over 200 school students in the northern province of Sri Lanka benefited from the programme.

▶ The IEEE WIE Affinity Group of the student branch secured a WIE special fund of USD 400 in 2022. This grant was obtained to promote technology among women, highlighting the branch's efforts to empower and support women pursuing careers in Computing, Engineering and Technology.

These grants not only reflect the dedication and innovation of the IEEE-SB-UoJ but also provide valuable resources to support its activities.

The Counsellor IEEE-SB-UoJ



Prof. Manivannan Siyamalan
Department of Computer Science,
University of Jaffna.

The IEEE Student Branch of the University of Jaffna (IEEE-SB-UoJ) is one of the most active student branches in Sri Lanka since its inception in 2018. The branch is now expanded with six chapters and the Women in Engineering (WIE) affinity group. Among them, the Computational Intelligence Society student branch chapter and the Electron Devices Society & Nanotechnology Council student branch chapter were the new additions in 2022 and they became the first chapters in Sri Lanka under the respective societies.

Due to the dedication, cooperation, and the hard work of the Counsellors/Advisors and the executive committees (past and the present), the branch received several international and national awards.

The IEEE members from the Faculties of Engineering, Science, and Technology of the University of Jaffna, other non-IEEE members of the university and the community greatly benefit from the activities organized by the IEEE-SB-UoJ. Despite the country's current economic crises, the branch organized various activities for the betterment of the students which includes tech-talks, workshops, industrial collaborations, soft skill developments etc.

Moreover, several of our student members were selected to contribute to various national level projects, which not only helps them to improve their leadership, team working and soft skills, but also gives a good visibility to the IEEE-SB-UoJ. Many congratulations to them.

This newsletter is another achievement of the branch. On behalf of the student branch, I thank and congratulate all the authors who contributed to this newsletter.

The Senior Treasurer IEEE-SB-UoJ



Prof. Amirthalingam Ramanan
Department of Computer Science,
University of Jaffna.

The IEEE-SB-UoJ remains committed to our members and volunteers in bringing awareness to the latest technology for the benefit of humanity. In 2022, though we reacted to the impact of COVID variants, we began to reopen in-person activities to strengthen our connections with scholars and technologists to make our members inspired by the emerging trends in computing and engineering. Together with our dedicated members and volunteers, the IEEE-SB-UoJ throughout the year was focused on helping especially IEEE student members and school students to succeed in countless ways. I am pleased to present the audited financial reports of IEEE-SB-UoJ for 2022. These reports indicate that the overall financial health became stronger, with a net balance of LKR 941,864.25 as of January 05, 2023, with the special funds of LKR 143,700.00 received by our WIE Affinity Group to conduct a workshop on IoT & Robotics, an amount of LKR 254,859.42 was received by the student branch as the IEEE rebate 2022, and a special fund of LKR 706,596.53 to conduct a series of programmes to inspire school students in STEM education. The IEEE-SB-UoJ had total expenses for 2022 of LKR 352,086.50. I submit these financial statements with confidence that IEEE-SB-UoJ continues to be a financially sound student branch at the University of Jaffna.

The Chairman SL Section



Prof. Pradeep Abeygunawardhana,
Chairperson,
IEEE Sri Lanka Section (2022/2023).

I warmly welcome all our readers to the newsletter produced by the IEEE-SB-UoJ. I wish a happy and prosperous 2023 to everyone who is reading this newsletter.

It is great to hear that the IEEE-SB-UoJ is producing a newsletter to enhance its members' technical knowledge and share their experiences. Out of 21 student branches under the IEEE Sri Lanka section, the IEEE-SB-UoJ is doing great with many activities with many students participating. It is pleased to see that the newsletter is helping its members to improve awareness about the events happening around the student branch.

As the Chair of the IEEE Sri Lanka Section, I would like to thank all who have contributed to this issue of the newsletter and I hope all the readers will enjoy the newsletter while sharing, recognizing, and appreciating the efforts put forth by IEEE volunteers of IEEE-SB-UoJ for the betterment of the membership and the society.

I wish the IEEE-SB-UoJ in the year of 2023.

The Chairman IEEE-SB-UoJ



Mr. Dilendra Tennakoon
Final Year Honours Degree Student,
Department of Computer Science,
University of Jaffna.

Releasing the second issue of the "IEEENews@UoJ" Newsletter of the IEEE-SB-UoJ is a proud achievement for all of us. As the Chairman of the Student Branch I extend my greetings to all our readers, and hope this publication will be of immense value to you in one way or another. The year 2021/2022 has not been very kind to all of us and we went through a rough time as a country due to numerous reasons. Nevertheless, we survived and have progressed through the year with determination and resilience. The same can be said for the Student Branch, and we grew to be the Student Branch with the second highest member count, received several awards including the Special Recognition for IEEE R10 Outstanding Student Branch Award 2022, IEEE Regional Exemplary Student Branch Award 2022, and the IEEE Sri Lanka Section Outstanding Student Branch Award 2022. We conducted several techtalks/sessions, established two new Student Branch Chapters: IEEE Computational Intelligence Society and the IEEE Electron Devices Society and Nanotechnology Council. Both of which are the first in the Sri Lanka Section. I believe there is still more to be achieved, a longer way to go and the potential to achieve it in the student branch. IEEENews@UoJ presents the reader with well-written articles carefully selected on interesting and enlightening topics and a record of the past year of IEEE-SB-UoJ, all of which are worthwhile and sure to enthrall the reader. I thank the Editor Ms. K. Pavithra, Designer Mr. N. Thileepan, Prof. M. Siyamalan and Prof. A. Ramanan for all their tireless effort and time put into releasing yet another successful issue of IEEENews@UoJ. Finally, I sincerely appreciate for the volunteers, IEEE members, staff and everyone else who contributed in some way to bring the Student Branch this far and for an unforgettable past term.

Wishes for a better and successful future!
Happy Volunteering!

The Secretary IEEE-SB-UoJ



Ms. Pavithra Kanmanirajah
Final Year Honours Degree Student,
Department of Computer Science,
University of Jaffna.

It gives me immense pleasure to pen my words for the second issue of our very own newsletter IEEE News@UoJ, released by the IEEE-SB-UoJ. It is with so much pride that we were able to conduct virtual events in a manner that offered our Student Branch a forum for creative thinking, discussion, information sharing, problem-solving, and decision making. The IEEE-SB-UoJ achieved some of the socio-emotional criteria, such as empowerment, engagement, and affiliation, which were addressed through various webinars, workshops, tech talks, collaborations, and contests. I am happy to report that, this newsletter, with the help and support of our Branch Counselor, Senior Treasurer, and all our lecturers, along with the hard work of our Student Branch, contains the contents that we believe will be of interest to you.

We hope you enjoy the issue.

Joint Editors IEEE News@UoJ



Ms. Pavithra Kanmanirajah
Final Year Honours Degree Student,
Department of Computer Science,
University of Jaffna.



Ms. Varsha Jeyarajalingam
First Year Undergraduate,
Department of Computer Science,
University of Jaffna.

It is a great pleasure to work as the Editors of the second issue of our newsletter. In this issue, we report the events that were organized by the student branch, its chapters and the affinity group during 2021/2022. In addition, we report the achievements, awards, and the recognitions earned by the student branch and its members. A set of selected scientific articles from the members of IEEE-SB-UoJ are also published in this newsletter. We do hope that this newsletter is a good platform for the members of the IEEE-SB-UoJ to express their creativity and skills. We wish to thank our Senior Treasurer Prof. A. Ramanan for always being with us and encouraging our students to take the student branch to the next level. Also, we are really thankful to our Branch Counsellor Prof. M. Siyamalan for his tremendous support to the student branch. In addition, we wish to thank Ms. Dharmalingam Hashini Rasanjali for proofreading this newsletter. Our special thanks to Mr. N. Thileepan for his wonderful creative design for the pages of our newsletter. Finally, we would like to thank all the volunteering pillars who worked hard behind the scenes for completing this newsletter successfully.



IEEE Student Branch - University of Jaffna

Introduction

The IEEE-SB-UoJ consists of members from the Faculties of Science, Engineering and Technology of the University of Jaffna, which is situated in Jaffna the Northern part of Sri Lanka. The student branch was established on the 27th of September 2018. Currently, there are six chapters and an affinity group established under the IEEE-SB-UoJ, among which the Signal Processing Society, the Computational Intelligence Society, and the Electron Devices Society and Nanotechnology Council Student Branch Chapters were established during the period 2021/2022.

As a young student branch of the IEEE Sri Lanka Section, it strives among more than a hundred undergraduate students

and graduate members from the University of Jaffna. It focuses on achieving IEEE's objectives, namely fostering technological innovation and excellence for the benefit of humanity and promoting the theory as well as the practice of all aspects of Computer Science, Computer Engineering, Information Communication Technology, Electrical, and Electronics. It provides undergraduates a platform to prosper and flourish in their innovative ideas and technical and non-technical skills. It is a very active branch with many activities throughout the year that focuses on enhancing the professional and technical skills and knowledge of IEEE and non-IEEE members.

Vision

Become a remarkable student branch dedicated to empower technological leaders by encouraging and facilitating students to attain highest achievements by developing their skills.

Mission

Foster technological innovation and excellence for the benefit of humanity and promote the theory as well as the practice of all aspects of Computer Science, Computer Engineering, Information Communication Technology, Electrical and Electronics Engineering.

National/Regional Level Volunteers



Dr. Ahilan Kanagasundaram
Editor of the IEEE Sri Lanka Section



Mr. Dimuthu Anuraj

- Editorial Committee Member - IEEE Sri Lanka Section.
- IEEE STEM Champion at IEEE TryEngineering.
- Program Committee Member at IEEE Connecting the Unconnected Challenge in IEEE Future Direction.
- Manager at IEEE Puzzler Community.
- Lead Ambassador at IEEE Collaborate.



Mr. Heshan Nayanajith

- Lead Coordinator of Public Visibility - IEEE R10 Student Activities Committee 2023.
- Vice Chair of Public Visibility for Student Activities Committee 2023 IEEE Sri Lanka Section.
- Graphic Designer and Supporting Coordinator of IEEE R10 Student Activities Committee.
- Editorial Committee Member - IEEE Sri Lanka Section



Mr. Nickson Joram
Lead Ambassador of IEEEExtreme 16.0
IEEE Sri Lanka Section



Ms. Mayuri Rajakaruna

- Social Media Coordinator of IEEE Computer Society Sri Lanka.
- Performance Tracking Coordinator of Chapter Engagement IEEE Sri Lanka Section SAC.
- Social Media Admin of IEEE Brain Global Community.
- Volunteer Training & Development Coordinator of Training and Development Subcommittee - IEEE Young Professionals



Ms. Divya Varatharajan
Digital Experience and Branding Coordinator of Public Visibility
IEEE Sri Lanka Section SAC



Mr. Dilendra Tennakoon
Project Lead (SYWC) of Member Activities
IEEE Sri Lanka Section SAC



Ms. Chamodi Hansika
Social Media Coordinator of Public Visibility
IEEE Sri Lanka Section SAC



Ms. Hiruni Thakshila
Publicity Team Lead of SLInspire
IEEE Young Professionals



Ms. Pavithra Kanmanirajah
Secretary Team Member of AI Driven Sri Lanka
IEEE Young Professionals



Ms. Dulmi Leelarathna
Program Team Member of SLInspire
IEEE Young Professionals



Ms. Gayathri Bandara

- Logistics Team Member of SLInspire IEEE Young Professionals.
- Ambassador for University of Jaffna - IEEE DAY



Ms. Ayomi Darshika
Publicity Team Member of SLInspire
IEEE Young Professionals



Mr. Eranga Kodithuwakku

- Program Team Member for Technical Activities. Student Activities Committee - IEEE Sri Lanka Section.
- Design Team Member of Y2NPro - IEEE Young Professionals



Mr. Imesh Nuwantha

- Design Team Member of Let'sTalk - IEEE Young Professionals.
- Student Ambassador for the University of Jaffna - IEEEExtreme 16.0.
- Editorial Committee Member - IEEE Sri Lanka Section



Mr. Kushan Rathnayake
Finance Team Member of SLInspire
IEEE Young Professionals



Ms. Mani Manohari

- University Representative of INSL IEEE Sri Lanka Section.
- Co-chair - Subcommittee of INSL Northern Province



Mr. Kalpa Nayanajith
Video Editor of Volunteer Training & Development
Sub Committee -IEEE Young Professionals Sri Lanka.



Mr. Bhagya Kavijan
University Representative of IEEE StudPro 5.0
IEEE Young Professionals Sri Lanka



Ms. Nigee Hettige
Member of Secretariat & Editorial Committee
IEEE Sri Lanka Section SIGHT



Ms. Nipuni Fernando
Member of the Editorial Committee
IEEE Sri Lanka Section



Mr. Chanuka Ranathunga

- University Ambassador StudPro 5.0
- Designer IEEE Sri Lanka Section PES Chapter



Try not to become a man of success, but rather try to become a man of value.

— Albert Einstein



Power & Energy Society®

PES Chapter IEEE-SB-UoJ



The Advisor

Prof. A. Atputharajah
Department of Electrical and Electronic Engineering,
University of Jaffna.

Today the country is facing its biggest challenge. Here Science, Technology, Engineering and Mathematics plays a major role in uplifting the country as well as keeping up the transparency, on whatever possible, in its management.

Accordingly, the IT sector plays a major role in automating all possible simple operations. This provides all information with date and time (first in first out transparency), documents transferring from one place to another place without loss and very fast action (instantly - reduces labor cost and reduces delays while increasing reliability and transparency). Simple example is foreign leave approval system implemented in the University system, which reduces the duration to get approval, from months to days and many of us experienced this. All operations should be automated where the developed countries have already taken in this direction. It also brings a number of advantages such as paper-less operations, which might have helped the country tremendously as what we are experiencing is a shortage of paper. Further reducing institutional operational cost in terms of employees salaries. Further speeding up operations itself has huge benefits in terms of efficient and effective operations. This will automatically make people's lives more efficient and effective while reducing wastage.

Further the Power and Energy sector, which is a large sector in the country, needs to implement the projects, which were planned already. Enormous time was spent on planning and it took further time on implementing. So many Renewable Energy based power plants were planned and not implemented on time. These all due to inefficient operations of Government sectors. These all need to be speeded up by properly implemented administration. When the administrative operations are automated, it becomes transparent and thus makes all accountable to the officer responsible. Then this will reduce any time delay of any specific officer. The automation also makes it transparent to the top rank officer where the operation is getting delayed.

In the higher education sector, all top class students are selected for free education. This education needs to be modified by reducing classroom teaching to project based teaching. The projects could be taken from the Industries or communities. Those projects could be arranged in such a way that will solve problems in the industries or communities. Every person's time should be effectively utilized. For example when the students are learning they should also be involved with the lecturers to solve real world problems in the industries or communities. Then all students' projects will lead to an outcome instead of academic activities. This will also produce responsible and practically experienced and solution based knowledgeable graduates.



The Chairman

Mr. Rajitha Priyankara Hemachandra
Final Year Undergraduate,
Department of Electrical and Electronic Engineering,
University of Jaffna.

It is my great pleasure to extend my heartfelt greetings to the readers of the second issue of the newsletter of IEEE-SB-UoJ. I am humbled by the opportunity to serve as the Chairman of the IEEE Power and Energy Society Student Branch Chapter, University of Jaffna. We are blessed with many dedicated volunteers who are deeply concerned about our discipline, its standards, and its contributions in an ever-growing world. I honestly appreciate my committee and all the members of the IEEE PES Student Branch Chapter, University of Jaffna for their immense commitment and collaboration in uplifting the standards of our society. Our prime objective is to foster technological innovation, creativity, and excellence in our students in the power and energy sector, for the benefit of humanity and for the advancement of technical professionalism. We are contributing to assist fellow students with precious opportunities to learn, share and innovate in the field of power and energy. I believe that this newsletter will serve as a window through which the complete profile of all the volunteering activities, achievements, and progress made during the stipulated period can be viewed.

Annual General Meeting 2023

The Annual General Meeting of the IEEE-PES-SB Chapter of the UoJ for the year 2022 was held on the 27th of March 2022 from 5.00 pm to 6.00 pm via the Zoom platform. The gathering was welcomed by Mr. Ishara Mahanama, former Chairman of the Student Branch Chapter. Followed by that, previous meeting minutes were presented by Miss. Achintha Rajapaksha, former Secretary of the Student Branch Chapter. Then the meeting was addressed by the former advisor of the Chapter, Mr. R. Valluvan, and it was followed by the election of a new committee. Prof. A. Atputharajah was appointed as the new Advisor of the Student Branch Chapter. Finally, the AGM was concluded along with the vote of thanks from the newly appointed Chairman.

EVENTS

PS CAD Workshop

The first session of the PS CAD workshop was conducted on 1st of November 2022 from 4.00 pm to 6.00 pm at the Simulation laboratory of the Department of Electrical & Electronic Engineering, Faculty of Engineering, University of Jaffna by Prof. A. Atputharajah, the former Dean of the Faculty of Engineering, University of Jaffna. The main objective of this session was to deliver preliminary knowledge to the students on PS CAD as it is a

powerful tool to visualize and analyze power systems and to give them a hands-on experience, while convincing them about the importance of learning and applying this tool for analyzing power systems. The targeted audience of this event was final year undergraduates of the Electrical & Electronic Engineering Department of the University of Jaffna who are interested in the power and energy sector. The event was concluded as a successful and an effective session.

PS CAD WORKSHOP
PSCAD is the professional's simulation tool for analyzing power systems transients.

01/NOV/2022

FREE ENTRY

START
4.00 pm - 6.00 pm

PLACE
Simulation lab
@elec_department

PROF. ARULAMPALAM
ATPUTHARAJAH
Professor in Electrical and Electronic Engineering
Department of Electrical and Electronic Engineering

Specially for final year students & 5th year students in Electrical & Electronic engineering

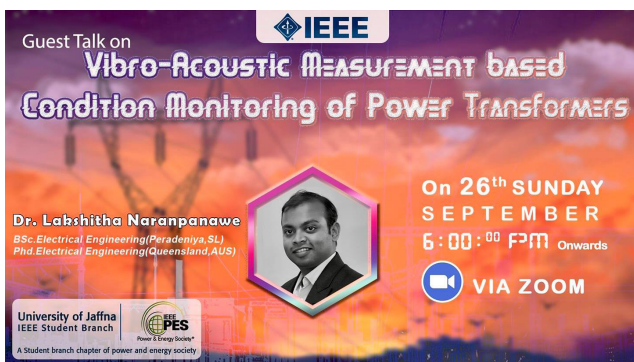
Organized by Power & Energy Society/IEEE student branch | University of Jaffna IEEE Student Branch | PES



Guest talk on "Vibro-Acoustic Measurement Based Condition Monitoring of Power Transformers"

The Guest talk on "Vibro-Acoustic Measurement Based Condition Monitoring of Power Transformers" by Dr. Lakshitha Naranpanawe was conducted on 26th September 2021 from 6.00 pm to 7.00 pm via Zoom platform.

Dr. Lakshitha Naranpanawe is currently a Research Fellow attached to the School of Information Technology and Electrical Engineering, the University of Queensland, Brisbane, Australia. He received BSc and Ph.D in electrical engineering degrees from the University of Peradeniya, Sri Lanka and the University of Queensland, Australia, respectively. The main objective of this session was to deliver more knowledge to the undergraduates on the Condition Monitoring of Power Transformers. The event was successfully completed with over 70 participants.



Webinar on "Engineering Ethics"

The webinar session on "Engineering Ethics" was conducted by Eng. Thilak De Silva (Chairman, Engineering Council Sri Lanka) and Eng. Asela C. R. Galappattige (CEO, Sri Lanka Telecom Services Ltd.), on the 27th December 2021 from 7.00 pm to 9.00 pm, via Zoom platform. The IEEE-PES-SB Chapter of the UoJ organized the event together with IEEE-RAS-SB Chapter, UoJ and the Institution of Engineers Sri Lanka (IESL). This event was supported by the IEEE-PES-Chapters Student Activities Committee of the IEEE Sri Lanka Section. The main objective of this session was to enhance the knowledge of undergraduates and all the participants on engineering ethics. The event was a massive success with the participation of over 220 participants.



5G TECHNOLOGY

Ms. Shobiga Sivabalan
Third Year Undergraduate,
Faculty of Science, University of Jaffna.

5G technology is the fifth generation of the Internet and is considered the fastest and most secure means of data transfer so far. Its speed is more than 1Gbps, which is about ten times faster than a normal wireless mobile phone. 5G is much more powerful than its previous generations due to its high-speed data transfer and low latency.

5G will be able to sustainably satisfy the requirement of the 1000-time traffic growth. It provides users with fiber-like access data rate and "zero" latency user experience. It is capable of connecting 100 billion devices, and able to deliver a consistent experience across a variety of scenarios including the cases of ultra-high traffic volume density, ultra-high connection density, and ultra-high mobility. 5G will also be able to provide intelligent optimization based on services and users' awareness and will improve energy and cost efficiency by over a hundred times, enabling us all to realize the vision of 5G, "information a finger away, everything in touch."

How does 5G Work?

The transmission of the 5G network does not require any type of tower, but rather the transmission of signals through small cell stations in rooftops or electric poles. These small cells are significantly more important because of the millimeter-wave spectrum. Various state-of-the-art technologies such as Multiple Input Multiple Output (MIMO), Time Division Duplex (TDD), etc. are used in 5G. MIMO technology provides downloading capability with an intensity of around 952 Mbps.

Evaluation from First Generation to Fifth Generation

In 1980, 1G Technology was launched, which worked on analog radio signals and supported only voice calls. 2G Technology was launched in the 1990s which used digital radio signals and supported both voice and data transmission with a bandwidth of 64 Kbps. In the 2000s, 3G Technology was launched with a speed of 1Mbps to 2 Mbps and it had the ability to transmit telephone signals including digitized voice, video calls and conferencing. 4G Technology was launched in 2009 with a peak speed of 100Mbps to 1Gbps.

Advantages of 5G Technology

Some of the important advantages of 5G Technology are: It is expected to offer advanced mobile broadband that can meet high coverage requirements, high resolution and bi-directional large bandwidth shaping, provides technology to gather all networks on one platform and to facilitate subscriber supervision tools for quick action. In addition, it will provide a huge broadcasting data (in Gigabit), which will support more than 60,000 connections. It can be easily manageable with the previous generations. It supports heterogeneous services (including private networks), and provides the possibility to provide uniform, uninterrupted, and consistent connectivity across the world.

Challenges of 5G Technology

Some of the challenges of the 5G technology are: the proposed speed of 5G is difficult to adopt considering the inefficient technical support in most parts of the world. 5G requires investors to invest more than \$2000 billion per year, which discourages investors. The switch from 4G to 5G will be infrastructure intensive and the development of infrastructure for 5G is very expensive.



IEEE COMPUTER SOCIETY

CS Chapter IEEE-SB-UoJ



The Advisor

Dr. S. Mahesan
Department of Computer Science,
University of Jaffna.

The IEEE Student Branch at the University of Jaffna is releasing its second issue of the Newsletter, IEEE@UoJ. I am happy to write this note as an advisor to the Computer Society Chapter of this branch.

The Chairman of the Computer Society planned for annual events based on a survey conducted among the Computer Science related students. Due to constraints in time, the society was able to implement only part of the plans. The rest can still be brought forward for the completion of the good plan.

At this juncture I wish to congratulate the committee of the IEEE-SB-UoJ for their award-winning activities. The Computer Society chapter also takes part in the happy moments of the celebration. I wish to thank all the members, national/regional level volunteers for their contribution and also wish to thank the counsellor and senior treasurer for their valuable guidance and timely decision to lead the branch towards the right direction.

I wish the new committees of the branch and its societies will take forward good activities along with new fruitful activities on the mission in order to achieve the vision of the IEEE-SB-UoJ.



The Chairman

Mr. Heshan Nayanajith
Final Year Honours Degree Student,
Department of Computer Science, University of Jaffna.

I am pleased to write this message for the second issue of the newsletter "IEEE@UoJ" as the Chairperson of the IEEE Computer Society Student Branch Chapter of the University of Jaffna.

As the student branch was started in 2018, we came along a challenging path to the position that we are in today. When the branch was started we didn't have any sectional or regional level volunteers with much experience. However, in 2021 we won many awards and recognitions in the IEEE Boost recognition Ceremony and in IEEE Sri Lanka Section Awards night. I'm really happy to be a part of those winning moments and I wish you all the best to obtain those remarkable winnings this year also.

As I started as a chairperson of the IEEE-CS-SB Chapter, we conducted a survey to get an idea from the Computer Science-related students to plan our yearly plans. By considering those and by getting advice from our Chapter Advisor Dr. S. Mahesan, we came up with an awesome plan line-up and at the moment we are at the stage of executing those. So I hope those activities also will help to bring IEEE-SB-UoJ name to a remarkable place in IEEE Sri Lanka Section as well as in IEEE Region 10.

Inaugural General Meeting 2022

The Annual General Meeting of the IEEE Computer Society was held on 14th March 2022 at 4.00 p.m via Zoom Platform. The session started with a welcome speech and followed by a Guest Speech. The guest speaker Mr. Chamika Sudusinghe (Chair, Student Activities Committee, IEEE Sri Lanka Section) gave an introduction about the benefits of IEEE CS Chapter membership and IEEE Computer Society Sri Lanka Chapter Activities. In addition, he briefed the opportunities, in terms of scholarships awarded to the IEEE CS members. Then, the previous committee's Secretary minutes were read by Mr. Dilendra Tennakoon. Next, we moved to the important part of the AGM in electing the new office bearers. The rules and regulations for the election were explained and the election was held for the year 2022/2023. After the new committee members were elected, the new Chairperson delivered his speech with gratitude. The session was successfully completed with over 40 participants.

EVENTS

Flip the Pages of IEEE Volunteering

The session titled "Flip the Pages of IEEE Volunteering" was held on 30th June 2022 at 6.30 p.m via Zoom Platform with over 30 participants. There were three speakers who shared their experiences. Our first speaker Mr. Chamika Sudusinghe (Chair, Student Activities Committee, IEEE Sri Lanka Section), shared his previous volunteer experience with IEEE and the benefits he received from it. After that, Ms. Thihara Mallikaratchy (Industry Engagement Coordinator - Student Activities, IEEE Computer Society Sri Lanka Chapter) briefed the audience about IEEE volunteer opportunities and why volunteers should take advantage of them. She also described how the volunteer process works and the importance of attending conferences. After that, Mr. Thimira Chandrasekara (Vice Chair - Chapter Engagement, Student Activities Committee, IEEE Sri Lanka Section) shared how his own experiences and skills developed, as he progressed through his IEEE career. The session followed with Q&A. Many questions were dropped in the Zoom chat related to IEEE volunteering and national project opportunities. Finally, the session concluded with a vote of thanks.

Flip the pages of IEEE volunteering

Chamika Sudusinghe
Chair
Student Activities Committee
IEEE Sri Lanka Section

Thihara Mallikaratchy
Industry Engagement Coordinator
(Student Activities) IEEE Computer
Society Sri Lanka Chapter

Thimira Chandrasekara
Vice Chair - Chapter Engagement
Student Activities Committee
IEEE Sri Lanka Section

📅 30th May 2022 ⌚ 6.30 pm via 📺 zoom

REGISTER NOW
<https://bit.ly/flip-the-pages-of-ieee-volunteering>

Let's Git Together

The "Let's Git Together" technical session was held on 21st June 2022 at 5.00 p.m via Zoom Platform. The Session started with a small introduction about the speaker Mr. Dilum De Silva (IoT Engineer at Hectre Group New Zealand, Visiting Lecturer at IIT Co-Host TechSideChat at GitHub). He shared his experience and knowledge in Git and GitHub. The session was conducted as a presentation session with a demonstration done by Mr. Lakshitha Viraj (Final year Undergraduate, Department of Computer Science, UoJ). The session focused on the basics of version control and GIT. Speakers gave a deep idea to the audience and gave answers to all the questions raised to them. The overall session was very useful and informative especially for the students who are doing their project work. The session was successfully completed with 30+ participants.



Info industry v1.0

As the first initiative, the IEEE Computer Society Student Branch Chapter of the University of Jaffna organized the "Info Industry v1.0" series of sessions. The first session in collaboration with IFS (leading enterprise software solution provider) was conducted via zoom on 30th September 2022 from 6.30 p.m. Our speakers Mr. Supul Mallawarachchi (Program Manager, IFS R&D), Mr. Rifki Razick (Vice President Development and Extensibility) and Mr. Shawn Britto (Lead Systems Engineer) explained about IFS, their working style, and their expectations of freshers and newbies. Over 40 participants attended the session and got to know about IFS and its work culture.



Privacy and Security in the Digital Era

Ms. Vieronicka Kanesamoorthy
 Second Year Undergraduate,
 Department of Computer Science,
 Faculty of Science, University of Jaffna

"People often represent the weakest link in the security chain and are chronically responsible for the failure of security systems" - Bruce Schneier (cryptographer and computer security professional and writer of many books related to computer security and cryptography).

Security and privacy are two widely used terms in this digital era, and they are about safeguarding data and safeguarding user identity respectively. Data security, Cyber security, and Blockchain play a major role in the field of privacy and security.

Data Security

Our data is exposed to the possibility of being attacked, stolen or harmed no matter where it resides. Due to social engineering and other attacking techniques we cannot ensure hundred percent security for our data. However, we can try our best to secure it by the use of techniques such as encryption, data erasure, access controls, data masking, data resiliency, authentication and backup and recovery. Effective data security takes into account the sensitivity of various datasets and corresponding regulatory requirements. Confidentiality, Integrity, and Availability are three core elements of data security that all organisations should adhere to, and are known as the CIA triad. CIA triad functions as a security model and framework for data security. Though it's really a hard task to ensure security for data, there are several steps, tactics and best practices that can help to minimise the chances of data breach, loss and exposure. Without making common data management mistakes the data and sensitive files should be quarantined and protected. In addition, high risk activities should be blocked when using websites to ensure the security of data.

Cyber Security

Since digital technologies play a bigger role in everyone's lives, cyber security has become important as it protects all categories of data from theft and damage. Just as physical security protects buildings and people in them from various physical threats, cyber security safeguards digital technologies and their users from digital dangers. Cyber security is a broad topic covering many different disciplines, actions, threats and ideas. However these parts come back to the same idea, protecting people's digital lives and assets. With the widespread adoption of digital technologies and the immense amount of data being used today, numerous cybersecurity measures have been developed, including network security, application security, cloud security, information security, endpoint security, and more. Additionally, managing cyber threats like malware, phishing, insider threats, man-in-the-middle attacks, and botnets is crucial to maintaining security. Cybersecurity best practices that can be implemented include using anti-malware software, verifying before trusting, updating frequently, encrypting data where possible, segmenting networks, creating backups of sensitive files, and regularly reviewing security measures.

Blockchain

Blockchain is another major aspect of security and privacy in the digital world. Blockchain started as a way to store and secure digital data. It is an openledger that several parties can access at once. Blockchain can provide secure transactions, reduce compliance costs and speed up data transfer processing. The CIA triad mentioned above is highly maintained by blockchain technology which implies that the trust is maintained in many linked fields such as business, finance, law, medicine, real estate etc.

Cryptocurrency is also related to Blockchain which is a coded string of data representing a currency unit, and they are being served as both a currency and an accounting system. Cryptocurrency is a digital or virtual currency that is meant to be a medium of exchange. It is quite similar to real-world currency, except it does not have any physical embodiment, and it uses cryptography to work.

Technology is just a tool, we the human beings should work with that tool with self discipline and self control which will pave way to successful protection in any field. This privacy and security can be a complex topic but it is essential. Everyone from the world's most powerful CEOs to casual Facebook users should understand the importance of security. Understanding privacy and security is the basic and first step to staying safe in today's digital world.



RAS Chapter IEEE-SB-UoJ



The Advisor

Mr. N. Pathmapirian
Department of Computer Engineering
University of Jaffna.

The IEEE Robotics Automation Society Student Branch Chapter of the University of Jaffna has opened doors to serve the students who have an interest in automation. When a university student is involved in club activities he also gets benefitted and hence it is a "win-win" situation for the community as well as the society. It is with great enthusiasm that I have taken up the Advisor for the year 2022/23 and look forward to the Worthy year 2022/23 where we shall engage with one another in all the activities like workshops and webinars to guide the students to achieve their goals. Wishing the new team for their future endeavors and a great year of service.



The Chairman

Mr. M.W.M. Keshan
Final Year Honours Degree Student,
Department of Computer Engineering
University of Jaffna.

As the Chairman of the IEEE Robotics and Automation Society Student Branch Chapter, University of Jaffna, it gives me great pleasure to extend a hearty greeting to each and every reader of the second volume of the IEEE News@UoJ newsletter.

IEEE RAS-SBC-UoJ was established in July 2021. We are blessed to have many active volunteers who are truly interested in our field. The RAS's objectives are scientific, literary, and educational in character, which aim to foster the development and facilitate the exchange of scientific and technological knowledge in Robotics and Automation. RAS is interested in both applied and theoretical issues in Robotics and Automation. Robotics is not limited to intelligent machines and systems while automation includes the use of automated methods in various applications to improve performance and productivity. Society strives to advance innovation, education, and fundamental and applied research in Robotics and Automation.

As of date, the IEEE RAS-SBC-UoJ has successfully held events like workshops, tutorials, and guest talks and intends to hold numerous events in the near future to enhance the Robotics and Automation knowledge and skills of the undergraduate students of the University of Jaffna.

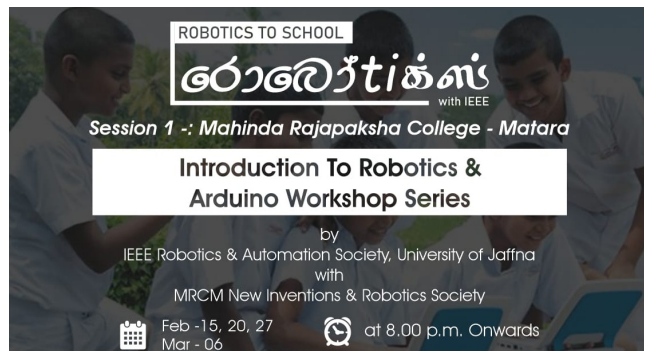
Annual General Meeting 2022

The AGM of the IEEE RAS-SBC-UoJ was conducted on 27th of July 2022 from 7.30 pm to 9.00 pm via the Zoom platform to appoint a new committee. The previous Advisor Mr. S. Sangar addressed the meeting, and then, the Secretary conducted the election and appointed the new committee. Finally, the newly appointed Advisor Mr. N. Pathmapirian addressed the meeting, and the AGM was concluded.

EVENTS

Robotics to School-රොබෝතික්ස් with IEEE

The virtual workshop series "Robotics to school-රොබෝතික්ස් with IEEE" was organized by the IEEE RAS-SBC-UoJ to create awareness in the field of Robotics and Automation among school students. This series was organized in collaboration with the New Inventions and Robotic Society - Mahinda Rajapakse College, Matara. It consisted of four virtual workshop sessions conducted from the 15th of February to the 7th of March 2022. The key resource persons for the event were Mr. Banula Lakwindu, Mr. Anuka Mithara, Mr. Madusha Keshan, and Mr. Isuru Akalanka - Undergraduate students from the Faculty of Engineering, University of Jaffna. The event covered the introduction and several other key areas of Arduino Programming with live demonstrations and implementation of different projects. The workshop series was successfully concluded with the participation of over 35 school students.



Introductory Session for "IEEE R10 Robotics Competition 2022"

An introductory session on "IEEE R10 Robotics Competition 2022" was held on the 12th of August 2022 from 7.00 pm to 9.00 pm via the Zoom platform to introduce Innovative Robots Development for Healthcare and Humanitarian Applications Project 4.0. The guest speaker, Mr. Thimira Chandrasekara, (Undergraduate - Electronic Engineering, SLIIT) briefly gave an introduction about the competition, its eligibility criteria, the rules and regulations, judging criteria and the prizes. The target audience for the event were undergraduates from all the universities in Sri Lanka. More than 50 students participated in the session.

Internet of Things for Sustainable Community Development

The talk "Internet of Things for Sustainable Community Development" addressed a portfolio of cutting-edge, interdisciplinary research developments and challenges in environmental, climate change, energy, water, health, mining, agro-economic, and cybersecurity that limits the development of a sustainable community. This talk aimed to introduce the usage of IoT and its challenges in these fields of study. The event was organized by the THREE-Lanka Project - University of Jaffna Center jointly with IEEE RAS-SBC-UoJ, Mechanical Engineering Society UoJ, Electrical and Electronic Engineering Society UoJ, IEEE PES-SBC-UoJ, IEEE SPS-SBC-UoJ and IESL Vadakkin Chapter. The resource person for the event was Dr. S. Thananjeyan (Senior Lecturer, Department of Electrical and Electronic Engineering, UoJ). The session was conducted on the 19th of January 2022, from 7.00 pm to 8.00 pm, virtually with the participation of over 20 participants.



WIE Affinity Group IEEE-SB-UoJ



The Advisor

Dr. (Mrs.) Barathy Mayurathan
Department of Computer Science,
University of Jaffna.

It is a great pleasure to congratulate the IEEE-SB-UoJ on presenting the second issue of the newsletter for the IEEE community. I believe this will contribute to the dissemination of knowledge and awareness in a wide area of disciplines.

IEEE is the world's largest technical professional organization dedicated to advancing technology for the benefit of humanity. The IEEE-SB-UoJ is one of the outstanding and very active student branches in Sri Lanka, thanks to its members for their commitment and heartily dedication. I wish the IEEE-SB-UoJ great success in all its endeavors. I wish all of the office bearers for this accomplishment on publishing the newsletter successfully. I wish you all the best for the success of the upcoming issues of this wonderful initiative in future.



The Chairman

Ms. Kokila Madhuwanthi
Third Year Honours Degree Student,
Department of Computer Science, University of Jaffna.

It is my pleasure to be appointed as the Chairperson of IEEE WIE Student Branch Affinity Group University of Jaffna for the year 2022 and I would also like to add my heartiest greetings to all the members of the 2022 new Executive Committee. I will take this opportunity to thank our past executive committee for their valuable activities and their sacrifices for the university. We would like to express our heartfelt thanks to our WIE-SB-AG-UoJ Advisor Dr. (Mrs.) B. Mayurathan, IEEE-SB-UoJ Counsellor Prof. M. Siyamalan and IEEE-SB-UoJ Senior Treasurer Prof. A. Ramanan for their valuable advice and guidance and look forward to their close support to carry out the work well in the future.

Annual General Meeting 2022

The first AGM of IEEE WIE-SB-AG-UoJ was held on 6th of September 2022 to assign the new executive committee for the year 2023. First, the welcome speech with a small introduction on WIE was given by Ms. T. Methusha the former Chair of IEEE WIE-SB-AG-UoJ. Then Dr. (Mrs) B. Mayurathan, Advisor, IEEE WIE-SB-AG-UoJ delivered her speech. The guest of honour, Dr. (Ms.) Akila Wijethunge (Chair, IEEE WIE Sri Lanka Section) then addressed the audience. Her speech included an introduction to IEEE WIE, the benefits of joining WIE and some special moments of her IEEE journey. Then the annual report was submitted by Ms. R.H.M. Mayuri Rajakaruna and Ms. K. Pavithra (Former Treasurer of IEEE WIE-SB-AG-UoJ) presented the financial report for the year 2021/2022. After that, the election for different positions were conducted.

EVENTS

Spill the Ink - Poetry Competition

In honour of the International Day of the Girl Child 2021, the IEEE WIE Affinity Group organized a poetry competition for the first time under the theme of "Digital Generation. Our Generation". The details of this competitions were mainly published via WhatsApp, Facebook, and LinkedIn social media platforms. Female undergraduate students from all universities in Sri Lanka were eligible to participate in the competition. Eighteen submissions were received from students from seven Sri Lankan universities. The ranking was based on both voting obtained from social media for the post related to the submission and the marks received from a judging panel. Ten merit certificates were issued in addition to the certificate and a cash prize for the winner.



Workshop on Roadmap to successful project

A virtual webinar on "Road Map to Successful Project" was held on the 27th of September 2021, from 6.00 p.m. to 7.00 p.m. Ms. Abarnah Kirupananda (Editor, IEEE WIE Sri Lanka Section, Senior Lecturer at IIT, Sri Lanka) was the resource person for this workshop. More than seventy students benefited from this workshop.



Workshop on IoT and Robotics

The IEEE WIE-SB-AG-UoJ secured a special funding of USD 400 from IEEE R10 to conduct an IoT workshop under the title "An awareness session on IoT and Robotics". This workshop was successfully conducted on the 26th of February 2022 from 9.00 am to 4.00 pm. Three resource persons delivered talks under different topics and at the end a hands-on session on IoT was conducted. Prof. S. R. Munasinghe from the Department of Electronic and Telecommunication Engineering, University of Moratuwa delivered a talk on "IoT and Robotics". Following that a talk on "Bionic Limbs in Biorobotics" by Prof. Ruwan Gopura from the Department of Mechanical Engineering, University of Moratuwa was delivered. Finally, Prof. Buddhika Jayasekara from the Department of Electrical Engineering, University of Moratuwa, delivered a talk on "Intelligent Service Robots". After these tech-talks, the hands-on session on IoT was conducted by Mr. T. Kalaineethan (Founder of AIRIIS). Approximately 100 students benefited from this event.



WomenShar Essay Competition

"WomenShar" - an essay competition in honour of the Women's Day of 2022 was conducted in March 2022 to empower girls, enhance their writing skills, and amplify their voices in their own native languages. This competition was open to the undergraduate students of any university in Sri Lanka. The details of this competition were published via social media platforms. Top three winners were selected from each of the Tamil and Sinhala language submissions by a judging panel consisting of four lecturers from two different universities in Sri Lanka.



Techtalk on Coverage Path Planning for Reconfigurable Floor Cleaning Robots

A techtalk on "Coverage Path Planning for Reconfigurable Floor Cleaning Robots" was conducted by IEEE WIE-SB-AG-UoJ on 16th of August 2022 from 1.30 pm to 3.00 pm at the Department of Computer Science, University of Jaffna. The guest speaker Ms. Bhagya Samarakoon (Secretary IEEE WIE-AG Singapore) delivered her talk via the Zoom platform. More than 35 students participated in this event.



Techtalk on Deep Learning and its Applications

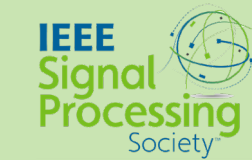
A techtalk "Deep Learning and its Applications" by Dr. (Mrs.) Subha Fernando (Senior lecturer, Department of Computational Mathematics, University of Moratuwa) was held on 9th of August 2022 from 1.30 pm to 3.30 pm at the Department of Computer Science, University of Jaffna. The session focused on an introduction to Deep Learning and its applications. Over 40 students benefited from this session.



Personality Development

A webinar on "Personal Development" was conducted on the 17th of January 2022, from 6.00 p.m to 7.00 p.m by Mr. Samisa Abeysinghe (Technology Consultant at Virtusa) via Zoom. This was a mentoring session to support our young generation to develop themselves to be a better version of themselves and achieve a bright future. Over fifty participants benefited from this webinar.

A workshop on "Personality Development" was organized by the IEEE WIE-SB-AG-UoJ on the 13th of August 2022 at 1.00 pm to 3.00 pm at the Department of Computer Science, University of Jaffna. The guest speakers of this session were Ms. R. Mithulan (Lecturer, Department of HRM, University of Jaffna) and Ms. T. Yogeshwaran (Lecturer, Department of HRM, University of Jaffna). The speakers explained about personality, personality development skills and table etiquette. The event mainly targeted undergraduates and there were more than 35 participants who benefited from this event.



SPS Chapter IEEE-SB-UoJ



The Advisor

Dr. M. K. Ahilan
Department of Electrical and Electronics Engineering
University of Jaffna.

It is my great pleasure to write this message to the IEEE News@UoJ as the advisor for IEEE Signal Processing Society Student Branch Chapter University of Jaffna.

The IEEE-SB-UoJ organized several events to enhance the skills of students. IEEE Signal Processing Society Student Branch Chapter UoJ was formed in October 2021. It conducted many technical talks for the benefits of fellow students and members of the community even during these challenging times. I am sure this trend will continue further with innovative ideas going forward. I take this opportunity to congratulate the IEEE-SB-UoJ and its Chapters of technical societies for their tremendous achievements and wish them the very best for another great year!



The Chairman

Mr. Marasinghe P. G. I. M. M.
Final Year Honours Degree Student,
Department of Electrical and Electronics Engineering
University of Jaffna.

I am extremely happy to present this message to you as the founding president of IEEE Signal Processing Society Student Branch Chapter of the UoJ. The signal processing society joined as a new IEEE student branch chapter of the UoJ on 29 of September 2021. It was started with the aim of improving knowledge, skills and understanding topics regarding signal processing. Signal processing is the enabling technology for the generation, transformation, and interpretation of information. The main goal of this society is to create a better platform for people interested in signal processing to interact and exchange ideas. In order to achieve these objectives, we are actively working by organizing various activities. With the active contribution of the members of the society, we are trying to adopt new knowledge concepts and new methods day by day.

Inaugural General Meeting 2021

The petition submitted to establish the IEEE Signal Processing Society Student Branch Chapter - University of Jaffna was approved by the IEEE on the 29th of September 2021 with the Geo-code SBC11373C. The inauguration of the Signal Processing Society was held on the 8th of Oct 2021. First the welcome speech was delivered by Mr. Indunil Madushan - the Interim Chairman IEEE SPS-SBC-UoJ. Special Guest, Dr. K. Ahilan addressed the gathering. Then the election was conducted for different posts. The newly elected Secretary of SPS-SBC-UoJ delivered the vote of thanks. The meeting adjourned at 4.30 pm.



EDS Chapter IEEE-SB-UoJ



The Advisor

Dr. M. Thanihachelvan
Department of Physics
University of Jaffna.

I am humbled to write this message for the second issue of the newsletter from the IEEE-SB_UoJ as the founding advisor of the IEEE University of Jaffna Electron Devices Society and Nanotechnology Council Student Branch Chapter.

The year 2022 is an important year for the field of Electronics as we are celebrating the 75 years of the invention of the transistor. As one of the leading institutions in the electronic devices and nanotechnology research in Sri Lanka, University of Jaffna is the first to establish an EDC and NTC chapter in Sri Lanka. The EDC and NTC chapter at UoJ was inaugurated on April 19th 2022. I take this opportunity to thank the founding chair, members and the administrators for the help to establish the society and to support the ongoing activities. The EDC and NTC chapter is keen on conducting innovative and knowledge sharing events for the undergraduate and graduate students and education and personal development programs to the school students. Also I sincerely acknowledge the hard work offered by the committee members of the year 2022 as they came across many hurdles due to the economic crisis in Sri Lanka.



The Chairman

Mr. Randika Medagama
Final Year Honours Degree Student,
Department of Physics,
University of Jaffna.

I'm happy to write this message for the newsletter of the IEEE-SB-UoJ as a chairperson of the newest member of the IEEE UoJ family. Our EDS and NTC student branch chapter is the first ever Electronic Devices Society in Sri Lanka. It is a matter of pride for our university as well as the IEEE-SB-UoJ. As the Chair of the new chapter, I take this time to say thanks to our Advisor Dr.Thanihachelvan, Branch Counselor Prof. M. Siyamalan, and Senior treasurer Prof. A. Ramanan for this success. In the near future we are planning to conduct a Nano Technology awareness program for G.C.E.O/L and G.C.E.A/L students and a Special programme to celebrate the diamond jubilee of transistors. Apart from this, I and my team will give our utmost to keep the name of our Chapter and Student Branch at the top through various activities and programs.

Inaugural General Meeting 2021

The Inaugural General Meeting of the IEEE EDS and NTC student branch chapter was held on 19th of April 2022, at 10.00 am via Zoom with the purpose of assigning new committee members for the year 2022/2023.

Annual General Meeting 2021/2022

The IEEE-SB-UoJ conducted its third AGM on the 26th of September 2021 from 4.00 p.m. to 5.30 p.m. via Zoom. In this AGM the first newsletter of IEEE-SB-UoJ, the "IEEENews@UoJ" (can be accessed via <http://society.jfn.ac.lk/ieee/in-dex.php/newsletter>) was launched by Dr. (Mrs.) Maheshi B. Dissanayake (Chair of the IEEE Sri Lanka Section). Then the awarding ceremony of Benvenuto 2021 was held. Benvenuto is a team competition among the IEEE student members of the UoJ which was organized in January-February 2021 to identify volunteers for creative tasks. Six tasks were conducted and the winners of each category were announced. The first three places of the overall winners in all six tasks were announced at the end of the awarding ceremony. It was followed by the election of the new executive committee for the year 2021/2022.



Green Home Computing

The IEEE Student Branch of the University of Jaffna organized a virtual session under the theme "Green Home Computing" as a celebration of "IEEE Day 2021". The session was held on the 11th of October with the keynote speaker Dr. S. Thananjeyan (Senior Lecturer, Department of Electrical and Electronic Engineering, UoJ). The objective of this session was to give a brief introduction about Green



Home Computing to students. The students of the Faculty of Science and the Faculty of Engineering of the University of Jaffna, participated in this session as they are more likely to use computers than others. Over 90 participants attended this session.

IEEE Day 2021 - Recreato Competition

The Logo recreation competition Recreato 2021 was organized by the IEEE-SB-UoJ on the occasion of the International IEEE Day 2021 celebration. Every year IEEE-SB-UoJ celebrates IEEE Day in memorable ways. Just like the other years, the IEEE-SB-UoJ decided to celebrate this year's IEEE Day with a logo recreation contest and a virtual session on Green Computing. Students from all the faculties of the University of Jaffna participated in this contest. This contest was opened for submission from the 06th of October 2021 to the 12th of October 2021. The basis of this contest was to recreate the IEEE Day 2021 logo in a creative manner (for example kolam, paper quilling, cross-stitching, etc). Digital arts, pastel arts, and paintings weren't accepted for the contest as the aim of this contest was to challenge the participants' divergent thinking skills. There were over 15 submissions for the contest. All the participants in this contest received an E-Certificate for their participation and the winners were awarded with valuable prizes.



WORKSHOP

IEEE STEMόνειρα

This workshop was held on 23rd and 24th of December 2022 from 9.00 AM to 5.00 PM for the school students from the Jaffna district with the main objective of improving their knowledge in IoT and providing them hands-on experience. A total of 121 students from six schools participated in this workshop and the medium of instruction was Tamil. Mr. N. Pathmaprian (Lecturer, Department of Computer Engineering, Faculty of Engineering, University of Jaffna), Mr. S. Suthakar (Senior Lecturer, Department of Computer Science, University of Jaffna), and Mr. T. Kalainethan (Software Engineer, Greystack Pvt. Ltd.) were the resource persons for this workshop. At the end of the session an IoT related competition was conducted among the students and certificates of excellence were given to the winners.



CODING COMPETITION

IEEEXtreme 16.0

IEEEXtreme 16.0 was held on the 22nd of October 2022 with 58 competitors from 20 teams competing through the IEEE-SB-UoJ with knowledge and the understanding acquired from the "Step-Up" session and the guidance provided by the proctors. The competitors faced the competition well and were able to obtain good marks and good ranks in the standings. Thanks to the dedication and hard work of the competitors. Three teams have reached the top 100 teams in Sri Lanka.



AWARENESS SESSIONS

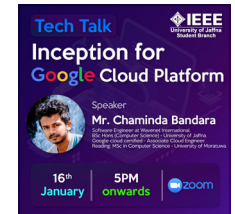
IEEEXtreme 15.0 & IEEEXtreme Awareness Session

IEEEXtreme is an annual hackathon and competitive programming challenge, supported by an IEEE Student Branch and proctored by an IEEE member, competing for 24 hours in a programming platform against each other to solve a set of programming problems. IEEEXtreme 15.0 was held on the 23rd of October 2021. The IEEE-SB-UoJ proudly presented a virtual awareness session, "Prolog to Xtreme 15.0", on the 21st of October 2021, with keynote speakers Mr. Budvin Edippularachchi (Tactician, Team CodeBreakers - University of Moratuwa) and Mr. Sunera Avinash (Coding Machine, Team CodeBreakers - University of Moratuwa), to encourage the students and to give them essential tips about participating in the competition. It was mainly focused on Data structures and Algorithms required for problem solving. Over 100 students participated in the session.



Inception for Google Cloud Platform

The IEEE-SB-UoJ organized an awareness Session on the Google Cloud Platform which was held on the 16th of January 2022 from 5.00 pm to 6.00 pm via Zoom. The keynote speaker for this event was Mr. Chaminda Bandara (Software Engineer at Wavenet International). More than 40 participants were present in the session.



Google Code Jam Awareness Session

The Google Code Jam Awareness session provided a basic idea about the Google Code Jam competition which was held on the 28th of March 2022 from 8.00 pm to 9.00 pm via the Zoom platform. The keynote speaker of this event was Mr. Indrajith Ekanayake, (Lecturer, Open University of Sri Lanka). The speaker elaborated about the Google Code Jam competition and its benefits in addition to Algorithmic programming. The event was mainly targeted at coders, and there were more than 20 participants for the event.



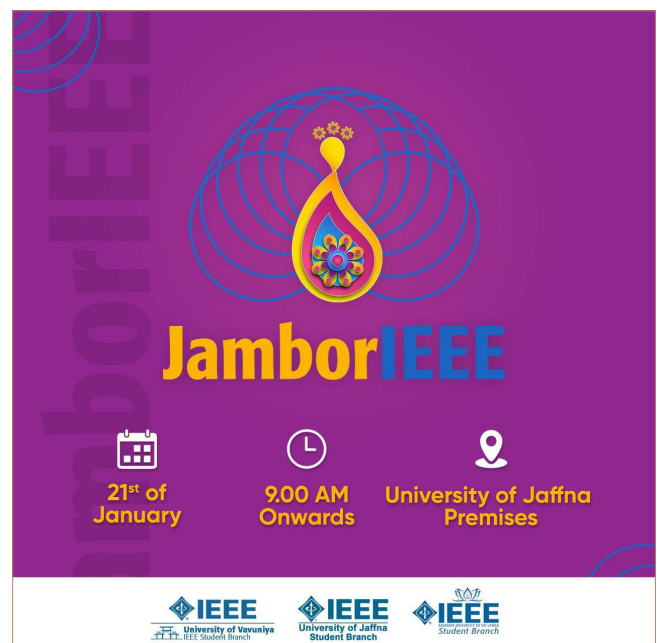
Benvenuto 2022

As a result of the membership development campaigns, many new students joined IEEE, and they wanted to show their skills and volunteer in branch activities. So, IEEE-SB-UoJ organized Benvenuto 2022 to welcome the new members to the IEEE-SB-UoJ. It was a series of activities and team competitions that was organized as a week-long event among all the IEEE-SB-UoJ members to identify their talents and skills in content writing, flyer designing, and riddle creation.



JamborIEEE

The IEEE-SB-UoJ in collaboration with the University of Vavuniya and the Rajarata University of Sri Lanka organized this event at the University of Jaffna premises on 28th of January 2023. The main purpose of the event was to raise awareness about IEEE and its benefits among undergraduates. Moreover to improve their soft skills, expand their professional network, and to increase the IEEE student membership. The event started at 10.30 am at the Kailasapathy Auditorium with lighting oil lamp. The Co-Chair of JamborIEEE Mr. Eranga Kodithuwakku welcomed the gathering. The Guest speaker Mr. Lakshan Madushanka (IEEE SL Section SIGHT Chair) delivered his speech about IEEE. Following that, the keynote speakers Mr. Heshan Mallawaarachchi (Chair, IEEE-CS-SB Chapter, UoJ) and Mr. Dimuthu Anuraj (Chair, IEEE-CIS-SB Chapter, UoJ) shared their experiences in the IEEE journey. The event was colourful with amazing dances and fun activities with over 170 participants.



INDUSTRIAL COLLABORATIONS

Software Quality Assurance to Quality Engineering

The IEEE-SB-UoJ organized an Industry Orientation Programme series with SLASSCOM to focus on Software Quality Assurance. This series was held on the 21st of June, 23rd of June, 30th of June, and 2nd of July 2022 with the keynote speakers Ms. Thuvareka Shanmugalingam (Lead Quality Assurance Engineer, IFS), Mr. Kishan Nuvarathne (Manager - Quality Engineering Sysco Labs), Mr. Siva Velauthapillai (Lead - Quality Engineering, Wiley Global Technology (Pvt) Ltd), Ms. Suganthika Amaradasa (QA Lead, 99X), and Mr. Tarinda Liyanage (Senior QA Lead, 99X). In the first three days techtalks were conducted on Quality Assurance and Quality Engineering and the last day ended with an assessment. Over 30 participants attended and benefited from each of these sessions.



Neural Network Learning Paradigms

A session on "Neural Network Learning Paradigms" was held on 28th of June 2022 from 10.00 am to 12.30 pm with five keynote speakers. Professor Saman Halgamuge (Faculty of Engineering and IT, University of Melbourne, Australia), Professor Niranjan (School of Electronics and Computer Science, University of Southampton, UK) and Professor Suganthan (School of Electrical & Electronic Engineering, Nanyang Technological University, Singapore) delivered their talks via Zoom, and Ms. Tamasha Malepathirana (PhD Candidate, Optimization and Pattern Recognition Group, University of Melbourne, Australia) and Ms. Rashindrie Perera (PhD Candidate, Optimization and Pattern Recognition Group, University of Melbourne, Australia) delivered their talks in person at the Department of Computer Science, University of Jaffna. More than 170 participants attended this event.



Enterprise AI using IBM POWER Systems

A session on Enterprise AI using IBM POWER Systems was held on the 19th of August 2022. This physical event was conducted by Mr. Ganesan Narayanasamy (IBM Global Leader, AI and Cloud Enablement and Ecosystem) along with Mr. Madan Kantheesan (Technical Leader, Object Automation Systems Solutions, India) and Mrs. Bragathalakshmi Bharani (Operational Automation Systems Solutions, India). This session helped students to know more about machine learning, natural language processing, enterprise AI, and chip design using IBM openPOWER.

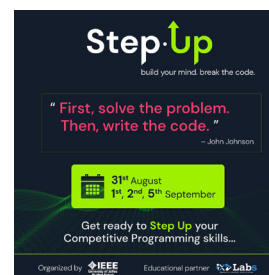


GlaceUp

The IEEE-SB-UoJ collaborated with H2O.ai and presented a two-day session on "Introduction of H2O.ai and a brief introduction to its applications" on the 26th and 27th of August 2022 at the Department of Computer Science, University of Jaffna. Speakers for the event were Mr. Sajith Ariyaratna (Lead Software Engineer, H2O.ai), Mr. Mathanraj Sharma (Machine Learning Engineer, H2O.ai), Mr. Ahsan Shamsudeen (Senior Solutions Architect, H2O.ai), Mr. Nayananga Anuradha Muhandiram (Software Engineer in Full Stack Development, H2O.ai) and Mr. Vijitha Ekanayaka (Senior Full Stack Software Engineer, H2O.ai).

Step-Up

The IXD Labs partnered with the IEEE-SB-UoJ and conducted an event named as "Step-Up" focusing on competitive programming and making students aware of data structures and algorithms. This was a series of events from 31st of August 2022 to 3rd of September 2022. On the first day (31st of August 2022) Mr. Deepana Ishtaweera (CEO of IXD Labs) conducted the first session about competitive programming. The attendees received a clear understanding of what competitive programming means, how it improves skills, and how to prepare for a competition. On the second day (1st September 2022) Mr. Sunera Avinash (CTO of IXD Labs) gave a brief introduction to data structures and explained how to use them to solve problems. On the next day (2nd of September 2022) Mr. Budvin Edipulliarachchi (DevOps Engineer at IXD Labs) conducted the session on Introduction to Algorithms and he explained how to write algorithms to solve problems. The last day (3rd of September 2022) was a hands-on session on competitive programming, and it was conducted by Mr. Damika Gamlath (Software Engineer, The AI Team (Pvt) Ltd). He demonstrated how to solve problems step by step using the knowledge we acquired from previous sessions.



Evolution of Perovskite Field Effect Transistors as light absorbers to X-ray radiation detectors

Mr. Mr. G. Abiram
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 University of Jaffna.

The introduction of perovskite semiconductors has revolutionized the field of electronics due to their outstanding electro-optical properties. Additionally, these materials offer the advantage of much easier and less expensive processing techniques for depositing thin films on insulator surfaces to construct devices, as opposed to the costly and complicated manufacturing methods used for depositing conventional semiconducting thin films on substrates. Furthermore, after their impactful performance with the power conversion efficiency (PCE) in solar cell applications as denoted in the chart in Figure 1, perovskite semiconductors have recently gained prompt attention as semiconducting material to fabricate active channels in Field Effect Transistors (FETs). However, the poor stability of the perovskite material during the fabrication and operation stages and toxicity due to the heavy metals are considered obstacles to commercialization. Nevertheless, the evolution of lead-free all-inorganic perovskites research provides solutions to overcome those issues.

The term perovskite stands for the structure of the materials with the generic chemical formula of ABX_3 and the 3D framework of corner-sharing octahedral crystal shape, causing multiple advantages over the other semiconductors in different applications, including FETs. A perovskite thin-film field-effect transistor consists of two metal electrodes, Source 'S' and Drain 'D', and Gate electrode 'G', separated by an insulator from the active channel layer. In the early stages, perovskite FET studies were carried out by the IBM T.J. Watson Research Centre [1,2] employing different solution process techniques and fabrication methods. Subsequently, perovskite FETs are being extensively studied for a wide range of applications such as phototransistors, photo detectors, light emitting FETs and Ferroelectric Random Access Memory (FeRAM) as shown in Figure 1. Furthermore, the current studies of radiation detectors based on perovskite FETs are considered a pioneer for futuristic developments in the medical imaging field. Hybrid halide perovskites have been the most dominant materials in those applications'

studies. Most notably, Methylammonium Lead Halide ($MAPbX_3$) perovskite is studied in the highest proportion of perovskite FETs research works and unreservedly in the radiation detectors as well. The X-ray images captured with the two terminal perovskite X-ray detectors have dark currents and noise. Still, those effects are reduced by the three-terminal perovskite FET radiation detectors.

X-rays are electromagnetic waves with wavelengths ranging from 0.01 to 10 nm, and they possess incredibly high photon energy, typically in the order of 10^4 to 10^8 times greater than that of visible light. These high-energy X-rays interact with matter through scattering and absorption phenomena. The radiation detecting material with the effective interaction between the photons and electrons is mainly used to construct the radiation detectors. The high sensitivity of perovskite materials is crucial for detecting even small doses of X-rays, as exposure to high levels of X-rays can lead to an increased lifetime risk of cancer in patients. The X-ray detection ability of $MAPbI_3$ perovskite was tested by [4] for medical imaging, and [5] tested X-ray imaging capabilities of different all-inorganic perovskites in the photon energy range with a hyper spectral camera as shown in Figure 2.

For the purpose of designing highly sensitive materials for direct X-ray detection, [6] studied triple cation metal halide perovskite thin films as X-radiation detectors. Perovskite FETs were fabricated to look at the photo conversion properties of perovskites during the detection of X-rays. The detection performance of the $MAPbI_3$ was improved significantly with the MA^+ cation mixed with FA^+ (Formamidinium) and Cs^+ ions. Generally, the radiation detectors work in current mode for medical imaging and spectroscopy and in voltage mode. Figure 3 (a-c) represents the observed X-ray sensitivity of the perovskite films even at low voltages less than 10V which is a promising sign to the future developments of perovskite radiation detectors.

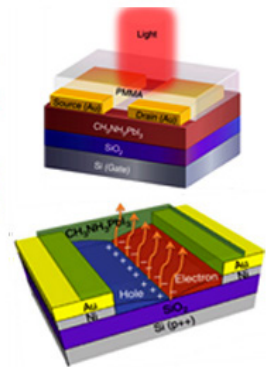
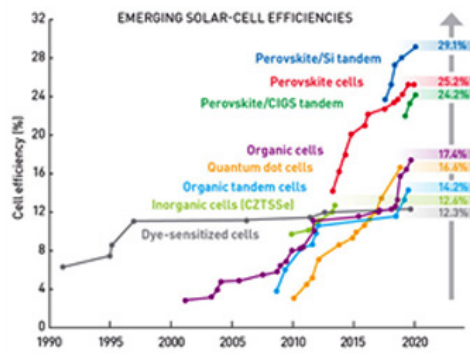


Figure 1. Numerous applications of perovskite materials due to their unique properties [3] and the high power conversion efficiencies of perovskite solar cells [4]. Photo FET and LeFET applications of perovskite FETs [3]

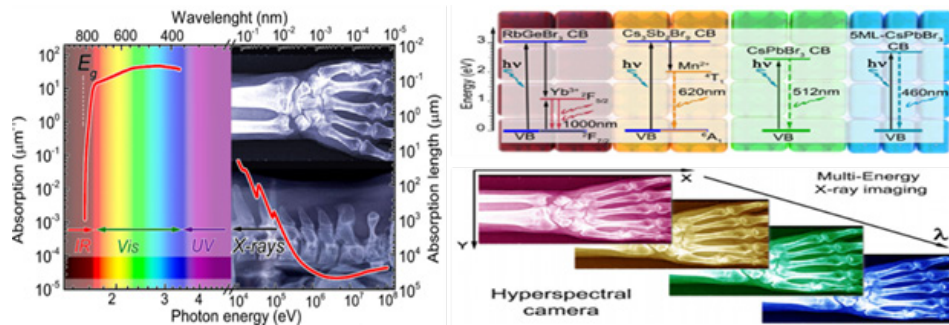


Figure 2. Absorption coefficient and absorption length as a function of photon energy, spanning from infrared to X-ray of a MAPbI₃-based radiation detector [5] and multi-energy X-ray imaging of different perovskites [7]

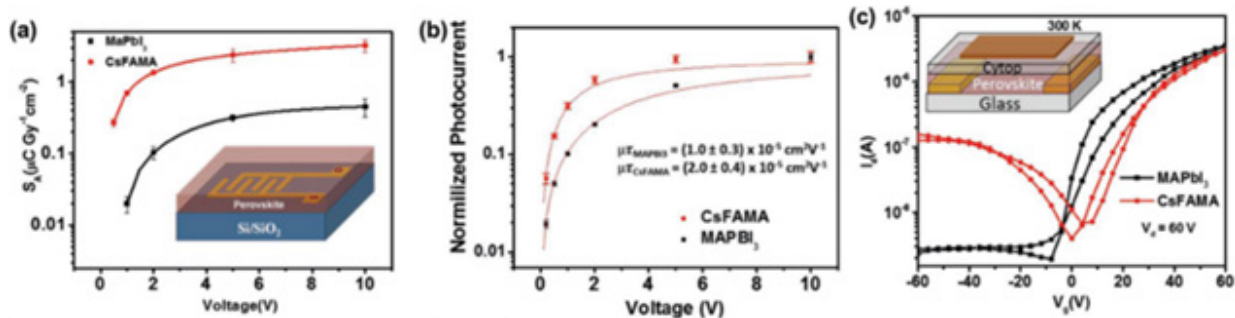


Figure 3. Figure 3. Electrical characterization of fabricated perovskite thin films of MAPbI₃ (Black) and CsFAMAPbI₃ (Red). (a) Sensitivity of the two terminal inter-digitated X-ray detectors (b) Log normalized photocurrent variation of the X-ray detector. (c) Transfer characteristics of the perovskite thin films obtained using the perovskite FET [6].

All-inorganic perovskite Cs₃PbBr₃ quantum dots (QDs) were used as a channel material in a thin film FET to detect the X-rays [7] as shown in Figure 4 (a-c). An inexpensive inkjet printing method was demonstrated to fabricate radiation detectors on a large scale at the Department of Materials Science and Engineering, Monash University, Australia. The flexible, printable and soft X-ray detectors are considered the ideal platforms for the future evolution of the perovskite FET-based X-ray detectors as they

respond to the soft X-rays with the low bias voltage.

Different perovskite semiconductors such as Cs₂AgBiBr₆, RbGeBr₃, Cs₃Sb₂Br₉, RbGeBr₃ and (BA)₂(MA)₂Pb₃I₁₀, in addition to MAPbI₃ perovskites, have been synthesized for fabricating X-ray and gamma-ray detectors in recent studies. The performance of these devices has shown promising signs of potentially dominating the medical imaging field.

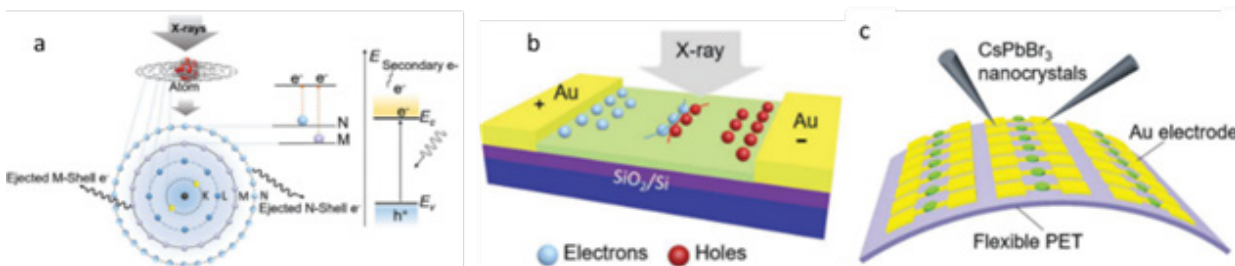


Figure 3. (a) Mechanism of conversion of photons to current by CsPbBr₃ QDs film used in Australian Synchrotron. (b) The configuration of CsPbBr₃ QDs FET-based X-ray detector (c) Schematic of the flexible perovskite-based X-ray detector printed arrays on PET substrate [7]

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Prospects of Perovskite-based Light Emitting Diodes for Display Technologies

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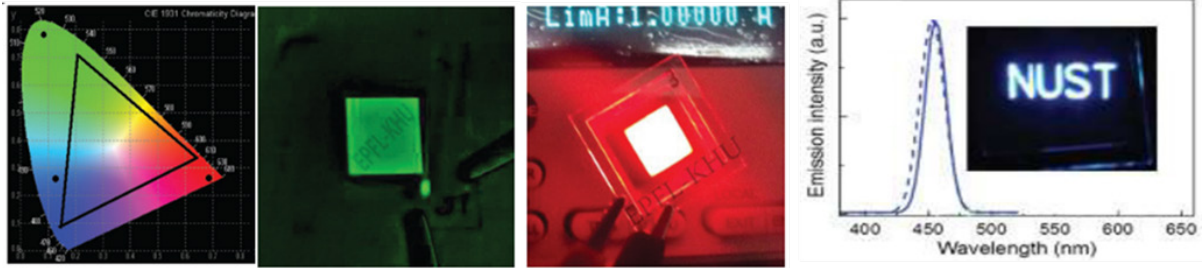


Figure 1: The near-infra-red and green-coloured large triple cation perovskite-based scale LEDs [6], and Blue emission by the CsPbBr_xCl_{1-x} perovskite-based LED [7]

Perovskite semiconductors have come to the forefront in the fields of optoelectronics after metal halide perovskites produced the highest efficiency in non-silicon solar cells [1]. Perovskites are touted as the potential materials to fabricate numerous device applications, from PV solar cells [2] to field effect transistors [3], due to their uncomplicated fabrication techniques and preminent optoelectronic properties. As researchers turned to perovskite semiconductors to boost optoelectronic device applications, perovskite-based Light Emitting Diodes (LED) have gained a lot of research interest. Unlike conventional semiconductors, perovskites are synthesized by solution-based compositional and structural engineering, which allows fine-tuning their outstanding optoelectronic properties essential for light emission applications, such as narrow emission widths, high photoluminescence quantum yield, high color purity, and tunable range of emission wavelengths.

The Organic-based light emitting diodes (OLEDs) have performed well in commercialized products such as televisions and smartphones since the 1990s and have evolved as the best current display technology. But the limitations with the optimizations of the colors and the efficiency of conversion of electrical power to light energy are always considered obstacles in advancing the display technology. But the perovskite semiconductors-based displays are perceived as the potential predecessors to overcome these bottlenecks and get an improved light extraction. The first-ever perovskite thin-film-based LED study, carried out by a group at the University of Cambridge [4], corroborated that low-cost and high-performing emitters could be made off perovskite semiconductors. Perovskite materials are synthesized in different structural forms such as Quantum Dots (QDs),

Nanocolumns, Nanorods, and Nanowires to fabricate Thin-films to enhance the light emission in LEDs.

Sir Richard H. Friend, a professor of Physics at the University of Cambridge, is renowned for his pioneering work in commercializing organic LEDs. He published a study on high-efficiency perovskite-polymer bulk heterostructure light-emitting diodes (LEDs) that achieved an excellent external quantum efficiency (EQE) exceeding 20% [5]. Though organic LEDs can produce green and red lights with an EQE over 20%, getting a blue emission is consistently the hardest, as depicted in Figure 1. But recent perovskite-based LEDs studies have been carried out to achieve the blue emission. The color of the photon emission with perovskite LEDs depends on the chemical constituents. Hence the chemical compositions of the perovskite materials could be varied by tuning the mixed halide anions and multiple cations. A multicolor display with perovskite materials is more attainable than the conventional emitters.

In the perovskite thin-film LEDs, the light emission function is carried out by recombining the excited electrons and holes. Therefore, two injection layers or electrodes are essential to excite the electrons and holes. Then the recombination of charge carriers occurs deep within the perovskite layer, generating photons' emissions rather than heat emissions. Therefore, using perovskites with different band gaps as the luminescent material achieves the emission of different colors in LEDs as explained in Figure 2. The light emitting operation can be technically elaborated using External Quantum Efficiency (EQE) and Photoluminescence Quantum Yield (PLQY).

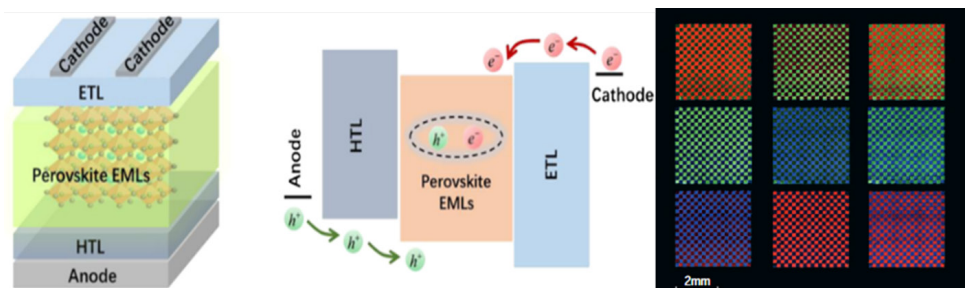


Figure 2: A schematic of the 3D structured perovskite-based p-i-n and carrier injection and transport in LEDs [8]. LED device structure with transport layers and electrodes, and 3D painted perovskite nanowires exhibiting adjustable multicolor display with certain filters [9]

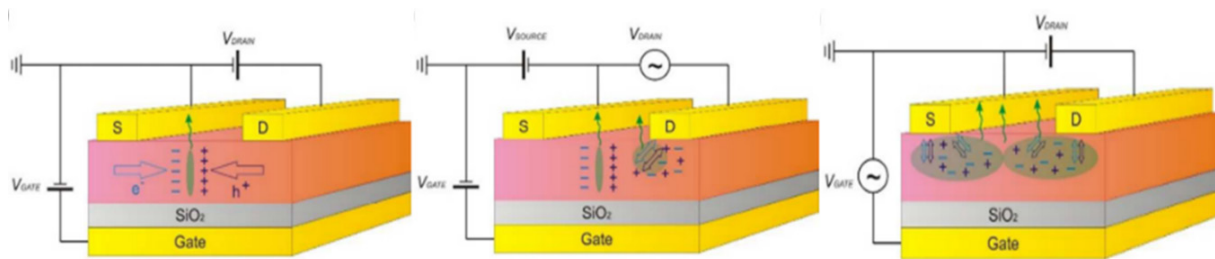


Figure 3: Injection of charge carriers from the electrodes perovskite LEFET and the recombination of electrons and holes to produce light emission in the perovskite layer

The EQE is determined by several factors, including the PLQY (Photoluminescence Quantum Yield), light out-coupling efficiency, the balance of injected electrons and holes, and the radiative exciton ratio injected from the electrodes. LEDs achieve high efficiency by increasing these parameters by changing the recipes for perovskite synthesis. The 3D structured perovskite materials are the perfect semiconductors for the displays as they show exceptionally high carrier mobility and transparency to the visible light.

The performance of LEDs can be improved through perovskite optimizations and device engineering. The lifetimes and the toxicity of the heavy metals of the reported perovskite LED studies are the primary concerns in future developments. But the emergence of all-inorganic

lead-free double and triple perovskites in optoelectronic research is improving those two drawbacks in perovskite LEDs. Therefore, researchers remain optimistic about its commercialization. Recently perovskite Light Emitting Field Effect Transistors (LEFET) has gained attraction due to their controllable light emission and acting as a switch simultaneously by varying the applied gate electric field. Unlike the two terminal LEDs, in LEFETs, two electrodes of the source and drain inject the electrons and holes, and the third terminal gate functions as the control and reduces noise. The recombination of charge carriers occurs at the center of the semiconducting active layer to produce the light emission, as shown in Figure 3. The ability to control the light emission in these FET devices makes them prospects for light-emitting devices.

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Ms. Divya Varatharajan
Secretary

IEEE Computer Society Student Branch Chapter - UoJ

My IEEE journey for the past three years filled with happy memories, lots of learning. I always use IEEE as ladder to my career as well as self development. Throughout these years I have discovered my potentials, improved my soft skills and much more. I would say leadership and networking are two main keys of my journey. I would cherish all the great moments of my journey with IEEE. This volunteering path is a great way to bring positive impact to people, communities and society.

Happy Volunteering!

AI - Technology that changes the world

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Artificial Intelligence (AI) mimics the problem-solving and decision-making capabilities of the human brain, is becoming a part of daily life from the spread of smart assistants like Siri and Alexa to the emergence of self-driving cars. As a result, several IT firms from a variety of sectors are making investments in AI technology. AI is impacting our lives through smart phones, navigation, e-commerce, social media platforms, banking and finance sector, security, autonomous vehicles, smart homes and so on. So, if we name a technology that completely changed the 21st century, it would be AI.

AI is the science and engineering of making intelligent machines, and can also be defined as the development of computer systems that can carry out activities that need human intelligence, such as decision making, object detection, solving complicated problems with higher precision and so on.

A brief history of AI

The idea of AI dates back to the 19th century, and it was Alan Turing who proposed the Turing test in 1950 to determine if a computer could exhibit human-like intelligent behavior. Turing's proposal is considered the first in the philosophy of AI, making him widely regarded as a founding father of the field. The term "Artificial intelligence" was first coined by John McCarthy in 1956, and the first AI laboratory was established in 1959. The first robot was introduced to the General Motors assembly line in 1960, and the first AI chatbot, ELIZA, was unveiled in 1961. In 1996, IBM's Deep Blue defeated the world champion in chess, and in 2005, the autonomous robotic car named Stanley won the DARPA Grand Challenge. IBM's Watson, a question-answering machine, was introduced in 2011.

Stages of AI

There are three different stages of AI, which are: *Artificial narrow intelligence*, *Artificial general intelligence* and *Artificial super intelligence*.

Artificial narrow intelligence (ANI) is called weak AI and it involves machines that can perform only a narrowly defined set of specific tasks. Much of narrow AI is powered by breakthroughs in Machine Learning and Deep Learning. Voice assistants like Siri and Alexa, Google search, conversational bots, email spam filters, Netflix's recommendations and self-driving cars are the examples for weak AI.

Artificial general intelligence (AGI) also called strong AI and it is the evolution of AI in machines which possess the ability to think and make decisions just like humans. AGI has the ability to learn, generalize, apply knowledge and plan for the future. These systems are currently not fully realized.

Artificial Super intelligence (ASI) is the stage of AI when the capability of computers will surpass human beings.

This is currently seen as a hypothetical situation as in movies and science fiction books.

Types of AI

There are four types of AI, which are: Reactive Machines, Limited Memory, Theory of Mind, and Self-Awareness.

Reactive machines are able to perceive and react to the world in front of it as it performs limited tasks. Example is the IBM chess program that defeated the world champion in the game of chess. The second type is called Limited Memory which can store past data and/or predictions, and use that data to make better predictions. Self-driving cars are an example for the limited memory AI. Theory of Mind is a more advanced type of AI that will mainly focus on emotional intelligence. It can make decisions based on its perceptions of how others feel and make decisions. Although this type of AI has not been fully developed yet, the humanoid robot Sophia, developed by Hanson Robotics in Hong Kong, can recognize faces and respond to interactions with her own facial expressions. The last type, Self-Aware, is the most advanced type of AI, which is able to operate with human-level consciousness and understand its own existence. This type of AI does not exist yet.

The present and future of AI

So far, many advanced AI systems have emerged and they continue to improve. The AI robot Sophia was given Saudi Arabian citizenship in 2017, and became the first robot to receive citizenship of any country. Further, Intelligent Process Automation, AI with the Internet of Things (AIoT), AI for cyber security and data privacy, AI infused chatbots, the transformation of digital workflow, advancements in Computer Vision, Hybrid Workforce with AI, and AI-enabled processors to enhance performance are some of the latest AI innovation trends. In almost every sector, AI is influencing how people will live in the future. It already serves as the primary force behind developing technologies like big data, robotics, and the Internet of Things (IoT). Also it will continue to do so for the foreseeable future.

Conclusion

AI is a world changing technology and it provides many valuable advantages. Such as reduction in human error, faster decision making, new inventions, applicable to all kinds of important fields, digital assistance, medical and research progress, substitution of humans by machines in risky jobs, and operates 24x7 without interruption or breaks. So, AI is an outstanding technology that has been playing a key role in helping industries and offices enhance their workflows. However, there are some disadvantages too, including, high development costs, unemployment as a social problem, lack of out of the box thinking, dangers concerning military operations and serious threat to humanity.

What is Plagiarism and how to avoid it?

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Regrettably, academic plagiarism is a pervasive and prevalent problem at every educational level. Apart from the usual instances among young students, it is not difficult to come across well-known cases of plagiarism that have been reported in various settings. While the problem is not new, the revolution in how we search and process content brought by the Internet has increased the challenge in educational settings. Plagiarism has various forms, including passing off the ideas or words of another as one's own, using another's work without crediting the source, and committing literacy theft. Although various definitions exist, Plagiarism can be simply defined as the act of using another author's work without citation, thus portraying it as one's own work.

There are six types of plagiarism. They are:

- ⊗ **Self-plagiarism:** It occurs when someone uses data, facts, or figures from his/her previously written work and fails to mention its source of origin.
- ⊗ **Direct plagiarism:** It is a direct copy of a significant amount of phrases from another source without acknowledgement. It is also known as "word-for-word plagiarism" or "copy and paste" plagiarism.
- ⊗ **Idea plagiarism:** If a person came up with a new and unique idea, concept, or solution to a problem, then it belongs to him or her. Copying and using these ideas or concepts without proper acknowledgement to the sources of origin is also considered plagiarism.
- ⊗ **Mosaic plagiarism:** Here, the copied parts are almost similar to the original source but with minor changes, and without proper acknowledgements to the original source.
- ⊗ **Unintentional Plagiarism:** In this case, the writer does not know that everything that comes from outside must be cited. This includes, failure to cite a source that is not common knowledge, paraphrasing some information in the writer's own words but without citing the original source where the information comes from. The misuse of sources can be the result of ignorance or laziness but is not the result of a desire to cheat.
- ⊗ **Intentional Plagiarism:** This is knowingly presenting someone else's ideas, research, or words as your own, i.e., not giving credit to the source of origin.

The following are some of the ways and means to avoid being accused of plagiarism:

- ⊗ **Quoting:** Quoting is reproducing words from another source using exactly the same wording, spelling, punctuation, and capitalization. The general rule of thumb is any time when using three or more words as they appeared in the original source, it should be treated as a quote and cited properly.
- ⊗ **Synthesizing:** Synthesis is the process of using information from two or more sources in order to develop new ideas about the topic or draw conclusions about it. It provides background, to explore causes and effects, contrast explanations, or consolidate support for your writing. Synthesis is a core component

of the critical thinking and writing process.

- ⊗ **Paraphrasing:** If the original author's exact words are not especially important to the point you may try to reword it in your own words to have a clear explanation. This might be particularly true in writing details or information. You need to be careful about directly quoting your research too much because it can sometimes make for awkward and difficult-to-read prose. So, one of the reasons to use a paraphrase instead of a quote is to create balance within your writing. Note that proper citations should be included even if you paraphrase someone else's wording in your writing.
- ⊗ **Summarizing:** A summary helps to understand the key ideas and content in an article, part of a book, or a cluster of paragraphs. It presents key ideas and information from a source in our own writing without unnecessary detail that might distract readers. Summarizing is most useful when we wish to focus on the main ideas of a selection rather than specific details or steps of a process. When summarizing, it is necessary to use your own words, sentence structure, and phrasing to avoid plagiarism.
- ⊗ **Citing:** Every author is responsible to provide reference sources using appropriate citation styles. Referring appropriately to a source leads the readers to identify resources that help to follow the argument and avoid plagiarism by linking other people's contributions to the work.
- ⊗ **Highlight a particular idea:** A writer could highlight a particular idea as a new issue in knowledge development or a challenging topic to discuss further. This technique is subject to ensure that there'll be more possible chances of the writer's own words and could ease an author to follow the rules and ethics of the writing which helps in avoiding plagiarism.
- ⊗ **Build argument:** The writer could learn new things by contributing to the development of the argument. Usually supervisors of students do not expect students to write the paper entirely but expect the students to produce the original idea to create space for building the argument.

To identify potential plagiarism in your writing you may use plagiarism checking softwares such as Grammarly, Quetext, and Ouriginal. These softwares save students a lot of time by pointing out the parts of writing with potential plagiarism. In the academic world, plagiarism is a serious matter because ideas in the forms of research, creative work, and original thought are highly valued. Accessing information for free on the internet does not imply that you are permitted to use it in your academic writing without appropriate citation. Similarly, when information from library journals and books is available to you for free, it is essential to cite it to acknowledge the original source.

3D Bioprinting for Tissue and Organ Regeneration

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Introduction

In our day to day life tissue damage and degeneration is a common scenario. When some damage happens to our body tissue our body can regenerate it. But it is a slow process, and if that damage is very serious it would be difficult for our body to recover from that. In such cases, the damaged organ needs to be transplanted from a donor. However, the availability of donors is very limited. Therefore, most tissue engineers and doctors try to find a computer based solution for that. They use computer graphics to generate 3D models of organs and print them using 3D printing technology. This is a very huge procedure. The 3D models should be 100% accurate and that should be generated by the experts who are masters in both tissue engineering and computer graphics.

Printing Techniques

An important part of bioprinting is the use of bioinks. Bioinks contain biomaterials that can be used to assemble cells and synthesize biomolecules. Bioinks are full of hydrogel-based cells, as hydrogels have a high water content which is beneficial for cell survival and protects cells from degradation. The main bioink properties that need to be considered before printing include its viscosity, gelation and bonding strength. These structures can significantly affect the print reliability as well as cell function, multiplication and post-printing morphology. Producing hydrogel can support and protect cells, while at the same time providing a structurally secure scaffolding is challenging, as these features have different mechanical requirements. Solid hydrogels with dense networks may put cells under pressure during encapsulation, and inhibit their migration. Finally, hydrogel structures require a balance between structural integrity and cell configuration.

Although there are various techniques available for printing organs, Inkjet-Based Bioprinting is the most commonly used technique. The first problem encountered in the development of inkjet bioprinting was dying cells during printing due to rapid drying and substrate. The problem was solved by adding cells to a water-soluble polymer, which led to the formation of hydrogel-filled cells. Inkjet printing offers a maximum resolution of up to 50 µm. Many inkjet bioprinters provide high molecular performance, and although there is a potential for strong pressure to damage cells, many studies show that this is not the case. The advantages of inkjet-based bioprinting include high printing speed, low cost and wide availability.

Laser-Based Bioprinting is another type of technique. This is nozzle-free procedure and this eliminates the negative effects of shear pressure experienced when using nozzle-based bioprinting. It provides fast and accurate design, with resolutions ranging from 5-300 µm. Polymerization synthesis occurs at the top of the bioink vat when the biomaterial is exposed to light.

Extrusion-Based Bioprinting is another type of technique for printing. This is a pressure-driven technology. Bioink is extracted through a pipe, driven by air or mechanical pressure, and placed in a pre-designed structure. The main advantage of extrusion bioprinting is the ability to print with very high cell density. But it has some disadvantages when compared with other technologies. Modifications are very limited, as the minimum feature size is usually more than 100µm, which is a much worse fix than other bioprinting techniques.. This may limit its use to certain soft tissue systems that require smaller pore sizes to turn for improved tissue, yet it may still work on solid tissues larger than 10 mm.

In conclusion, 3D bioprinting is an emerging industry that can give benefit to both human and animal medicine. Advances in bioprinting have led to the production of high-resolution bioprinters, and the development of vascularization of printed tissues. As these technologies continue to emerge, we have seen an increase in research efforts aimed at the use of these techniques to animals. Current limitations include the inability of bioprinters to print on both high resolution and viscosity, bioinks to maintain cell function during printing, and effective integration of printed tissue arteries to inhibit clinical interpretation. In addition, the patent and control of this technology presents additional challenges that can have a profound effect on the access to this technology. However, the future advancements of biomedical and economic power of 3D bioprinting will inevitably lead to solutions to these problems. With further use and development, 3D bioprinting will likely emerge as a powerful tool for regenerative medicine in animal science. It may improve the treatment of several animal conditions such as cancer, and musculoskeletal injuries.

IEEE DAY!!!

OCTOBER



IEEE Day is celebrated on the first Tuesday of October.

Real-Time Communication for WWW

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We are currently approaching the era of Web 3.0, where we discuss decentralized web architecture in which the content depends on the client instead of the client-server model. Web, from its inception, depends on the concept of request-response architecture of client-server model, where the client requests web pages from the server and the server responds with the requested pages. For this communication both HTTP and HTTPS protocols are used which define the connection establishment of the client and server, and html content transmission in between. However, due to the dynamic content based web, the request-response architecture became a bottleneck for the further improvement of the web as the content of the web pages changes frequently on the server. Therefore, clients are unable to update their content until a new request to the server is made.

To overcome this issue, real-time communication was needed and therefore the concepts of periodic polling and long polling were introduced in the first place which is still based on the HTTP/HTTPS protocol and request-response architecture. In periodic polling, frequent requests are made to the same endpoint with a specific time interval, therefore if there is any update in the content client will receive them as a response to the corresponding request. On the other hand, in long polling, the request that the client made is being held by the server until the content gets updated. If the content got updated, the updated content would be sent as the response to the on-holding request. Though this mechanism is a better option, since the server has to hold the request in a long period until the content gets updated, it limits the number of requests the server can handle in a given time, which overall reduces the availability of the server. Anyhow, in both cases, the client is the one who initiates the connection, which means the server only responds to the requests made by the client. This makes the communication uni-directional. In addition to the above-mentioned mechanisms, there's a mechanism called Server-Sent Events (SSE), where in the

beginning the client initiates the connection and subscribes to the content in the server and then whenever there's an update in the content, the server pushes those updates to the browser. In SSE, unlike long and periodic polling, the server gets the ability to make the updates to the clients many times as long as the connection is opened. But still, SSE also uses uni-directional communication as only the server would be able to transmit the data, which makes real-time bi-directional communication impossible and in addition, unless major browsers, other browsers don't support SSE protocol.

WebSocket protocol was introduced as a solution to this issue. In WebSocket in the first place, the connection between the client and the server was initiated through an HTTP based handshake and then the bi-directional data transmission started over a single TCP connection. Moreover, the WebSocket architecture, unlike the other mechanisms, allows the client and server to communicate with each other in real-time which means both can send and receive data through the communication line at the same time which makes WebSocket most suited protocol for the real-time applications like chat applications and online games. However, even though the WebSocket is considered the most modern yet robust technology that exists to handle real-time communication in industry, it comes with its own flaws: unpredictable connection droppings, and vulnerability to Denial of Service (DoS) attacks are some of them. So, unless there's a specified need, there are some HTTP and REST based workaround mechanisms that can be used to achieve some sort of real-time but not yet bi-directional communication. Webhooks are one example that can be used for server-to-server real-time communication, where when the content gets updated in one server it will send a request to a pre-specified endpoint of the other server, which in this case can be considered as a client.

DID YOU KNOW ?????

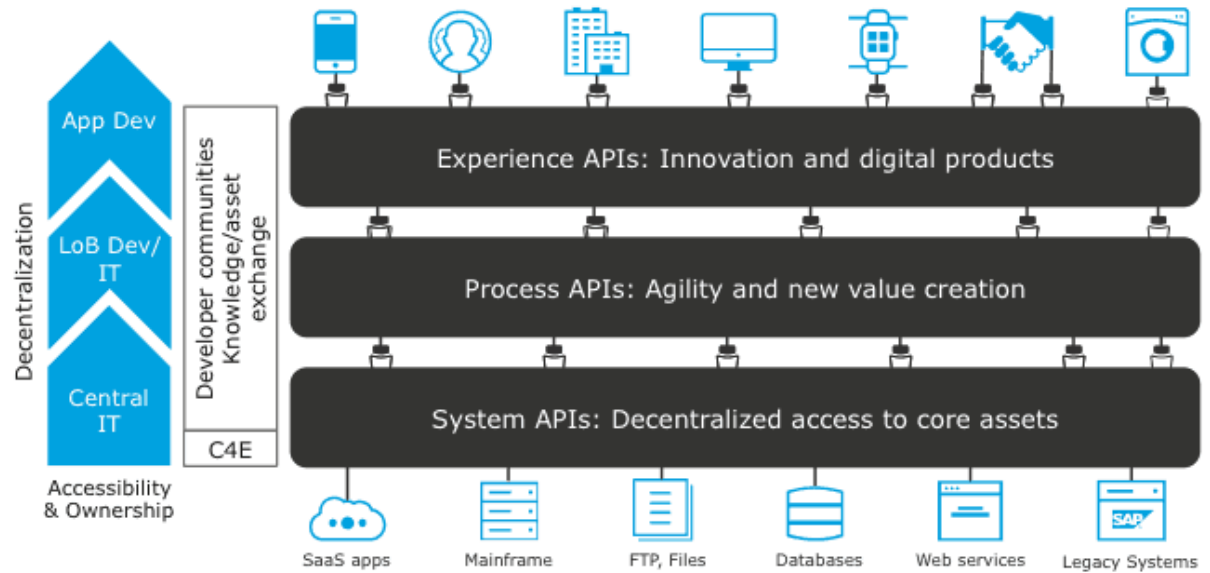


IEEE, pronounced "Eye-triple-E," stands for the Institute of Electrical and Electronics Engineers. The organization is chartered under this name and it is the full legal name.

However, as the world's largest technical professional organization, IEEE's membership has long been composed of engineers, scientists, and allied professionals. These include computer scientists, software developers, information technology professionals, physicists, medical doctors, and many others in addition to IEEE's electrical and electronics engineering core. For this reason the organization no longer goes by the full name, except on legal business documents, and is referred to simply as IEEE.

Why API led connectivity?

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Today Application Programming Interfaces (APIs) are used in every corner of the digital world. APIs are the key component of our digital world and enable billions of digital experiences every minute. APIs have created a high level of connectedness that allows us to interact and integrate fast and easy. With API-led connectivity, an enterprise can unleash its potential and stay competitive. Increasing high demand on services organizations end up with more data and systems at their fingertips than ever before. To survive this challenge and give customer satisfaction organizations need a concrete strategy for how to connect them with their own enterprise IT. This has led to the rise of API-led connectivity.

So, what is API-led connectivity? API Led Connectivity is an architectural style that connects data to applications through reusable API. These APIs are developed to perform specific jobs such as unlocking the data from systems, composing data into process, or delivering an experience. Traditional API-led connectivity contains three layers of APIs: Experience APIs, Process APIs, and System APIs. Experience APIs lie directly underneath the user experience interface such as a mobile device, IoT, desktop app, etc. Process APIs provide access to custom business logic and data transformation as well as aggregating APIs from the System API layer. System APIs provide access to application, database, and other data sources. System API allows us to fetch raw data from the system of records like JSBC, SAP, Salesforce, etc.

The current market scenario requires businesses to adapt to the changes and demands and take active measures to stay ahead of the competition by showing efficiency and agility in transforming the customer performances, and technological landscape. While agility and security are significant concerns, Integration is the biggest challenge an organization faces while adapting to the changing demands and strive to become more efficient. What is integration? Integration is the process of connecting data, applications, devices, and APIs across an organization for enhanced productivity and efficiency. API-led connectivity is becoming an important integration strategy because the technologies that enterprises are using to engage with their customers, employees, and partners have changed dramatically and rapidly. Why do organizations need API-led connectivity and What API-led connectivity brings to the table? API-led connectivity leads to faster development time, Improved agility, reliability, and scalability, avoiding project delivery risk, Greater governance, and security, etc. API-led connectivity has great influence in the development time with its features such as reusable APIs, templates, accelerators, and systems connectors.

As the end note, it's clear that API-led connectivity is swiftly becoming an indispensable model as enterprises move towards digital transformation. It's a vital strategy that helps companies upgrade data connectivity and take their business operations to the next level.

Dead Reckoning

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How was it possible for navigators to travel from one place to another place when there was no Global Positioning System (GPS)?

Well, at the beginning of navigation, the navigator knows the starting point very well. When the navigator starts to sail/fly/walk to his destination, he can come across three factors that he has to consider to know what his position is on his way to the destination. They are directions of his movement which he can get using a compass, the speed of his movement, and the time taken to reach each heading. Using these factors, the navigator calculates the distance and route he has covered. Also, he keeps track of his movement by plotting a nautical map (also called a sea chart if the navigator is in the sea or air aeronautical chart if the navigator is in the air). The way of doing this iteratively is known as Dead Reckoning.

Dead Reckoning is a method of calculating the navigator's location (in the sea or in the air or on the land) using the record of courses that have been sailed (or flown or walked), the distance covered (using the speed at which he has traveled and the time taken to reach the next course from the previous course), the known point (in this calculation we consider the previous point as a known point) and the estimated (or known or approximated) drift (due to the continuous thrust given by the sea wave or wind). Note that in this method, Celestial references are not considered. Also, using this method, we can advance the (current) location based on our expected parameter values.

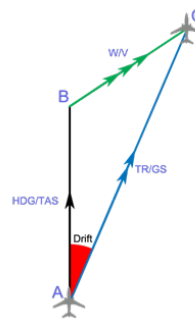
Sometimes, instead of computing the distance we travel by using the speed and time, we can also use the pace count method, especially in land navigation. Counting paces is typically the most precise way to determine the distance traveled while on foot. But how do we convert pace into distance? Well, we'll need to figure out how many regular paces we walk in 100 meters to know the answer. There are some factors that can affect the navigator's pace count. They are uphill or downhill, with wind, night navigation, heavy load, and rough terrain. Walking uphill, walking into the wind, walking at night, increasing in load, and walking in rough terrain increase the pace count.

The basic formulae in Dead Reckoning is $\text{Distance} = \text{Speed} \times \text{Time}$. That is, if an aircraft flies for 5 hours at a speed of 200 knots, we can say that at the end of 5 hours, the aircraft would have traveled about 1000 nautical miles through the air. The similar way can be adapted to do Dead Reckoning in sea. But compared to Dead Reckoning in sea, it is very hard to do Dead Reckoning in air due to various factors and the complexity. At predetermined intervals, Dead Reckoning positions are measured, and are retained between fixes. The interval duration varies in sea navigation and it is fixed in air navigation to 0.5 hours (or 30 minutes). So how did they implement this?

We know that to find the distance covered, we need Speed and Time. To measure the speed, in early times, the sailors threw a log which was tied to a rope over the side and counted how long it took this log to pass. Alternatively,

they calculated how long it took to pull a rope with knots and counted how many knots get pulled out in a certain amount of time. After calculating the speed and the direction of motion using the compass, an approximation (a predicted value) has been made of the ship's current position. However, the wind and waves can give a drift to the ship that can change the direction of the sailing.

In aircraft, the speed of air can be found by various methods available. But it is not relative to earth. If we are able to calculate the airplane's altitude from the ground, then it is easy to find the ground speed by calculating the time taken to pass two fixed features on the ground. But this calculation can be inaccurate due to some wind types. They are tailwind, headwind, and crosswind. Almost always the higher you are the slower it appears to move on the ground. On the floor of the earlier aircraft, there was a window that was used to monitor the aircraft's ground speed and drift.



Dead Reckoning on land is very much easier than on sea and air as there are no external drifts on our motion like we have from water current in the sea and wind in the air.

There was a big possibility of getting a deviation from the intended destination to the destination coming from a series of iterations. This comes from the human error in each course which will be a huge number cumulatively and from

the unexpected changes in the environmental conditions, especially in sea and air. Best practice and use of Dead Reckoning before the invention of GPS have brought many discoveries so far. Christopher Columbus, an Italian explorer, navigator, and colonist discovered viable sailing routes to America, a continent then unknown to the Old World using this method.

Animals use Dead Reckoning to navigate and that is commonly known as path integration. They estimate their present location based on their movements from their last known position on their journey to a destination that does not need to be a straight line. The best example can be shown for path integration using the ants' movements. If there is no vision, such as when animals navigate on a cloudy night, in the open ocean, or in relatively featureless areas such as sandy deserts, the integration of the direction must be based on idiotic signals from inside the body. Due to this, some human activities can harm the navigation of animals, birds, and insects. Some pesticides may disturb the navigation of bees and this makes them never return to their colonies. Photophilic species such as sea turtles and moths, those that follow the light, are drawn to and disoriented by light pollution. It is observed that instead of navigating normally, many insects cluster around lamps at high densities.

Currently, with the integration of GPS, the Dead Reckoning is done more precisely in all places, especially in high-

end automotive navigation systems. With the help of Linear Quadratic Estimation (LQE, also known as Kalman filtering) along with Dead Reckoning and sensor data, the automotive navigation systems are working effectively in the places where the satellite microwaves are unavailable to handle automotive navigation. In

deep-sea navigation, Unmanned Undersea Vehicle (UUV) (for military purposes or) Autonomous Underwater Vehicle (AUV) (in common) uses Dead Reckoning and GPS technologies to do more precise navigation.

Demystifying Node.js

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Node.js is an open-source, cross-platform, back-end JavaScript (JS) Runtime Environment (RE) that runs on a JS Engine and executes JS code outside a web browser. It was designed to build scalable network applications. In recent years Node.js has received significant attention in the software engineering industry and is widely being used by Fortune 500 companies in building their products and services. According to the recent Stackoverflow Developer Survey for the year 2022, Node.js has become the sixth most popular technology among the global professional developer community. Although Node.js is a beginner-friendly and easy-to-learn backend technology, unlike other popular backend technologies, understanding the Node.js architecture and its core behavior is quite hard and mystifying. Professional and beginner-level developers need to understand the Node.js architecture, in order to create more stable software because careless usage of Node.js can cause untraceable bugs in the production environment and more error-prone codebase.

JavaScript RE

Though most of the time Node.js is categorized as a backend programming language, in truth Node.js is a runtime environment (RE) for JS. Basically, a RE is where the code primarily executes and in addition, it also defines which operating system functions, and properties the program can be accessed and changed. In the simplest term, a RE is a sort of layer of abstraction that exists between the program and the operating system. In the JS context, there are two types of REs: Browser-Based RE and Node.js RE. So, before understanding Node.js we need to have a broad understanding of how JS execution happens, what sort of role JS engine plays in the code execution and what are the concepts that JS engines mainly use in the code execution process.

JS Execution

JS is known to be browser-based interpreted, single-threaded and event-driven language. Its execution in browsers is a bit different than how the other interpreted languages execute. Since JS codes which execute in the users' browser are written by the third-party web pages, it's unsafe to exploit users' systems to these third parties scripts, therefore executing these scripts directly in the user's operating system is not advised. Therefore, in browsers, there exists a JS engine which parses the JS code, converts it into machine code and executes it in the user's operating system. The majority of browsers have their own JS engine or open-sourced JS engines.

The V8 engine that's been introduced by the Chromium project is the most popular JS engine and is being used by Chrome and Opera as their primary JS engine. A typical JS engine consists of two main components: Call Stack and Heap Memory. In addition to these two components, there are two other important concepts that are basically involved in the JS code execution which are Event Loop and Event Queue.

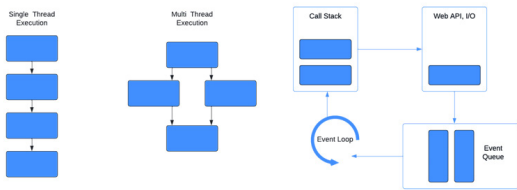
Call Stack

JS call stack follows the same concept as a typical stack data structure, which follows the Last in First Out (LIFO) principle. The responsibility of the JS call stack is to track the functions that have been called and executed. This means if a function needs to get executed it will get added/pushed to the call stack and after the function completes its execution, that particular function will get removed/popped out from the call stack. The role of the JS call stack in the code execution is pretty straightforward. When a user/browser loads a JS, it creates and pushes a global execution context to the top of the JS call stack which later could be executed. When any function is invoked, the JS engine creates a function execution context and that will be added to the top of the JS call stack, in case if this function invokes another function under that circumstances another function execution context will be created and will be added to the top of the call stack, and as long as new functions get invoked the above process will be continued, and when each of these functions gets executed they will be popped out from the call stack from top to bottom. However, there is a limitation in the number of functions that we can push to the call stack and can be held in the call stack at a given moment, this limitation depends on the pre-fixed JS call stack size and varies between the host environment. When the JS engine executes the JS code, if the code pushes functions into the call stack in a recursive manner, it may result in an exceeding of the call stack space, at the end which results in a stack-overflow error and inevitably stops the code execution as well. As mentioned above, since JS is a single-threaded language, only one call stack will be attached per JS engine, which leads us to note a point that since JS engine has a limited amount of call stack, JS and Node.js won't be the best choice when it comes to execution of recursion based algorithms.

Event Loop and Event Queue

Before learning about Event loop, it's important to have an idea of what it means by single threaded and event-

driven language because an event loop is a mechanism that involves both of those concepts. In a single-threaded programming language, the code is executed in line by line manner without giving a chance to parallel code execution, which means for the code execution, only one single thread of the CPU is being used. So, the specific thread won't be able to execute further until the top-level code blocks finish their execution, which means if any delay of I/O occurred in the system the code execution won't be further continued until that particular I/O tasks get completed.



Even though we were using procedural function execution in the above examples, in real-world, JS uses event base function execution, where the user's actions such as mouse clicks, and network requests determine the flow and execution of the functions. Because of this feature, JS is said to be an Event Driven programming language as well.

In JS execution when an event is triggered by the user, its corresponding callback function gets invoked, and in the first place, that function context gets into the Event Queue, which is a queue data structure that holds the functions that are supposed to get into the JS call stack next. When a function is called and it requires an input/output operation or an asynchronous task, the execution process of the asynchronous task moves to a separate thread. Once the asynchronous function is complete, the main function is added to the Event Queue and returns. In addition, there is a dedicated task process responsible for monitoring the status of the Event Queue. If there are functions waiting in the Event Queue and space available in the call stack, this process will prioritize the functions based on the "first in, first out" principle, adding them to the call stack. The Event Loop runs continuously in a loop until the JavaScript engine is terminated. Essentially, the task process responsible for this is known as the Event Loop.

Node.js RE

Until now we were considering the general JS execution but as mentioned above there are two separate JS REs. In the browser-based RE, the scripts don't have direct or API-based access to the end users' operating system. But generally, in the browser-based RE, the scripts have the access and control over the browser and its interaction like the window object, but yet in order to execute the JS we needed a browser. After considering this issue in the year 2009, the Node.js RE was introduced which built upon Chrome's V8 engine and uses the users operating system as the execution context instead of laying upon an abstraction layer like in a browser-based RE. This leads scripts to access the users' operating system functionalities, file system, and databases which were hidden inside the browser's abstraction layer in the browser-based RE. Furthermore, since there is no browser engaged in the Node.js environment, the scripts are unable to access browser-based APIs like window objects. Since Node.js RE can execute JS directly on the operating system like most of the other backend programming languages like JAVA and .NET, Node.js

enables programmers to develop backend applications using JS. Although there are no more browsers in the Node.js environment, the code execution procedure with the event loop remains the same in the Node.js.

Performance of Node.js over Myths

Since JS is single threaded most people believe that Node.js only uses one single thread in the execution, but the story under the hood claims differently, it says Node.js is single-threaded only because Node.js execution and the event loop are running on a single thread but there are some libraries in Node.js that enable parallel execution and therefore use more than a single thread. For instance, the libuv library used by Node.js to handle operating system-related tasks, I/O handling and networking uses the concept of the thread pool, which simply defines a set of reserved multiple threads waiting for tasks and executes the tasks concurrently. However, most of the time Node.js applications don't use the threads available in the most utilized way, which makes most of the cores of the processor to be idle. When it comes to the production environment this feature becomes a bottleneck to the overall performance of the application. For instance, suppose we reserve an eight-core processor-based server to the Node.js application, but yet it will only consume one core at a time and therefore the other seven cores become idle and useless. To overcome this issue in the production environment two approaches are followed: the first one would be running multiple instances of the same application on the same server in different ports and distributing the incoming load by using a load balancer. The other solution would be using a pre-written library like PM2 that manages multiple instances of application as multiple processes and balances the incoming traffic by using in-built load balancers.

Future of Node.js

Even though in this article we specifically discussed Node.js, Node.js is not the only non-browser JS RE available in the industry. Deno.js and Bun.js are two main competitors of Node.js. However, Node.js was the first runtime that was to introduce a non-browser JS execution concept and yet has the widest ecosystem with over 1.3 million third-party packages. In addition, Node.js remains the most popular Web Framework in the year 2022, according to the StackOverflow developer survey.

When it comes to Node.js it's a known fact that, in some scenarios it doesn't provide the best performance as it does in the other programming languages, mostly when working with heavy computational applications with recursion, in addition to that the relational database ecosystem of Node.js is also not wide as the other backend languages. But yet Node.js is being widely used for implementing web servers, and real-time communications by the tech giants in the industry. In addition to that, from the year 2011, up to now Node.js has been released 18 versions and with each of these new versions, the developers of Node.js have improved the Node.js execution and performance. Now Node.js supports the majority of the functionalities natively which needed third party libraries in prior. So with all these, Node.js has been categorized as an important technology in the software industry.

Alternative Energy and Sustainability

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The alternative energy industry is providing nontraditional energy sources for consumers. Energy can be obtained from many sources, and some of them are depleted when used and some are not eco-friendly. Nowadays, the whole world is facing an energy crisis because of using unsustainable energy sources. 85% of the world's energy needs are met by fossil fuels, and the energy sector is also to blame for 76% of greenhouse gas emissions. Also, air pollution, global warming, and climate change are other environmental effects. In addition, fossil fuels may end in the future. This is why alternative energy is so important for a sustainable world. Hydroelectric power, solar energy, geothermal energy, wind energy, and biomass energy are the main alternative sources. They are available naturally, renewable and eco friendly. It is notable that 8.5% of the world's power was produced by wind and solar energy in 2019.

Light and heat from the sun are the main energy of solar. Photovoltaics and other components help translate light and heat to electrical energy. Solar systems are installed in large buildings and houses in Sri Lanka as well as in many other countries. Concentrated solar power, artificial photosynthesis, and solar architecture have been introduced to the world. The only downside here is climate change. Energy storage systems can be used as a solution.

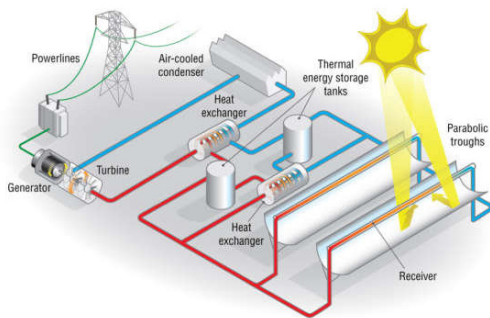


Figure 1: Electricity production using concentrated energy

In electricity production using concentrated energy (Figure 1), sunlight is absorbed by the PV cells. In reaction to an internal electric field within the cell (Figure 2). This energy generates electrical charges that move, which results in the flow of electricity. In the receiver (Figure 2), a heat transfer fluid is heated and pumped around and used to create steam. The steam is transformed into mechanical energy, which drives a generator to provide electricity.

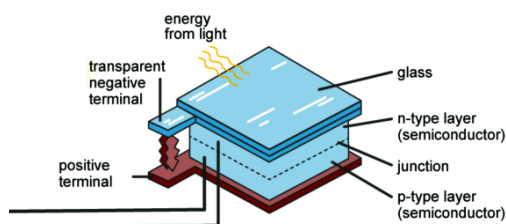


Figure 2: PV cell

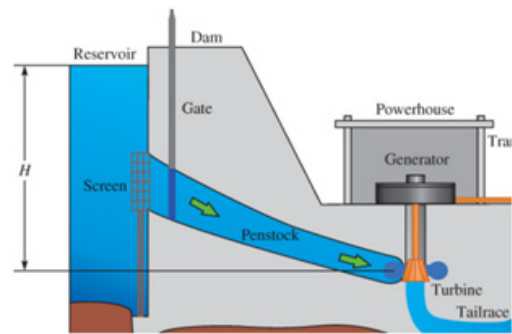


Figure 3: Hydro Power Generation

Traditional hydro plants (Figure 3), reservoir-based or run-of-the-river plants utilising diversion, and pump storage systems integrated with renewable energy are all methods of generating hydropower. Another source of hydropower is derived from the energy of ocean surface waves. In this method, the potential energy of water is harnessed and converted into kinetic energy using turbine. The rotation of the turbine then drives a generator which produces electricity.

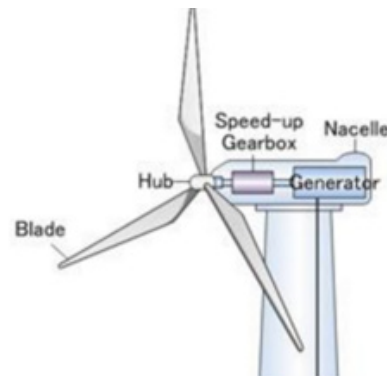


Figure 4: Wind Power Generation

In wind power generation (Figure 4), the turbine should be given high wind speed. The mechanical energy due to wind is converted to electrical energy using a generator. It requires a large area to install a turbine and the area should be rich in the wind.

By using these energies, a sustainable world can be built as renewable energy can reduce CO2 emissions. Every day the world's population and the energy demand are increasing. So, alternative energy technologies should be introduced and promoted among people.

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02

Computer Society

Approved: 21 January 2021 | Geo-code: SBC11373A

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Treasurer: Mr. Roy Nesarajah Viththagan

Vice Chair: Mr. Imesh Nuwantha

Vice Secretary: Ms. Mayoorka Srikantharasa

Editor: Ms. Nigee Hettige

04

Robotics and Automation Society

Approved: 06 June 2021 | Geo-code: SBC11373B

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Secretary: Mr. Banula Lakwindu Chandrasiri

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06

IEEE Computational Intelligence Society

Approved: 15 February 2022 | Geo-code: SBC11373D

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08

IEEE Electron Devices Society and Nanotechnology Council

Approved: 06 April 2022 | Geo-code: SBC11373E

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