



# 5<sup>TH</sup> INTERNATIONAL CONFERENCE ON ELECTRICAL ENGINEERING AND INFORMATION & COMMUNICATION TECHNOLOGY (ICEEICT)

November 18-20, 2021



Military Institute of Science and Technology (MIST)  
Mirpur Cantonment, Dhaka-1216, Bangladesh



Organized by  
DEPARTMENT OF EECE  
**MIST**



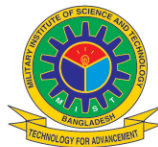
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**5<sup>th</sup> International Conference on Electrical  
Engineering and Information & Communication  
Technology (ICEEICT 2021)**

**18 - 20 November 2021**

**Technical Co-Sponsors**

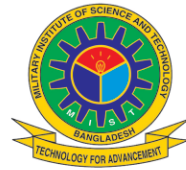


**Department of Electrical, Electronic and  
Communication Engineering (EECE)**

**Military Institute of Science and Technology (MIST)  
Mirpur Cantonment, Dhaka-1216, Bangladesh**



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ICEEICT 2021

Department of Electrical, Electronic and Communication Engineering  
Military Institute of Science and Technology  
Mirpur Cantonment, Dhaka-1216

# ICEEICT 2021

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**Military Institute of Science and Technology**

## LEGACY OF ICEEICT





**Minister**  
Ministry of Planning  
Government of the People's  
Republic of Bangladesh

## Message

It gives me immense pleasure to know that the Department of Electrical, Electronic and Communication Engineering (EECE) of Military Institute of Science and Technology (MIST) is going to organize the 5<sup>th</sup> International Conference on Electrical Engineering and Information & Communication Technology (ICEEICT) 2021 during 18-20 November 2021 at MIST, Dhaka, Bangladesh.

The principal agenda of the Ministry of Planning is the development of Bangladesh through accelerating growth and empowering citizens. In the past decade, we have had tremendous success in socio-economic development, but we have to keep in mind that there is no place for complacency. The world is moving faster, and a few countries are outperforming us. We have a huge population, but to transform them as assets, education, and knowledge of ICT is sine qua non.

In the last decade, the government has taken every initiative to make services digital. The results are obvious; now ICT is changing the lives of rural Bangladesh by making education, health, and agriculture services more accessible to them. Apart from the above, we have to keep pace with the world by achieving the global agenda-called Sustainable Development Goals (SDGs). We will be implementing SDGs through the next two five-year plans. We alone cannot attain the goals within the stipulated time. That is why we need partnership and cooperation with both the developed and developing world through the transfer of knowledge, technology, investment, and trade.

SDGs as integrated with the 7<sup>th</sup> Five-year plan, we are focusing on the development by increasing spending on Research and Development from 0.6% to 1% of GDP and also by increasing the proportion of primary government schools with a computer laboratory.

I am certain that the conference will bring together engineers, researchers, academics, and entrepreneurs across the world to share ideas and collaborate on research. I also admire MIST's motivation in generating opportunities for enhancing new knowledge by conducting these kinds of international conferences.

I firmly believe that the conference sessions will benefit the scientific and engineering community of Bangladesh.

I appreciate the organizers' efforts in making the ICEEICT 2021 a grand success.



**M A Mannan, MP**



**Chairman**  
University Grants  
Commission of Bangladesh

## Message

I am delighted to hear that the Department of Electrical, Electronic and Communication Engineering (EECE) of Military Institute of Science and Technology (MIST) is going to host the 5<sup>th</sup> International Conference on Electrical Engineering and Information & Communication Technology (ICEEICT) 2021 at MIST, Dhaka on 18-20 November 2021.

The Government of Bangladesh has put tremendous efforts in the sectors of engineering and ICT development to improve people's lives. New technology and discoveries are being developed and we have to keep pace with the fast moving world. Amidst the pandemic that has brought the world to a halt, MIST's initiative to conduct this international event deserves appreciation. This type of international conference will allow individuals to share new ideas and perspectives, which will eventually inspire the young professionals to innovate new technologies to deal with new horizons of research.

Undoubtedly, engineering has made our lives simpler, easier, and more comfortable in various sectors. Even during this pandemic, we can communicate effectively with one another, conduct online seminars, symposiums, workshops, conferences, etc., and make education more accessible and affordable by using ICT. I believe this conference will inspire researchers and engineers to continue their work despite the challenges they face.

I applaud all the participants, volunteers, authors, exhibitors, and organizers for their dedication and enthusiasm to make this event a successful one. I hope that this conference will provide us with new solutions to address the forthcoming challenges that our beautiful world faces.

I wish ICEEICT 2021 a grand success.



**Professor Kazi Shahidullah**



**Commandant**  
Military Institute of  
Science and Technology

## Message

The unprecedented advancement of Science and Technology in the 21<sup>st</sup> century has revolutionized the control of sapiens over the universe. We have also witnessed the application of artificial intelligence, machine learning, and robotics in almost every field of Science, Engineering, and Technology. In this connection, the 5<sup>th</sup> International Conference on Electrical Engineering and Information & Communication Technology (ICEEICT) 2021 strives to be a premium multi-track international conference in Bangladesh to support the vision of ‘Digital Bangladesh’.

I am glad to patronize ICEEICT 2021 that aims to bring experts from academia, industry, and research to exchange their visions, views, and achievements through keynotes, invited talks, and technical sessions along with informal discussions. Research in the field of engineering must focus on authentic, complex problems substantiated by empirical evidence. Not only innovative cross-domain studies but also pilot showcasing is expected from our potential researchers.

I wish ICEEICT 2021 all the success.



**Major General Md Wahid-Uz-Zaman**  
Chief Patron, ICEEICT 2021



**Chair**  
IEEE Bangladesh Section

## Message

It is immense pleasure to know that the Department of Electrical, Electronic and Communication Engineering (EECE) of the Military Institute of Science and Technology (MIST) is going to host the 5<sup>th</sup> International Conference on Electrical Engineering and Information & Communication Technology (ICEEICT) 2021 to be held on 18-20 November 2021, Dhaka. IEEE Bangladesh Section is pleased to serve as the technical co-sponsor of ICEEICT 2021, providing technical support to ensure the highest technical quality.

It is high time to contribute to society/nations by developing an innovative culture in Contemporary Science & Technology. A significant number of innovative initiatives should be taken to up-skill our young talents, fellows, researchers as the competent manpower to take the upcoming global challenges of Industry 4.0. With regards to this, ICEEICT 2021 is a timely initiative to develop such a platform that may be helpful for our talented young generations to gather/share knowledge with renewed scientists of science, engineering, and technology.

IEEE is the largest professional organization in the world and is dedicated to advancing technological innovation and excellence for the benefit of humanity, society, and mankind. In recent years, IEEE Bangladesh Section is working tremendously by organizing a series of national/international events for developing the young talents, such as region 10 first virtual flagship conference IEEE Tensymp 2020, International Covid-19 Congress 2020, 1st virtual online Conference Organizer's Panel in IEEE Region 10 (Asia Pacific) VCOP 2020, IEEE r10 HTC 2017, IEEE WIECON-ECE 2015-2020, IEEE WIE International Leadership Summit 2018, IEEE r10 MiniPoco 2017-20, 8-10 technically co-sponsored conferences in every year and many more. In recent years, IEEE Bangladesh Section and its members have acquired several outstanding achievements under the dynamic leadership of Past Chairs of the IEEE Bangladesh Section, including Prof. Sheikh Anowarul Fattah and Prof. Celia Shahnaz. Few remarkable achievements are the 2018 IEEE MGA Outstanding Large Section Award (which is the highest possible recognition for a section), 2018 Outstanding Section Membership Retention Performance Recognition award, 2018-19 Outstanding Section Membership Recruitment and Retention Performance Recognition award, 2018 R10 Outstanding Volunteer Award, 2016 IEEE R10 HTA Outstanding Activities Award, 2016 MGA Achievement Award, 2016 IEEE MGA Leadership Award and 2018 IEEE R10 YP Affinity Group of the Year Award.

IEEE Bangladesh Section was established in 1993 with 56 members, and its membership reached the landmark of 1000 after 21 years in 2014. Due to the rapid growth of quality events/activities in recent years,

the membership is now more than 4000. Currently, Bangladesh Section has 14 society chapters, two affinity groups, 50+ student branches which makes the IEEE Bangladesh Section the 5th rank among 342 Sections over 160 countries. Bangladesh Section appreciates all members to work together for continuing the momentum of the Section and to retain its glory by increasing more scientific and technological activities to bring more prestige and visibility to the world.

On behalf of the IEEE Bangladesh Section, I express my sincere gratitude to all the guests, authors, speakers, committee members, reviewers, track chairs, session chairs, sponsors, and volunteers whose incredible efforts are the key factors for actualizing the ICEEICT 2021. We hope that all participants will find the conference enjoyable, informative, and thought-provoking.

I wish all the success to ICEEICT 2021.

A handwritten signature in black ink, appearing to read 'M. Moshikul Hoque'.

**Professor Dr. M. Moshikul Hoque**  
Chair, IEEE Bangladesh Section



## Message

IEEE Communication Society (ComSoc) Bangladesh Chapter takes the opportunity to welcome all the participants to the 5<sup>th</sup> International Conference on Electrical Engineering and Information & Communication Technology (ICEEICT) 2021 during 18-20 November 2021 at Military Institute of Science and Technology, Dhaka, Bangladesh. IEEE Communication Society Bangladesh Chapter is serving as the technical co-sponsor of ICEEICT 2021, so that this conference has become one of the highest quality conferences.

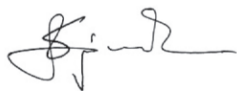
I hope the conference will offer a very good environment to share information and knowledge with the professionals both from home and abroad. This conference will obviously contribute to the development of science and technology for the betterment of mankind.

IEEE ComSoc is one of the largest professional organizations in the world. The vision of this society is to advance global prosperity in the field of communication by fostering technological innovations, enabling members' careers, and promoting community worldwide. It also encourages dissemination and sharing of knowledge through interaction among engineers, academics, researchers both on a global and local scale to create a harmonious world and environment through the application of communication technologies. This society is playing a lead role in education, training, and research in the vast area of communication engineering.

The IEEE Communication Society has been actively participating in different technical activities like conferences, workshops, seminars, tours, and training programs. The members of the chapter are bringing glory to the country by winning prizes in international competitions. Society is committed to serving the technical needs of the community in the coming days.

My sincere appreciation and gratitude go to all ICEEICT 2021 committee members for their endeavors who have worked tirelessly to make the conference successful. I hope you will enjoy the conference through your active participation and plan to contribute to future events of ICEEICT as authors, speakers, and volunteers. I wish you all the best during the conference and hope you will have time during your visit to explore and enjoy our city.

I ardently wish a grand success to the ICEEICT 2021.



**Professor Dr. Satya Prasad Majumder**  
Chair, IEEE ComSoc, BD Chapter



**Conference Chair**  
ICEEICT 2021

## Message

I am delighted to know that the Department of Electrical, Electronic and Communication Engineering (EECE), Military Institute of Science and Technology (MIST) is going to organize the 5<sup>th</sup> International Conference on Electrical Engineering and Information & Communication Technology (ICEEICT) 2021 during 18-20 November 2021 in MIST, Dhaka. I express my heartfelt salutation to the Commandant and all members of MIST for organizing such a time-demanding international conference.

I take pride to mention that MIST, a well-known technical institute of Bangladesh Armed Forces, is making remarkable progress in enlightening and empowering our personnel to face adversity in the field of engineering and technology. Through excellence in academic and research activities, MIST is on well its way to achieving the motto 'Technology for Advancement'.

The main intent of ICEEICT 2021 is to bring together academicians, engineers, and researchers from home and abroad universities, industries, and research labs to share their expertise on the latest trends and advancements in various areas of electrical, electronics, information, and communication technology.

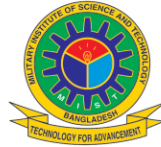
As I know, the ICEEICT 2021 produces excellent results in terms of opening opportunities for information and knowledge sharing, updating with the current innovations in the Electrical & Electronic Engineering and ICT fields. Continuing the trend, I hope that this 5<sup>th</sup> conference at MIST will also act as a knowledge-sharing forum for the participants. I am sure that such an auspicious event will undoubtedly add an impetus to our efforts towards the development activities for realizing digital technologies in all areas of industry, health, education, agriculture, and commerce.

The ICEEICT 2021 would provide a great opportunity for our scholars to present their research outcomes to the rest of the world, thus, creating possibilities to make effective cooperation and collaboration among the participants. It is a pleasure to know that a good number of participants from all over the world have responded to ICEEICT 2021 this year.

I fervently wish a grand success to the ICEEICT 2021.



**Professor Dr. Mohammed Hossam-E-Haider**



**Technical Chair**  
ICEEICT 2021

## Message

On behalf of the technical committee, it gives me immense pleasure to welcome you all to the 5<sup>th</sup> International Conference on Electrical Engineering and Information & Communication Technology (ICEEICT) 2021 organized by the Department of Electrical, Electronic and Communication Engineering (EECE) at Military Institute of Science and Technology (MIST).

I would like to express my sincerest gratitude towards all the authors who have enriched the conference through their contribution. This year, we have received an overwhelming amount of responses from researchers at home and abroad. A total of 262 manuscripts were submitted from Bangladesh and 12 other countries. These papers were peer-reviewed by 147 distinguished researchers from all over the world. However, 100 papers are finally accepted and registered for presentation at this conference. All accepted papers are included in the conference proceedings and will be sent to the IEEE Xplore Digital Library.

The conference consists of 17 technical (13 regular and 4 special) sessions, 8 keynote sessions, 3 industry and academia sessions, and 1 tutorial session covering all the aspects of Electrical Engineering and Information & Communication Technology. Likewise the previous editions of ICEEICT, outstanding research contributions will also be recognized this year with the “Best Paper” and “Best Presentation” awards.

As the 5<sup>th</sup> endeavor of arranging an international conference, we would like to thank the renowned academicians from home and abroad for their valuable contributions in peer reviewing and evaluating the manuscripts. We also owe a debt of gratitude to the members of the international and local Advisory Committees and Technical Co-sponsors for their invaluable guidance, collaboration, and recommendations in ensuring the success of the conference. All technical and organizing committee members deserve special appreciation and acknowledgment for their tireless and earnest efforts.

I look forward to seeing your active participation in ICEEICT 2021 and making this conference a grand success by exchanging industrial and academic experience in the domains of Electrical and Electronic Engineering and Information and Communication Technology.



**Brigadier General A K M Nazrul Islam, PhD**



**Organizing Chair**  
ICEEICT 2021

## Message

On behalf of the organizing committee, I take the privilege to welcome you all to the Military Institute of Science and Technology (MIST) on the occasion of the 5<sup>th</sup> International Conference on Electrical Engineering and Information & Communication Technology (ICEEICT) 2021 organized by the Department of Electrical, Electronic and Communication Engineering, MIST. I feel honored and privileged to organize this international conference at MIST. In this conference, researchers and practitioners can exchange their innovative ideas by means of keynotes, technical presentations, and discussions. I also deeply appreciate the technical co-sponsorship of the IEEE Bangladesh Section and IEEE ComSoc Bangladesh Section.

The Organizing Committee of ICEEICT 2021 would like to thank all the authors for their submission of papers. The technical committee worked hard to get these papers peer-reviewed and selected the contributory papers for the presentation at the conference. I express my heartiest congratulation to the respected reviewers and the review committee members for their effort towards the successful review of the papers in a short period of time.

I acknowledge the financial support and the sponsorship from all the sponsoring organizations towards the successful completion of the conference events. I deeply express my gratitude and thanks to the Commandant, MIST, for rendering continuous support in carrying out all the activities of the conference.

My sincere appreciation and gratitude go to the technical chair Brigadier General A K M Nazrul Islam, and all other people for their endeavor who have worked tirelessly to make this conference successful.

I wish you all the best during the conference and hope you will explore and enjoy our environment during the conference through your active participation and plan to contribute to the future events of ICEEICT as authors, speakers, and volunteers.



**Group Captain Md Abdul Halim**

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*Plenary Session*  
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# Power Electronics Technology - Quo Vadis

**Frede Blaabjerg**  
Professor, Faculty of Engineering and Science



Aalborg University, Denmark

**Abstract:** The world is becoming more and more electrified combined with that the consumption is steadily increasing – at the same time there is a large transition of power generation from fossil fuel to renewable energy based which all together challenges the modern power system but also gives many opportunities. We see also now big steps being taken to electrify the transportation – both better environment as well as higher efficiency are driving factors. One of the most important technologies to move this forward is the power electronics technology which has been emerging for decades and still challenges are seen in the technology and the applications it is used. This presentation will be a little forward looking (Quo Vadis) in some exciting research areas in order further to improve the technology and the systems it is used in. Following main topics will be discussed.

- The evolution of power devices
- Renewable Generation
- Reliability in power electronics
- Power Electronic based Power System stability



**Biography:** Frede Blaabjerg (S'86–M'88–SM'97–F'03) was with ABB-Scandia, Randers, Denmark, from 1987 to 1988. From 1988 to 1992, he got the PhD degree in Electrical Engineering at Aalborg University in 1995. He became an Assistant Professor in 1992, an Associate Professor in 1996, and a Full Professor of power electronics and drives in 1998. From 2017 he became a Villum Investigator. He is honoris causa at University Politehnica Timisoara (UPT), Romania and Tallinn Technical University (TTU) in Estonia. His current research interests include power electronics and its applications such as in wind turbines, PV systems, reliability, harmonics and adjustable speed drives. He has published more than 600

journal papers in the fields of power electronics and its applications. He is the co-author of four monographs and editor of ten books in power electronics and its applications. He has received 33 IEEE Prize Paper Awards, the IEEE PELS Distinguished Service Award in 2009, the EPE-PEMC Council Award in 2010, the IEEE William E. Newell Power Electronics Award 2014, the Villum Kann Rasmussen Research Award 2014, the Global Energy Prize in 2019 and the 2020 IEEE Edison Medal. He was the Editor-in-Chief of the IEEE TRANSACTIONS ON POWER ELECTRONICS from 2006 to 2012. He has been Distinguished Lecturer for the IEEE Power Electronics Society from 2005 to 2007 and for the IEEE Industry Applications Society from 2010 to 2011 as well as 2017 to 2018. In 2019-2020 he served as a President of IEEE Power Electronics Society. He has been Vice-President of the Danish Academy of Technical Sciences. He is nominated in 2014-2020 by Thomson Reuters to be between the most 250 cited researchers in Engineering in the world.

# Unlocking the Hidden Capacity of the Electrical Grid Through Power Electronics

**Marco Liserre**  
Professor, Power Electronics



University of Kiel, Germany

**Abstract:** Studies have revealed that the actual electrical grid is less utilized than 25 years ago: there is a higher utilization for a shorter time. This “greater demand variability” has been mostly caused by new loads, like air conditioning, but also by changes in the industrialization landscape. The wider integration of renewable energies and new loads (like heat pumps and electric vehicle charging stations) is expected to worsen the situation resulting in further congestion or underutilization of the electrical network, while their control (e. g. Load Demand Response) could relieve the problem. The use of direct current (Hybrid grid) and the coordination among more energy carriers (Multimodal grids) together with Smart Grid technologies, is attempting to give to the electrical grid more flexibility in controlling the power flow by exchanging it with the dc-infrastructure or with other energy layers. Power Electronics is a key technology in all these solutions and offer the possibility to unlock the hidden potential of the grid without the need of a massive reinforcement of the electrical infrastructure.



**Biography:** Marco Liserre received the MSc and PhD degree in Electrical Engineering from the Bari Polytechnic, respectively in 1998 and 2002. He has been Associate Professor at Bari Polytechnic and from 2012 Professor in reliable power electronics at Aalborg University (Denmark). From 2013 he is Full Professor, and he holds the Chair of Power Electronics at Kiel University (Germany). At Kiel University he is leading a team of 25 researchers with a 2 Million Euro annual budget through third-party funded projects, with a Power Electronics Laboratory, a Medium Voltage Laboratory and a Laboratory on Batteries and Energy Conversion, in cooperation with colleagues in material science, approved for 2 Million Euro. He has been leading in the last 7 years’ third-party

projects for more than 13 Million Euro (of which 5 % direct company assignment) having responsibility role, among the other, within the strategic governmental 10 years’ initiative “Copernicus” in Germany for the Energy Change towards 80 % renewable based energy society and in a priority program of the German research Foundation DFG within a cooperative project with EPFL. Notably he has been awarded in 2013 with an ERC Consolidator Grant (European Excellence Grants) for the project “The Highly Efficient And Reliable smart Transformer (HEART), a new Heart for the Electric Distribution System”. He has published 500 technical papers (1/3 of them in international peer-reviewed journals) and a book. These works have received more than 35000 citations. Marco Liserre is listed in ISI Thomson report “The world’s most influential scientific minds” from 2014. He is fellow of IEEE (achieved at the age of 38) and member of IAS, PELS, PES and IES. He has been serving all these societies in different capacities. He has received the IES 2009 Early Career Award, the IES 2011 Anthony J. Hornfeck Service Award, the 2014 Dr. Bimal Bose Energy Systems Award, the 2011 Industrial Electronics Magazine best paper award in 2011 and 2020 and the Third Prize paper award by the Industrial Power Converter Committee at ECCE 2012, 2012, 2017 IEEE PELS Sustainable Energy Systems Technical Achievement Award and the 2018 IEEE-IES Mittelmann Achievement Award, which is the highest award of the IEEE-IES.

# The Internet of Things that Shouldn't be on the Internet

**Henning Schulzrinne**  
Professor, Department of Computer Science



Columbia University, USA

**Abstract:** The Internet of Things promises to make homes, factories, cars and cities smarter, promising better information and better outcomes. We have made significant progress in making these devices cheaper and allow them to communicate in many more places than a few years ago. But the promise of the Internet of Things faces significant obstacles: Security, usability, programmability and impact. I will discuss challenges to making the Internet of Things more secure, why using IoT services and devices remains difficult, how to effectively control thousands of devices within a single campus, factory or hospital, and how to think about possible impacts on the public.



**Biography:** Henning Schulzrinne was the Chief Technology Officer (CTO) for the United States Federal Communications Commission, having been appointed to that role on December 19, 2011 to 2014. Previously he was chair and Julian Clarence Levi Professor of the Computer Science department at Columbia University. He is a co-chair of the Internet Technical Committee of the IEEE Communications Society. Schulzrinne studied engineering management at the Department of Electrical Engineering and Information Technology of the German Technische Universität Darmstadt in Darmstadt, where he earned his Vordiplom (cf. Diplom), then went on to earn his M.Sc. at the University of Cincinnati and his Ph.D. at the University of Massachusetts Amherst. Schulzrinne has contributed to standards. He co-designed the Session Initiation Protocol along with Mark Handley, the Real Time Streaming Protocol, the Real-time Transport Protocol, the General Internet Signaling Transport Protocol, part of the Next Steps in Signaling protocol suite. He was elected as an ACM Fellow (2014) for contributions to the design of protocols, applications, and algorithms for Internet multimedia.

# Using Everyday Routines for Understanding Health Behaviors

Anind K. Dey

Professor, Department of Human-Centered Design and Engineering



University of Washington, USA

**Abstract:** We live in a world where the promise of ubiquitous computing and the Internet of Things is coming true. We have smart devices that pervade our lives, and that are constantly collecting data about us and mostly discarded as irrelevant. I will demonstrate how researchers can extract relevance from this passively collected data and use it to "image" people's behaviors. I will describe approaches for extracting behavioral routines from smart devices, and then how these routines can help us better understand individual and group human behaviors, as well as anomalies. Using examples from healthcare, I will describe how we can leverage both the routines and anomalies to improve our understanding of health-related behaviors and support behavior change.



**Biography:** Anind K. Dey is a Professor and Dean of the Information School and Adjunct Professor in the Department of Human-Centered Design and Engineering. Anind is renowned for his early work in context-aware computing, an important theme in modern computing, where computational processes are aware of the context in which they operate and can adapt appropriately to that context. His research is at the intersection of human-computer interaction, machine learning, and ubiquitous computing. For the past few years, Anind has focused on passively collecting large amounts of data about how people interact with their phones and the objects around them, to use for producing detection and classification models for human behaviors of interest. He applies a human-centered and problem-based approach through a collaboration with an amazing collection of domain experts in areas of substance abuse (alcohol, marijuana, opioids), mental health, driving and transportation needs, smart spaces, sustainability, and education. Anind was inducted into the ACM SIGCHI Academy for his significant contributions to the field of human-computer interaction in 2015.

# Energy Technologies for Future Grids

**Kashem M. Muttaqi**  
 Professor, Faculty of Engineering and  
 Information Sciences



University of Wollongong  
 Australia

**Abstract:** New and modern energy technologies will make a significant change in the operation of electricity systems in future power grids. The current power grids are undergoing an unprecedented transformation, changing the way we have been producing, delivering, and consuming energy over the past century. This new energy era includes renewable sources and energy storage, integrated to power grids through power converters and transformers. In the future, these resources will be interfaced through high frequency magnetic links and solid-state transformers. Electric vehicles and energy efficient technologies are also rapidly emerging and interacting with the grids. As these connections are being evolved, it is causing the engineers to rethink the current paradigms of system analysis and planning with a focus on how they can achieve the most flexible, efficient, and reliable power grid for the future.



**Biography:** Dr. Kashem Muttaqi received his Bachelor of Science in Electrical and Electronic Engineering degree from Bangladesh University of Engineering and Technology (BUET), Bangladesh in 1993. He then received a Master of Engineering in Science degree from the University of Malaya (UM), Malaysia in 1997, and received his Doctor of Philosophy degree from Multimedia University (MMU), Malaysia in 2001. Currently, he is the Director of the Australian Power and Energy Research Institute (APERI) and a Professor at the School of Electrical, Computer and Telecommunications Engineering at the University of Wollongong. He is also serving as the Discipline Leader for Electrical

Engineering at the School of Electrical, Computer and Telecommunications Engineering (SECTE), University of wollongong. He served as the Postgraduate Coursework Degree Coordinator at the School of Electrical, Computer and Telecommunications Engineering, University of Wollongong from 2008 to 2010, and the Cluster Head for 09 Engineering, Faculty of Engineering and Information Sciences (EIS) at the University of Wollongong from 2019 to 2021. He was associated with the University of Tasmania, Australia as a Research Fellow/Lecturer/Senior Lecturer from 2002 to 2007, and with the Queensland University of Technology, Australia as a Research Fellow from 2000 to 2002. Previously, he worked for Multimedia University, Malaysia as a Lecturer from 1997 to 2000.

# Recent Advances in Learned Image and Video Compression

**Ahmet Murat Tekalp**  
Professor, Electrical and Electronics Engineering



Koç University  
Turkey

**Abstract:** Conventional video compression methods employ a linear transform and block motion model, and the steps of motion estimation, mode and quantization parameter selection, and entropy coding are optimized individually due to the combinatorial nature of the end-to-end optimization problem. Learned video compression allows end-to-end rate-distortion (R-D) optimized training of nonlinear transform, motion compensation and entropy model simultaneously. I will first review recent advances in learned image compression. Then, I will discuss the state-of-the-art in learned video compression and present recent results on learned hierarchical bi-directional video compression that combines the benefits of hierarchical bi-directional motion compensation and end-to-end rate-distortion optimization.



**Biography:** A. Murat Tekalp received BS degrees in Electrical Engineering and Mathematics from Bogazici University in 1980 with high honors, and the M.S. and Ph.D. degrees in Electrical, Computer, and Systems Engineering from Rensselaer Polytechnic Institute (RPI) respectively. Since June 2001, he has been a Professor at Koc University, Istanbul, Turkey. He was the Dean of Engineering at Koç University between 2010-2013. His research interests are in the area of digital image and video processing, including video compression and streaming, motion-compensated filtering, super-resolution, video segmentation, object tracking, content-based video analysis and summarization, 3D video processing, deep learning for image and video processing, video streaming and real-time video communications services, and software-defined networking. Prof. Tekalp is a Fellow of IEEE and a member of Turkish Academy of Sciences and Academia Europaea.

# Medical Image Analysis with Artificial Intelligence

**Syoji Kobashi**  
Professor, Graduate School of Engineering



University of Hyogo  
Japan

**Abstract:** Computer-aided diagnosis (CAD) in medical image analysis (MIA) is one of the expected fields that artificial intelligence (AI), especially deep learning (DL), improves the performance. However, DL alone is not enough to analyze medical images. DL process is just one processing step in the overall CAD system. Rather, the main role of researcher is to develop methods to synthesize data that are processed by the DL models, and methods that derive satisfactory results from the inferred results of the DL model. In order to discuss how to develop AI-based-CAD systems, I will introduce some CAD applications using DL models. It will include fatigue fracture detection in 3-D computer tomography (CT) images, tooth recognition in dental panorama radiograph, finger joint detection in hand radiograph. Through the applications, I am going to summarize the strategy to develop AI-based-CAD systems.



**Biography:** Syoji Kobashi received BE in 1995, ME in 1997, and Doctor of Engineering in 2000, all from Himeji institute of Technology. He was an assistant professor at Himeji Institute of Technology (2000-2004), an associate professor (2005-2016), currently a professor (2016-present) and the manager of advanced medical engineering research center (2016-present), University of Hyogo. And, he was a guest associate professor at Osaka University, WPI immunology frontier research center (2010-2016), and was a visiting scholar at University of Pennsylvania (2011- 2012). His research interests include computer-aided diagnosis in medical images and artificial intelligence. He received 16 international awards, including Lifetime Achievement Award (WAC, 2016), Franklin V. Taylor Memorial Award (IEEE-SMCS, 2009). He has been serving on Program Chair of WAC-2021, Publication Chair SMC-2018, of and many others. Moreover, he is an editor-at-large of Intelligent Automation & Soft Computing journal, an editor-in-chief of International Journal of Biomedical Soft Computing and Human Sciences, etc. He is the senior member of IEEE.

# Multi-perspectives of New and Next Generation Radio

**Ranjan Gangopadhyay**  
**Professor, Electronics & Communication Engineering**

**The LNM Institute of Information,  
 Technology, India**

**Abstract:** With the spectacular technological advances in wireless technology, the 5G - the new Radio has a great promise to expand its range of applications and versatility. Specifically, the target services aim at accomplishing enhanced mobile broadband ultra-reliable low-latency and massive machine type communication. With the recent upsurge of diversified mobile applications supported by AI and deep learning, the next generation radio (6G) will cater the needed communication services for 2030 using the THz-band. The Talk will dwell on multi-perspective visions, challenges, and prospects of both new Radio 5G and the XG Radio wireless.



**Biography:** Professor Ranjan Gangopadhyay, currently a Research Professor in the Department of Electronics and Communication Engineering, as well as the Centre Lead of one of the most vibrant research centres of LNMIIT, the Centre of Excellence for Next Generation Communication and Networking (C-NGCN). He has guided so far 10 PhD students and has published more than 135 research papers in journals and conferences. Before joining LNMIIT as a Distinguished Professor in 2008, Prof. Gangopadhyay, was Professor and Head of E&ECE, Indian Institute of Technology (IIT), Kharagpur and served as an Emeritus Professor in G. S. Sanyal School of Telecommunication, IIT-Kharagpur. He was Visiting Professor in the University of Parma, Italy; Chonbuk National University,

South Korea and Scuola Superiore Sant'Anna, Pisa, Italy. He was a member of the Scientific Advisory Committee in Scuola Sant'Anna, Pisa, Italy for three consecutive terms. He also received European Commission Senior Post-Doctoral Fellowship, INSA-Royal Society Fellowship (x2); JSPS (Japan) Senior Fellowship and CIDA (Canada) Fellowship. He was the Chief Investigator of several bilateral foreign projects: European Commission, Indo-Italy, Indo-Japan, Indo-UK and of the projects funded by National Agencies: DST, DOE, ISRO, MHRD. At LNMIIT, as the Principal Investigator, he has successfully completed a high value (~1.56 crores) project titled, "Mobile Broadband Service Support for Cognitive Radio" sponsored by ITRA, Government of India. He also served as a Referee for Peer Review Evaluation, European Commission till 2013.

*Industry-Academia Bridging Session*  
*Distinguished Speakers*



**Marcus Tee:** Marcus is part of Microsoft Germany Global Account team, serving as a Cloud Solution Architect. His focus is to drive digital transformation and public cloud adoption to realize business outcome. Prior to this role, Marcus was Client Technology lead for Microsoft Singapore's Public sector team, which drove several nation-wide cloud transformation projects aligning with Singapore's Smart Nation Initiatives. Some notable project includes Singapore Government Commercial Cloud, Tax System, as well as Nationwide Park's Management System. In addition to enterprise customer engagement, Marcus also actively engages the community to share his passion in technology. In the recent Microsoft Annual Internal Global Hackathon, Marcus took part in "Hack for Africa" with a global team and developed a wildlife identification system to enable non-intrusive wildlife monitoring and preservation using artificial intelligence. Prior to joining Microsoft, Marcus graduated from Nanyang Technological University (NTU) with a degree in Mathematics and Economics. As an undergraduate, he developed "NTU Bus Arrival", an AI chatbot that served 20,000 students on campus, and was featured in The Nanyang Chronicle and Vulcan Post. This chatbot received high demand and reached 100,000 messages in less than two months from the day that the chatbot is published.



**Jannatul Popy:** Popy is a tech enthusiast currently working as Partner Technical Strategist at Microsoft Bangladesh and leading the partner technical transformation for the Microsoft Bangladesh ecosystem. As part of her role at Microsoft she has taken care of partner transformation from other countries like Myanmar, Nepal, Brunei etc. As a proud ex-student of MIST, Popy is very keen and working towards the goal of bringing the right technical enablement which will drive the overall digital transformation across organizations. Prior working at Microsoft Popy has worked with one of the largest IT Solution Providers in the country for over 7 years where she drove the Cloud Business as a Technical and Solutions Lead starting from very scratch at the time when the country was trying to evangelize the new cloud solutions. Popy has completed here BSc in EECE from MIST in year 2011 and with the growth mindset towards technological learning, her passion for innovation and adoption of technology has brought the digital transformation in many major organizations in the country including Banks, large conglomerates, telcos and the regional Microsoft partners who are the key stakeholders when comes to innovation and transformation in areas like cloud computing, data and AI, advanced security etc.

## Samsung

*Do What You Can't*



**Raquibul Hasan:** Raquibul Hasan has 16+ years of experience in software engineering industry, currently serving as Head of the Department, Health Application Group, Samsung Electronics, Bangladesh (SRBD). His interest lies in mobile and wearable computing especially in Health and fitness domain. Raquibul started his career as a software engineering intern in 2003, and after completing his BSc from RMIT, Melbourne, AUS he worked full time as a developer and database engineer. He then completed his master's part time while working. He moved to USA in 2008 and worked for various teams in Microsoft for almost 7 years before returning to Bangladesh in 2014 when he joined Samsung.



**Md. Sazzad Hissain Khan:** Md. Sazzad Hissain Khan received his Bachelor of Science in 2010 and Master of Computer Science and Engineering degree in 2011 from University of Dhaka, Bangladesh. He joined Samsung R&D Institute Bangladesh (SRBD) as a Software Engineer and throughout his 10+ years of experience on mobile software development he has acquired a deep understanding on how to overcome the real hurdles of developing performant, robust, testable and maintainable applications from the requirement analysis to the architecture, design, development, continuous integration and continuous deployment. He has a strong fascination for CLEAN coding and precise communication. Problem solving is his passion regardless of if its design related or architectural and he values the passion for problem solving minds. Usability, especially user intuitive and interactive UX for frontends and fault tolerance and resilience for backends are his prime concerns on developing any product. He achieved his Associate Software Architect certification from SATTI (Samsung Advance Technical Training Institute, South Korea) in 2019 and till then he has been working to improve Samsung Health iOS which is a popular health application of Samsung Electronics for Apple users. In 2019, one of his developed products CareBot, received the best product award on robotic category in CES'2019 (Consumer Electronics Show - 2019, Las Vegas, US). Throughout his engineering career he received many awards and certifications. Mr Khan attained two utility patents in 2021.



**Laura M. Rueda-Delgado:** Laura M. Rueda-Delgado is a Marie Skłodowska Curie Research Fellow at Cumulus Neuroscience Limited. She has pioneered the research line on EEG applied to motor control in the Motor Control and Neuroplasticity research group. Before that, Laura was a postdoctoral researcher in Trinity College Dublin and BrainWaveBank Ltd. (Oct. 2019 – Sept. 2020) and Trinity College Dublin, School of Psychology (Jul. 2017 – Sep. 2019), where she has received SFI Industry Fellowship for developing a model for prediction of behavioral performance in older adults with advanced machine learning methods. As a result of her continuous research activity, 13 manuscripts have been published in peer-reviewed journals with impact factor (IF) between 2.8 and 9.42. As part of her achievements, she received a scholarship for a 2-year master’s in biomedical engineering in the CEMACUBE consortium, funded by the European Commission, and got a silver medal for academic performance- best GPA of the class from the Bachelor in Electronics Engineering, Universidad del Norte.



**Md Nurul Islam:** Md Nurul is a multidisciplinary result-driven researcher with training in Engineering, Neuroscience, Statistics, and software development- geared with research expertise. At present, he is an EEG Research Engineer at Cumulus Neuroscience Limited. Before that, he was a postdoctoral associate in the Department of Neuroscience and Center for Visual Science, University of Rochester, NY, USA. As a Psychology, Trinity College Dublin, Ireland, Nurul has developed an open-source, peer-reviewed, GUI-based computational platform for systematic analysis of the large volume of data. His ongoing research has resulted in several publications in peer-reviewed journals with impact factor ranging between 2.7 to 13.2 (300+ citations as of Oct 8, 2021). As part of his academic excellence, he received a scholarship for a 2-year master's in Common European Master’s in Biomedical Engineering (CEMACUBE) funded by the European Commission. Nurul graduated from Bangladesh University of Engineering and Technology with Dean’s list award for outstanding achievements in consecutive terms in junior years.

## Grameenphone

*Go Beyond*



**S M Monirul Haque:** S M Monirul Haque, well known as Murad, has a long professional career in corporate world. After having graduation in EEE, he was a faculty member in University of Asia Pacific, Bangladesh for a year. After that he started his journey in telecommunication area in 2002 at Grameenphone. He has worked, moved and lead various functions in Technology division covering Implementation, Operation and Planning in NW & IT and presently working as Director and Head of IT at GP. Throughout his career he has been an ambassador for Change Management and People Leadership. He has been part of and lead so many technical projects, Operating model change and various critical modernization drive. He is graduated from BUET in Electrical & Electronic Engineering and also earned his MBA degree from IBA, Dhaka University. He has undergone professional trainings in LUMS, Norwegian School of Economics, London Business School, McKinsey Academy, INSEAD to keep him relevant in this changing world.

## Walton

*It's Our Product*



**Tapash Kumer Mojumder:** Tapash is leading Research and Innovation of Walton, a top ranked Company on Electrical and Electronic Home appliances in Bangladesh. He joined with Walton family in 2008 as a Product Design Engineer. Currently he is holding Senior Executive Director of Walton and participating as a CTO of NUSDAT-UTS (laboratory, accredited on ISO 17025). His focus is to incorporate innovations with Electrical and Electronics Industries to make better Bangladesh Tomorrow. He is collaborating research issues with Universities. He has been contributing a lot of significant activities to reduce ODP and GWP since 2010. Prior to this role, he was a lead Industrial Engineer of various Garment Industry in Dhaka, Bangladesh. Overall, he has 17 years of professional experience. He received one year CAD experience from Japan in 2006. He completed his BSc. Engineering on Industrial and Production Engineering from Shahjalal University of Science and Technology (SUST) in 2005.



**Massimo Sacchi:** Massimo Sacchi is an enthusiastic and determined engineer, featuring a vivid interest for innovation, with a solid background in industrial automation based on over 13 years of extensive experience in managing projects in multinational contests. He has deep knowledge of markets and technologies of automated plants for the steel and logistic industries that turns him into an experienced decision maker, always lined up with the company business vision.



**Khadija Akhter:** Khadija Akhter is an experienced IoT engineer and lead trainer on Arduino boards. She is currently working as an IoT engineer at Code 19 and has extensive experience in IoT based product development for smart agriculture, smart security and automation. Her skills and interest are Arduino, IoT systems, cloud architecture and advanced industry 4.0 technology.



**Imtiaz Farhan:** Imtiaz Farhan is a dynamic entrepreneur with expertise in marketing, business development, financial analysis and information technology. He is leading Code 19 Business and challenging operations in Bangladesh with an extraordinary.

## The LNM Institute of Information Technology

Jaipur, Rajasthan 302031



**Anirudh Agarwal:** Dr. Agarwal received the Ph.D. in wireless communications from LNMIIT, Jaipur, India, where he is currently working as an Assistant Professor in the Dept. of ECE. He has published several papers in refereed journals and conferences including IEEE Wireless Comm Letter, Networking Letter, Globecom and ICC. Dr. Agarwal is the reviewer of various peer-reviewed journals, viz. IEEE TCOM, IEEE TMC, IEEE TCCN, IEEE WCL, IEEE Access, ETT (Wiley). His research interests include reflecting intelligent surfaces assisted 6G, UAV and D2D communication, intrabody communication, with special emphasis on applied deep learning and optimization techniques for resource allocation.

## *ICEEICT 2021 Programs*

## ICEEICT 2021 Programs

### Day-1: 18<sup>th</sup> November 2021 (Thursday)

Time	Program		Venue & Mode
0900-1100	<b>Inaugural Ceremony</b>		General Mustafiz Multipurpose Hall 10 <sup>th</sup> Floor, Tower-1 (In-person)
	0900-0925: 0925-0930: 0930-1035: 1035-1055:	ICEEICT highlights Chief guest arrival Opening speech Souvenir handover	
1100-1130	<b>Tea</b>		Central Tea Room 2 <sup>nd</sup> Floor, Tower-1
1130-1230	<b>Keynote Session 1</b> <b>Anind K. Dey</b> University of Washington, USA		General Mustafiz Multipurpose Hall 10 <sup>th</sup> Floor, Tower-1 (Hybrid)
1230-1400	<b>Lunch &amp; End of Hybrid Session</b>		
1400-1500	<b>Keynote Session 2</b> <b>Kashem M. Muttaqi</b> University of Wollongong, Australia	<b>Keynote Session 3</b> <b>Syoji Kobashi</b> University of Hyogo Japan	Virtual
1500-1515	<b>Break</b>		
1515-1700	Technical Sessions 1A, 1B, 1C, 1D, 1E and 1F		Virtual
1700-1830	<b>Break</b>		
1830-1930	<b>Keynote Session 4</b> <b>Henning Schulzrinne</b> Columbia University, NY, USA		Virtual

### Day-2: 19<sup>th</sup> November 2021 (Friday)

Time	Program		Venue & Mode
0900-1100	<b>Industrial Session 1</b>		General Mustafiz Multipurpose Hall 10 <sup>th</sup> Floor, Tower-1 (Hybrid)
1100-1115	<b>Tea &amp; End of Hybrid Session</b>		
1115-1300	Technical Sessions 2A, 2B, 2C, 2D, 2E and 2F		Virtual
1300-1400	<b>Break</b>		
1400-1500	<b>Keynote Session 5</b> <b>Marco Liserre</b> University of Kiel, Germany		Virtual

Time	Program	Venue & Mode
1500-1515	<b>Break</b>	
1515-1615	<b>Keynote Session 6</b> <b>Ahmet Murat Tekalp</b> Koç University, Turkey	Virtual
1615-1630	<b>Break</b>	
1630-1730	<b>Keynote Session 7</b> <b>Frede Blaabjerg</b> Aalborg University, Denmark	Virtual
1730-1745	<b>Break</b>	
1745-1930	<b>Industrial Session 2</b>	Virtual

### Day-3: 20<sup>th</sup> November 2021 (Saturday)

Time	Program	Venue & Mode	
0900-1130	Special Sessions 3A, 3B, 3C and 3D	Technical Session 3E	Virtual
1130-1145	<b>Break</b>		
1145-1245	<b>Keynote Session 8</b> <b>Ranjan Gangopadhyay</b> LNM Institute of Information Technology, India	<b>Academia Session 1</b> <b>Anirudh Agarwal</b> LNM Institute of Information Technology, India	Virtual
1145-1315	<b>Tutorial Session</b>		Virtual
1315-1430	<b>Break</b>		
1500-1600	<b>Closing and Award Giving Ceremony</b>		Virtual
1600-1900	<b>Break</b>		
1900-2230	<b>Gala Dinner</b>		Central Tea Room 2 <sup>nd</sup> Floor, Tower-1

### Conference Kit Collection

Date	Time	Place
18 <sup>th</sup> November	0800-1200	1 <sup>st</sup> Floor Tower-1
19 <sup>th</sup> November	0900-1200	
20 <sup>th</sup> November	0900-1200	

## Technical Program

**Day-1: 18<sup>th</sup> November 2021 (Thursday)**

### Keynote Session 1

**Day-1: 18<sup>th</sup> November 2021 (Thursday)**

**Time: 1130-1230 (Hybrid)**

**Venue: General Mustafiz Multipurpose Hall, (10<sup>th</sup> Floor), Tower-1**

<b>Session Chair:</b> Syed Akhter Hossain, CSE, ULAB	
<b>Session Co-chair:</b> Major Md Mokhlesur Rahman, CSE, MIST	
Keynote Speaker	Keynote Topic
Anind K. Dey University of Washington, USA	Using Everyday Routines for Understanding Health Behaviors

### Keynote Session 2

**Day-1: 18<sup>th</sup> November 2021 (Thursday)**

**Time: 1400-1500 (Virtual)**

<b>Session Chair:</b> Shahriar Khan, EEE, IUB	
<b>Session Co-chair:</b> Captain M S A Al Farook Shiblee (BN), EECE, MIST	
Keynote Speaker	Keynote Topic
Kashem M. Muttaqi University of Wollongong, Australia	Energy Technologies for Future Grids

### Keynote Session 3

**Day-1: 18<sup>th</sup> November 2021 (Thursday)**

**Time: 1400-1500 (Virtual)**

<b>Session Chair:</b> Kaushik Dev, CSE, CUET	
<b>Session Co-chair:</b> Major Maruf Hasan, BME, MIST	
Keynote Speaker	Keynote Topic
Syoji Kobashi University of Hyogo, Japan	Medical Image Analysis with Artificial Intelligence

### Technical Session 1A

**Day-1: 18<sup>th</sup> November 2021 (Thursday)**

**Time: 1515-1700 (Virtual)**

**Session Title: Artificial Intelligence-1**

<b>Session Chair:</b> A.K.M Ashikur Rahman, CSE, BUET		
<b>Session Co-chair:</b> Lieutenant Colonel Muhammad Nazrul Islam, CSE, MIST		
Serial No	Paper ID	Title of the paper
1	42	Diagnosis of Left Ventricular Hypertrophy from ECG Signals Based on CCS Methodology using SVM

Serial No	Paper ID	Title of the paper
2	46	Developing a Semantic Search Method for Retrieving Food Related Verses and Concepts from Holy Quran Using Ontology
3	59	Recognition of Basic Handwritten Math Symbols Using Convolutional Neural Network with Data Augmentation
4	78	Non-invasive Deception Detection in Videos Using Machine Learning Techniques
5	102	A Convolutional Neural Network for End-to-End Structural Prediction and Lane Detection for Autonomous Vehicle
6	246	Smart Meter Data Compression and Load Profile Classification Using UMAP and Random Forest

### Technical Session 1B

Day-1: 18<sup>th</sup> November 2021 (Thursday)

Time: 1515-1700 (Virtual)

Session Title: Biomedical Engineering-1

<b>Session Chair:</b> Mohiuddin Ahmed, EEE, KUET		
<b>Session Co-chair:</b> Md. Enamul Hoque, BME, MIST		
Serial No	Paper ID	Title of the paper
1	40	Application of Hybrid Classifier for Multi-class Classification of MRI Brain Tumor Images
2	52	Classification and Performance Analysis of Cancer Microarrays Using Relevant Genes
3	111	AllerHybrid: A Hybrid System to Predict the Allergen Using K-mer and Physicochemical Properties
4	148	Non-linear Behaviour Investigation of Accumulation Mode Silicon Nanowires for Biosensing Application
5	164	Medical Specialty Classification from A Bangla Dataset: A Token Level Approach Using Several Machine and Deep Learning Algorithms
6	256	Design and Analysis of a DGS Based UWB Monopole Antenna for Brain Tumor Detection

### Technical Session 1C

Day-1: 18<sup>th</sup> November 2021 (Thursday)

Time: 1515-1700 (Virtual)

Session Title: Communication Technology-1

<b>Session Chair:</b> Md. Raqibul Mostafa, EEE, UIU		
<b>Session Co-chair:</b> Shaikh Muhammad Rizwan Ali, CSE, MIST		
Serial No	Paper ID	Title of the paper
1	22	Performance Evaluation of a Directional Beam Forming Circular Antenna for ISM Band Application
2	175	A Study on the Performance Analysis of Hybrid Diversity Combining Techniques for Rayleigh and Rician Fading Channels under AWGN

Serial No	Paper ID	Title of the paper
3	188	Comparative Analysis of Hybrid Diversity Schemes under AWGN and Impulsive Noise models for Rayleigh Fading Channels
4	203	Simulation of a Massive MIMO FSO System Under Atmospheric Turbulence
5	237	Performance Analysis Through Image and Video Transmission for Alamouti Space Time Block Coding Over Rayleigh and Rician Fading Channel
6	245	Performance Investigation of Multi-Constellation Global Network Satellite System (GNSS) Using Precise Point Positioning over Bangladesh

## Technical Session 1D

Day-1: 18<sup>th</sup> November 2021 (Thursday)

Time: 1515-1700 (Virtual)

Session Title: Multimedia and Signal Processing-1

<b>Session Chair:</b> Md Golam Mostafa, EECE, MIST		
<b>Session Co-chair:</b> Group Captain Md Abdul Halim, EECE, MIST		
Serial No	Paper ID	Title of the paper
1	32	MC-CDMA System for Multi-User Using Walsh Code on Rayleigh Fading Channel
2	44	Control Factor Based Two Step LMS Algorithm for Channel Tracking and Impulse Noise Mitigation
3	66	A Real-time End-to-End Bangladeshi License Plate Detection and Recognition System for All Situations Including Challenging Environmental Scenarios
4	129	A Self-Supervised Convolutional Neural Network Approach for Speech Enhancement
5	136	DURISE- Deblurring of Underwater Image Search Engine by CBIR
6	217	Improving Automatic Sign Language Translation with Image Binarisation and Deep Learning

## Technical Session 1E

Day-1: 18<sup>th</sup> November 2021 (Thursday)

Time: 1515-1700 (Virtual)

Session Title: Power System & Renewable Energy-1

<b>Session Chair:</b> Abdul Hasib Chowdhury, EEE, BUET		
<b>Session Co-chair:</b> Md. Ali Azam Khan, EECE, MIST		
Serial No	Paper ID	Title of the paper
1	28	Influence of Large-Scale Solar Power on Stability of East West Interconnector System of Bangladesh Power System
2	75	An Efficient Adjustable Duty Control Based Current Limiter for Grid-Connected Solar PV System
3	85	A Case Study on the Cost-effectiveness of Net Energy Metering of Residential Grid Connected Photovoltaic in the Context of Bangladesh

Serial No	Paper ID	Title of the paper
4	126	Survey on Characteristics of Lightning Injuries in Remote Area of Bangladesh and Its Prevention
5	201	Design of an Integral Sliding Mode Controller-Based on a Hybrid Reaching Law for DC Microgrids
6	218	PID, LQR, and LQG Controllers to Maintain the Stability of an AVR System at Varied Model Parameters

### Technical Session 1F

Day-1: 18<sup>th</sup> November 2021 (Thursday)

Time: 1515-1700 (Virtual)

#### Session Title: Semiconductor Device & Circuits-1

<b>Session Chair:</b> Quazi Deen Mohd Khosru, EEE, BUET		
<b>Session Co-chair:</b> Md Soyaeb Hasan, EECE, MIST		
Serial No	Paper ID	Title of the paper
1	34	Diamond Shaped Dual Core High Sensitive Surface Plasmon Resonance Photonic Crystal Fiber Sensor in Visible to Near-Infrared Region
2	43	High-Efficiency Multi Quantum Well Blue LED Using 2D-SiC as an Active Material
3	57	Ultra-Wide Refractive Index Range Photonic Crystal Fiber Based Sensor with Gallium Doped Zinc Oxide Coating
4	178	Theoretical Investigation for Growth of High Quality GaN on Epitaxial Graphene
5	181	Effects of Structural Variation for Improved Performance of a Vertical AlGaIn/GaN Super junction HEMT
6	185	The Gold Coated Plasmonic Refractive Index Sensor with Low Propagation Loss

### Keynote Session 4

Day-1: 18<sup>th</sup> November 2021 (Thursday)

Time: 1830-1930 (Virtual)

<b>Session Chair:</b> A. B. M. Alim Al Islam, CSE, BUET	
<b>Session Co-chair:</b> Lieutenant Colonel Muhammad Nazrul Islam, CSE, MIST	
Keynote Speaker	Keynote Topic
Henning Schulzrinne, Columbia University, NY, USA	The Internet of Things that Shouldn't be on the Internet

## Technical Program

### Day-2: 19<sup>th</sup> November 2021 (Friday)

#### Industrial Session 1

**Day-2: 19<sup>th</sup> November 2021 (Friday)**

**Time: 0900-1100 (Hybrid)**

**Venue: General Mustafiz Multipurpose Hall, (10<sup>th</sup> Floor), Tower-1**

<b>Session Chair:</b> Mustafa Habib Chowdhury, EEE, IUB		
<b>Session Co-chair:</b> Colonel Molla Md Zubaer, EECE, MIST		
Time	Name of the Industry	Name of the Speaker
0900-0930	Code 19 & Arduino	Massimo Sacchi and Imtiaz Farhan
0930-1000	Microsoft	Marcus Tee and Jannatul Popy
1000-1030	Grameenphone	S M Monirul Haque
1030-1100	Samsung	Raquibul Hasan and Sazzad Hissain Khan

#### Technical Session 2A

**Day-2: 19<sup>th</sup> November 2021 (Friday)**

**Time: 1115-1300 (Virtual)**

**Session Title: Artificial Intelligence-2**

<b>Session Chair:</b> Mohammed Moshiul Hoque, CSE, CUET		
<b>Session Co-chair:</b> Asadur Rahman, BME, MIST		
Serial No	Paper ID	Title of the paper
1	106	Driving Range Prediction of Electric Vehicles: A Machine Learning Approach
2	112	Best Eleven Forecast for Bangladesh Cricket Team with Machine Learning Techniques
3	138	Analysis of CNL-UNet for Efficient Biomedical Image Segmentation
4	162	Online Review based Sentiment Classification on Bangladesh Airline Service Using Supervised Learning
5	168	A Review on Predicting Autism Spectrum Disorder (ASD) Meltdown Using Machine Learning Algorithms
6	187	Speech Command Recognition System Using Deep Recurrent Neural Networks

## Technical Session 2B

Day-2: 19<sup>th</sup> November 2021 (Friday)

Time: 1115-1300 (Virtual)

Session Title: Multimedia and Signal Processing-2

<b>Session Chair:</b> A. B. M. Aowlad Hossain, ECE, KUET		
<b>Session Co-chair:</b> Lieutenant Colonel Hussain Md Abu Nyeem, EECE, MIST		
Serial No	Paper ID	Title of the paper
1	144	Cochleagram Based Speaker Identification Using Noise Adapted CNN
2	179	A Deep Learning Based Approach for Real-Time Driver Drowsiness Detection
3	210	Automatic Detection and Recognition of Object to Help Visually Impaired People while Visiting Liberation War Museum in Bangladesh
4	213	Design of Inertial Measurement Unit in Attitude and Heading Reference System for Real-Time Maneuver Monitoring by Using Kalman Filter
5	226	Automated Diabetic Retinopathy Detection Using Transfer Learning Models

## Technical Session 2C

Day-2: 19<sup>th</sup> November 2021 (Friday)

Time: 1115-1300 (Virtual)

Session Title: Semiconductor Device & Circuits-2

<b>Session Chair:</b> Md. Sherajul Islam, EEE, KUET		
<b>Session Co-chair:</b> Lieutenant Colonel K M Mustafizur Rahman, EECE, MIST		
Serial No	Paper ID	Title of the paper
1	11	Modified ECRL Adiabatic Logic for Ultra Low Power VLSI Applications
2	70	Optimization and Sensitivity Analysis of a Single Core Low Loss PCF Sensor
3	79	Improving Operating Voltage and Frequency Ranges in a Microcontroller-based Low-cost Oscilloscope
4	98	Estimation of ZnO Nanoparticles Crystallite Parameters at Different Compression Temperatures
5	163	Design and Analysis of Miniature Type Impulse Based UWB Transmitter in 90 nm CMOS for Medical Application
6	250	Performance Analysis of Graphene/ $\text{Al}_x\text{Ga}_{1-x}\text{N}$ Schottky Contact at Elevated Temperature

## Technical Session 2D

Day-2: 19<sup>th</sup> November 2021 (Friday)

Time: 1115-1300 (Virtual)

Session Title: Power System & Renewable Energy-2

<b>Session Chair:</b> Abdur Razzak, EEE, IUB		
<b>Session Co-chair:</b> Captain M S A Al Farook Shiblee (BN), EECE, MIST		
Serial No	Paper ID	Title of the paper
1	21	An Efficient Protection and Control Schemes for IBDG System with Resistive Superconducting Current Limiter
2	95	Design of a 7.5 MVA Automated Substation with Fault Analysis Using ETAP Software
3	113	Demand Side Management in a Model House for Better Load Profile in the Perspective of Bangladesh
4	202	A Hybrid Reaching Law Based Double-Integral Sliding Mode Controller Design to Mitigate SSR Effects in a DFIG-Based Wind Farm
5	211	Effect of Electric Vehicle Fast Charging Station on Residential Distribution Network in Bangladesh
6	253	Design of I-V Scanner to Analyze the Effects of Partial Shading due to Soiling and Bird-dropping on PV Panels

## Technical Session 2E

Day-2: 19<sup>th</sup> November 2021 (Friday)

Time: 1115-1300 (Virtual)

Session Title: Power Electronics and Drives-1

<b>Session Chair:</b> Tareq Aziz, EEE, AUST		
<b>Session Co-chair:</b> Fahim Abid, EEE, IUT		
Serial No	Paper ID	Title of the paper
1	47	Design of Rotor for Single-Phase Induction Motor to Improve Startability in Refrigerator Application
2	53	Design and Implementation of IGBT Based Single Phase Multi converter for Industrial Load Control
3	116	A Universal Energy Harvesting System for Ultra-Low Power Management and IoT Applications
4	184	A Single Stage Off-board EV Charger Based on CUK Topology
5	189	An Efficient Switched-Capacitor Based Single DC Source Inverter with Selective Harmonic Elimination
6	249	Design and Analysis of Symmetric and Asymmetric Type Cascaded H-Bridge Multi-Level Inverters

## Technical Session 2F

Day-2: 19<sup>th</sup> November 2021 (Friday)

Time: 1115-1300 (Virtual)

Session Title: Artificial Intelligence-3

<b>Session Chair:</b> Muhammad Aminul Haque Akhand, CSE, KUET		
<b>Session Co-chair:</b> M. Akhtaruzzaman, CSE, MIST		
Serial No	Paper ID	Title of the paper
1	192	A Case Study on Risk Prediction of Heart Failure Patients Using Random Survival Forest
2	208	Artificial Intelligence Based Real-Time Attendance System Using Face Recognition
3	225	Performance Analysis of LSTMs and Fbprophet Models for Short Term Load Forecasting
4	229	Design of CanSat for Environmental Monitoring and Object Detection
5	230	A Prototype of Multi-Functional Rescue Robot Using Wireless Communication

## Keynote Session 5

Day-2: 19<sup>th</sup> November 2021 (Friday)

Time: 1400-1500 (Virtual)

<b>Session Chair:</b> Habib Kabir, EEE, IUT	
<b>Session Co-chair:</b> Brigadier General Md Humayun Kabir Bhuiyan, ME, MIST	
Keynote Speaker	Keynote Topic
Marco Liserre University of Kiel, Germany	Unlocking the Hidden Capacity of the Electrical Grid Through Power Electronics

## Keynote Session 6

Day-2: 19<sup>th</sup> November 2021 (Friday)

Time: 1515-1615 (Virtual)

<b>Session Chair:</b> M M A Hashem, CSE, KUET	
<b>Session Co-chair:</b> Major Md Abdul Wahed, EECE, MIST	
Keynote Speaker	Keynote Topic
Ahmet Murat Tekalp Koç University, Turkey	Recent Advances in Learned Image and Video Compression

## Keynote Session 7

Day-2: 19<sup>th</sup> November 2021 (Friday)

Time: 1630-1730 (Virtual)

<b>Session Chair:</b> Muhammad Abdul Goffar Khan, EEE, RUET	
<b>Session Co-chair:</b> Commander K M Tanveer Anwar, EECE, MIST	
<b>Keynote Speaker</b>	<b>Keynote Topic</b>
Frede Blaabjerg Aalborg University, Denmark	Power Electronics Technology - Quo Vadis

## Industry Session 2

Day-2: 19<sup>th</sup> November 2021 (Friday)

Time: 1745-1930 (Virtual)

<b>Session Chair:</b> Kazi Abu Taher, ICT, BUP		
<b>Session Co-chair:</b> Major Md. Fazla Elahi, BME, MIST		
<b>Time</b>	<b>Name of the Industry</b>	<b>Name of the speaker</b>
1745-1845	Cumulus Neuro	Laura M. Rueda-Delgado and Md Nurul Islam
1845-1930	Walton	Tapash Kumer Mojumder

## Day-3: 20<sup>th</sup> November 2021 (Saturday)

### Special Session 3A

Day-3: 20<sup>th</sup> November 2021 (Saturday)

Time: 0900-1130 (Virtual)

**Session Title: Imaging and Next Generation Networks for Smart Applications-1**

<b>Session Chair:</b> Brigadier General A K M Nazrul Islam, EECE, MIST		
<b>Session Co-chair:</b> Major Md Aminul Islam, EECE, MIST		
<b>Serial No</b>	<b>Paper ID</b>	<b>Title of the paper</b>
1	35	Comparison of Total Electron Content with International Reference Ionosphere Model Predictions near the Northern Crest of EIA at Bangladesh
2	139	Comparison of Condition Numbers and Ranks of the MIMO Channel at 77 GHz Carrier Frequency
3	153	Optimization of Reconfigurable Intelligent Surface for M2M Communications over Cellular Networks
4	215	Multimodal Decision Fusion of EEG and fNIRS Signals
5	216	A Novel Authentication Mechanism for Securing Underwater Wireless Sensors from Sybil Attack
6	261	Data-driven Embedding with Pixel Repetition for High Capacity Reversible Data Hiding

### Special Session 3B

Day-3: 20<sup>th</sup> November 2021 (Saturday)

Time: 0900-1130 (Virtual)

Session Title: Imaging and Next Generation Networks for Smart Applications-2

<b>Session Chair:</b> M Shamim Kaiser, IIT, JU		
<b>Session Co-chair:</b> Nusrat Sharmin, CSE, MIST		
Serial No	Paper ID	Title of the paper
1	36	Cardiac Arrhythmia Diagnosis Based on Features Extraction and Convolutional Neural Network from ECG Signals
2	99	Bangla-ExtraSum: Comparative Analysis of Different Methods in Automated Extractive Bengali Text Summarization
3	135	A Deep CNN Based Kaggle Contest Winning Model to Recognize Real-Time Facial Expression
4	140	Revisiting Deep Learning Models for Road Lane Detection
5	142	Finding Efficient Machine Learning Model for Hand Gesture Classification Using EMG Data
6	228	A Framework for Eye-Based Human Machine Interface

### Special Session 3C

Day-3: 20<sup>th</sup> November 2021 (Saturday)

Time: 0900-1130 (Virtual)

Session Title: Imaging and Next Generation Networks for Smart Applications-3

<b>Session Chair:</b> Abu Yousuf, IIT, JU		
<b>Session Co-chair:</b> Colonel Shajahan Majib, CSE, MIST		
Serial No	Paper ID	Title of the paper
1	50	Chaotic Singer Grasshopper Optimization Algorithm for Solving Combined Economic and Emission Dispatch
2	54	An Adaptive System for Detecting Driving Abnormality of Individual Drivers Using Gaussian Mixture Model
3	145	Estimating Traffic Density on Roads Using Convolutional Neural Network with Batch Normalization
4	149	Developing a Machine Learning Based Support System for Mitigating the Suppression Against Women and Children
5	152	A Deep Ensemble Approach for Recognition of Papaya Diseases Using Efficient Net Models
6	232	Performance Analysis of Initialization Algorithms of Deep Neural Network Based Coordinated Beamforming System for mm Wave

### Special Session 3D

Day-3: 20<sup>th</sup> November 2021 (Saturday)

Time: 0900-1130 (Virtual)

Session Title: Imaging and Next Generation Networks for Smart Applications-4

<b>Session Chair:</b> Shamim Al Mamun, IIT, JU		
<b>Session Co-chair:</b> Lieutenant Colonel Hussain Md Abu Nyeem, EECE, MIST		
Serial No	Paper ID	Title of the paper
1	09	Evaluation of DBSCAN Algorithm on Different Programming Languages: An Exploratory Study
2	107	Impact of Trace-Based Mobility Models on the Energy Consumption of Delay-Tolerant Routing Protocols
3	118	HDM-Chain: A Secure Blockchain-based Healthcare Data Management Framework to Ensure Privacy and Security in the Health Unit
4	120	Integrating Cloud Computing in E-healthcare: System Design, Implementation and Significance in Context of Developing Countries
5	200	Interpreting and Comparing Convolutional Neural Networks: A Quantitative Approach
6	259	Functional Modification of Advanced Encryption Standard Algorithm by Perturbing the Diffusion and Confusion Properties

### Technical Session 3E

Day-3: 20<sup>th</sup> November 2021 (Saturday)

Time: 0900-1130 (Virtual)

Session Title: Photonics and Smart Computing-1

<b>Session Chair:</b> Mohammed Hossam-E-Haider, EECE, MIST		
<b>Session Co-chair:</b> Md Soyaeb Hasan, EECE, MIST		
Serial No	Paper ID	Title of the paper
1	55	Analysis of a Hexagonal Lattice Photonic Crystal Fiber Biosensor Based on Surface Plasmon Resonance
2	96	IoT Based Smart Waste Monitoring and Management System
3	103	The Role of IoT in Digitalizing Mining Sector of Bangladesh
4	141	An IoT-based System for Air Pollution Data Analysis and Visualization
5	165	Design and Construction of Biogas Plant from Human Excreta at Remote Island of Bangladesh and Its Socio-Environmental Benefits
6	242	Thermal Simulation of 3D high Power GaN HEMT with a Low-Cost Technique to Reduce Junction Temperature due to Self-Heating

## Keynote Session 8

Day-3: 20<sup>th</sup> November 2021 (Saturday)

Time: 1145-1245 (Virtual)

<b>Session Chair:</b> Md. Ali Azam Khan, EECE, MIST	
<b>Session Co-chair:</b> Mubdiul Islam Rizu, EECE, MIST	
<b>Keynote Speaker</b>	<b>Keynote Topic</b>
Ranjan Gangopadhyay LNM Institute of Information Technology, India	Multi-perspectives of New and Next Generation Radio

## Academia Session 1

Day-3: 20<sup>th</sup> November 2021 (Saturday)

Time: 1145-1245 (Virtual)

<b>Session Chair:</b> Md Mahbubur Rahman, CSE, MIST	
<b>Session Co-chair:</b> Asadur Rahman, BME, MIST	
<b>Name of the Speaker</b>	<b>Topic</b>
Anirudh Agarwal LNM Institute of Information Technology, India	UAV Relaying for Optimal B5G Cooperative Communication

## Tutorial Session 1

Day-3: 20<sup>th</sup> November 2021 (Saturday)

Time: 1145-1315 (Virtual)

<b>Industry Name</b>	<b>Name of the Speaker</b>	<b>Tutorial Topic</b>
Code 19 (Arduino)	Khadija Akhter	Advanced Arduino IoT Board Hands-on Tutorial Session

*Abstracts  
of  
Registered Papers*

Paper ID – 009

## Evaluation of DBSCAN Algorithm on Different Programming Languages: An Exploratory Study

Md Amiruzzaman<sup>1</sup>, Rashik Rahman<sup>2</sup>, Md. Rajibul Islam<sup>2</sup> and Rizal Mohd Nor<sup>3</sup>

<sup>1</sup>Computer Science, West Chester University, West Chester, PA, USA

<sup>2</sup>Computer Science and Engineering, University of Asia Pacific, Dhaka, Bangladesh

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<sup>3</sup>rizalmohdnor@iiu.edu.my

**Abstract:** DBSCAN is a well-known clustering algorithm that is often used to find associations and structures in large spatial data. Due to its popularity, built-in functions for DBSCAN have been implemented on top of many different programming languages. Researchers and practitioners (i.e., data scientists) have been using these built-in functions to cluster and analyze a prolific area of research in data science. Due to the many implementations of DBSCAN and its utilization in many different languages, the output of each built-in DBSCAN function is assumed to be identical. In this paper, we present a systematic approach to evaluate the built-in functions of DBSCAN algorithms and to identify discrepancies in their output. The evidence from the study shows there are some discrepancies and recommends caution in dealing with some built-in functions.

Paper ID – 011

## Modified ECRL Adiabatic Logic for Ultra Low Power VLSI Applications

Mohammad Redwan Islam<sup>1</sup>, Takibul Islam Sabbi<sup>2</sup>, Nafiul Islam Ananta<sup>3</sup>, Saroar Jaman Badhon<sup>4</sup> and Satyendra N. Biswas<sup>5</sup>

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**Abstract:** Shrinking of the size of electronic devices has been accelerated due to the advanced fabrication process of reducing the feature size of VLSI circuits. On the other hand, reducing the feature size demands for low powered design topologies. Adiabatic Logic is a design approach to reduce the power. Efficient Charge Recovery Logic (ECRL) is one of the widely accepted adiabatic design techniques. In this research, a modified ECRL circuit model is proposed for low power application which shows better results in terms of power and energy dissipation. Extensive simulation experiments are conducted using LTspice XVII EDA tool and 16 nm PTM LP model developed by the Nanoscale Integration and Modeling (NIMO) Group at Arizona State University. Simulation results provides enough evidence that the proposed topology performs better than the conventional ECRL.

Paper ID – 021

## An Efficient Protection and Control Schemes for IBDG System with Resistive Superconducting Current Limiter

M. Shafiul Alam<sup>1</sup>, Fahad Saleh Al-Ismael<sup>1, 2, 3, 4</sup>, Md Shafiullah<sup>3</sup>, Md Shamimul Haque Choudhury<sup>5</sup> and M. A. Abido<sup>1, 2, 3</sup>

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**Abstract:** Distributed generators (DGs) are heavily integrated with the power system network through the power electronic inverters. Such inverter based distributed generation (IBDG) system increases the vulnerability of the

system due to faults. In this study, we develop a control and protection strategies of IBDG system employing superconducting fault current limiter (SFCL). The mathematical model of SFCL is developed based on transition period, fault occurring time, and maximum resistance during current limiting state. The detailed modeling for the SFCL, DG, voltage source inverter (VSI), and associated controllers is presented. In order to insert the limiting resistance dynamically during contingencies depending on critical current, SFCL is placed between the VSC and grid. The advantages of the proposed approach are manifolds: simplest control of system faults, and lossless operation during normal conditions. Several disturbances are applied in the system to see the positive impacts of the proposed approach. The comparative analytical results show that the protection approach well restricts the fault current within the tolerable range of the system and its converters.

Paper ID – 022

### Performance Evaluation of a Directional Beam Forming Circular Antenna for ISM Band Application

Md. Ershadul Haque<sup>1</sup>, Tanvir Hossain<sup>2</sup>, Ashraful Islam<sup>3</sup>, Salah Uddin<sup>4</sup> and Amira Khanom<sup>5</sup>

<sup>1,2,3,4</sup>Department of Electrical & Electronic Engineering, Feni University, Feni, Bangladesh.

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**Abstract:** Wireless communication is one of the most crucial technologies to build up a smart global society on the earth. An antenna is the fundamental element of that communication system. This paper proposes a circular microstrip patch antenna (CMPA) for industrial scientific and medical (ISM) frequency band. The antenna is comprised of a miniaturized size with a circular shape of radius 20mm and thickness 2.6mm. It obtained 2.4GHz resonant frequency that pertains as appropriate for the application of the 2.4-2.48GHz frequency band. A silicon layer having relative permittivity and loss tangent 11.9 and 0.000012, respectively is considered as substrate material of the antenna. 4.2728dB gain, polarizing most of the radiation towards the front direction of the antenna and avoiding the undesirable radiation, is found from the presented CMPA. It has minimum value of reflection coefficient (RC) -12.3557dB having more than 53.3 MHz wide bandwidth determined at -5dB RC that increases significantly at higher RC. It also has remarkable radiation efficiency of approximately 93.8%. Performance of the CMPA is fixed both in a free space and on a three layers human phantom model to determine the value of specific absorption rate, a measuring factor to have the impact of radiation on human body.

Paper ID – 028

### Influence of Large Scale Solar Power on Stability of East West Interconnector System of Bangladesh Power System

Pollen Barua<sup>1</sup>, Ratul Barua<sup>2</sup>, Muhammad Quamruzzaman<sup>3</sup> and M.G. Rabbani<sup>4</sup>

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<sup>2</sup>Dept. of C.S.E, Port City International University, Chittagong

<sup>4</sup>Dept. of E.E.E, Eastern University, Dhaka

<sup>1</sup>pollen.eee@gmail.com

**Abstract:** Renewable sources are independent of mechanical inertia, so their response to any power system is different than with any synchronous machine. As solar power is the most popular to get injected to any power system, their effect in any system is very important to examine in term of stability. This paper investigates the stability of east west interconnector system (EWIS) of Bangladesh power system (BPS) with the penetration of solar power in a large scale. As the loading limit and damping ratio increase with solar penetration, the results show the enhancement in power system stability in steady and dynamic state. The simulation model is organized and analyzed in NEPLAN software.

Paper ID – 032

## MC-CDMA System for Multi-User Using Walsh Code on Rayleigh Fading Channel

H.M. Abidur Rahman<sup>1</sup>, Foyjul Hasan<sup>2</sup>, Md. Mizanul Hoque<sup>3</sup>, Md. Mizanur Rahman<sup>4</sup> and Md. Waliur Rahman<sup>5</sup>

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**Abstract:** The aim of this paper is to investigate the BER and SNR analysis of multiuser Multi Carrier Code Division Multiple Access (MC-CDMA) system where a new combination of different fading channels is used. Walsh code has been chosen for spreading code and AWGN and Rayleigh channels are used for fading channels. In this paper 64,128,256,512 and 1024 users are used. The SNR range is 0 to 20db and the BER value showed an effect of AWGN and Rayleigh fading channel on the MC-CDMA system.

Paper ID – 034

## Diamond Shaped Dual Core High Sensitive Surface Plasmon Resonance Photonic Crystal Fiber Sensor in Visible to Near-Infrared Region

K M Mustafizur Rahman<sup>1</sup>, Arman Sharif<sup>2</sup> and Ismat Shahriar Rakib<sup>3</sup>

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**Abstract:** We put forward a very simple yet novel surface plasmon resonance (SPR) based photonic crystal fiber (PCF) refractive index (RI) sensor in the wavelength range of 510-1000 nm. The sensor structure consists of 27 uniform air-holes with diamond-shaped dual cores which renders easy fabrication. The characteristics of the sensor are investigated theoretically using the full-vectorial finite element method (FEM). After tuning structural parameters over a range, the optimal sensor can detect an RI range of 1.30-1.40. The reported sensor achieved wavelength sensitivity of 18000 nm/RIU, amplitude sensitivity of  $-1541.13 \text{ RIU}^{-1}$  and a figure of merit (FOM) of  $452.5 \text{ RIU}^{-1}$ . Besides, the sensor exhibits higher detection accuracy such as wavelength resolution of  $5.52 \times 10^{-6} \text{ RIU}^{-1}$  and amplitude resolution of  $6.49 \times 10^{-6} \text{ RIU}$ . Thus, the proposed sensor is a competitive candidate which has the potential to detect unknown RI of various applications such as biosensing, chemical sensing, biochemical sensing, etc.

Paper ID – 035

## Comparison of Total Electron Content with International Reference Ionosphere Model Predictions near the Northern Crest of EIA at Bangladesh

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**Abstract:** Total electron content (TEC) observations extracted from a Global Positioning System (GPS) receiver station in Dhaka, Bangladesh (geographic latitude 23.8°N, longitude 90.4°E, geomagnetic latitude 14°N) under the northern crest of equatorial ionospheric anomaly (EIA) is investigated. Eight years of TEC measurements from 2004-2011 constitutes an extensive dataset, which provides an excellent opportunity to perform such a study for the first time over this area. The analysis reveals that the diurnal maximum of TEC occurs around 13:00-14:00 BST. Peak TEC values during noontime are maximum during March and April (~70 TECU) and autumnal equinox (~50-60 TECU), and lowest during winter (~35-43 TECU) at high solar activity period. During low solar activity period, the peak TEC values reduce to ~35-50 TECU during equinoxes and to ~24 TECU during winter. TEC values

minimise (~2-10 TECU) after sunset to predawn hours. Observed monthly median TEC values are compared with predictions the from International Reference Ionosphere (IRI-2012) model. Results indicate that during high solar activity period, IRI-2012 underestimates TEC values (~8-17 TECU) at vernal and autumnal equinoxes during noon. IRI predictability is better as the values are underestimated by ~4 TECU from after sunset to pre-dawn hours and overestimated by ~4 TECU during early hours of the day. IRI predictions are more accurate in summer and winter months than in equinoctial months. IRI exhibits improved prediction accuracy during low solar activity period with discrepancies as low as ~0.13 TECU.

**Paper ID – 036**

## **Cardiac Arrhythmia Diagnosis Based on Features Extraction and Convolutional Neural Network from ECG Signals**

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**Abstract:** Conventionally, arrhythmias are diagnosed and classified by using manual inspection of electrocardiogram (ECG) signal. However, the diagnosis needs experts' interpretation and is time-consuming. To make the diagnosis efficient, the subject's ECG recordings from the MIT-BIH database have been segmented in short ECG segments of 60 seconds, and the investigation has been conducted in two categories: features extraction and pattern recognition. Here, the features (i.e. NN50, Mean RRI, kurtosis, and skewness) have been extracted in terms of time-domain and statistical analysis. From these analyses, it is evident that the value of NN50, Mean RRI, kurtosis, and skewness are respectively in the range of 30 – 50, 600–1000 ms, 1–3, and -1 to 1 for the ECG segments of the healthy group, while arrhythmia segments show values beyond those ranges. Besides, a pre-trained AlexNet convolutional neural network (CNN) has been used to facilitate the diagnosis. Here, the scalogram images of ECG segments have been obtained from time-frequency analysis using continuous wavelet transform (CWT), and these images have been fed into the CNN classifier for pattern recognition and classification. In this approach, the sensitivity, specificity, and overall accuracy are 98.7%, 100%, and 99.30%, respectively. So, the proposed analyses have delivered concrete results, and it can be an effective way to differentiate the healthy and arrhythmic groups.

**Paper ID – 040**

## **Application of Hybrid Classifier for Multi-class Classification of MRI Brain Tumor Images**

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**Abstract:** Correctly classifying the brain tumor images is a matter of utmost importance for protecting the lives of brain cancer patients. The individual infliction of machine learning and deep learning algorithms has shown a diminutive impact on accurate brain tumor classification. Therefore, this study goal to develop a hybrid classifier based on deep learning (DL) and machine learning (ML) approaches to correctly distinguishing the brain tumors from MRI images into multiple classes such as meningioma, glioma, and pituitary. A simple convolutional neural network (CNN) based DL method comprised of ten layers is developed to extract precise features of tumors. Then various ML methods such as support vector machine (SVM), k-nearest neighbors (KNN), random forest (RF), gaussian naive bayes (G-NB), logistic regression (LR), decision tree (DT), and linear discrimination (LD) are utilized to enhance the accurate classification rate than normally used softmax classifier. The performance of the modeled hybrid classifiers is evaluated based on four verification statistic metrics i.e., accuracy, precision, recall, and F1-score. Results exhibited that among seven hybrid classifiers, the CNN-KNN classifier shows the best performance in classifying brain tumors into three classes with an accuracy of 99.45%, precision of 99.40%, recall of 99.34%, and F1-score of 99.37% in the testing stage. Moreover, the CNN-KNN classifier outperformed existing state-of-art methods with an improvement of classification accuracy of 1.45%.

Paper ID – 042

## Diagnosis of Left Ventricular Hypertrophy from ECG Signals Based on CCS Methodology Using SVM

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**Abstract:** An electrocardiogram (ECG) is the easiest and most reliable way to understand Left Ventricular Hypertrophy (LVH), which leads to many other cardiovascular diseases at the initial stage. However, LVH can develop silently over several years without any symptoms, and it is not easy to diagnose LVH even with renowned methods and many other proposed theoretical approaches because of its interrelated nature. Utilizing ECG/EKG data availability, the authors have proposed a classifier using Support Vector Machine (SVM). Here the SVM classifier is a re-fabrication of the Combine Cornell-Sokolow (CCS) methodology, and the classifier has the effectiveness of over 90% detecting LVH in complex cases. Training variation constructs different models with various accuracies, but balance training can achieve quite admissible results. The paper will delineate the training procedure and discuss the findings in it. The study will also have concerned about ECG signal pre-processing, data processing, and feature detection in its path. Any electronic diagnosis system can utilize this research's classifier to distinguish LVH among complex cases. The classifier can identify LVH cases continuously because of its computation manner, even where an expert physician is unavailable.

Paper ID – 043

## High-Efficiency Multi Quantum Well Blue LED Using 2D-SiC as an Active Material

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**Abstract:** Due to its unique optical and electrical features, two-dimensional (2D) SiC has recently fascinated tremendous attention as an active material for optoelectronic devices. Here we numerically design a high-performance multi-quantum well (MQW) blue light-emitting diode (LED) using 2D-SiC. Our study suggests that for a rectangular potential well of 2D-SiC, having 4H-SiC as a quantum barrier and GaN as the electron blocking layer is an efficient electron confining structure, and almost all the recombination is radioactive, and injection efficiency is high. Due to this effect, the resultant internal quantum efficiency is also higher. The extraction efficiency is found to be around 23% for flat design, which can further be increased. The most effective improvement has been founded in the decrease in efficiency droops at high injection current. The internal quantum efficiency is constantly above 98% up to 150 mA. The CIE color coordinate refers to the supreme blue color and paves that the considered LED is a good candidate for LED display manufacturing.

Paper ID – 044

## Control Factor Based Two Step LMS Algorithm for Channel Tracking and Impulse Noise Mitigation

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**Abstract:** Fast deployment of wireless communication addresses various aspects of digital signal processing issues for noise reduction. Adaptive filtering is an efficient technique to reduce noise for both the stationary and time-

varying environment. In this paper, we consider the design of an adaptive algorithm where the goal is to improve the performance of the conventional LMS based modified adaptive algorithms. The performance of the LMS algorithm is good enough for a stationary environment but not for the non-stationary environment. We tried to propose an adaptive algorithm which can achieve faster convergence, minimum MSE and suitable in both the stationary and time-varying environment. We introduce a new parameter termed as control factor for the MGLMS algorithm that controls the convergence and provides minimum mean square error as well as the stability of the algorithm. The variable step size adjustment approach with control factor that improves the performance of MGLMS algorithm. Simulation results outperform the conventional LMS and MGLMS algorithm. Results show that the convergence and MSE level is better. We concentrated on impulse noise mitigation also. We proposed Order Statistics based method to mitigate impulse noise very effectively. Our simulated result shows that the method provides better performance for impulse noise suppression.

**Paper ID – 046**

### **Developing a Semantic Search Method for Retrieving Food Related Verses and Concepts from Holy Quran Using Ontology**

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**Abstract:** Qur'an is Allah (SWT)'s greatest miracle and is the holy book of Allah (SWT). Everything about the earth and the heavens is revealed in the holy Qur'an. This holy book is the source of all knowledge and information. As a Muslim, our duty is not only to recite the Qur'an but also it is important to gain knowledge from the Qur'an to lead our life. Ontology is the best way to retrieve Quranic knowledge in a technical way. So ontology technology is used in this proposed method. The modern age is the age of internet. With the help of internet, many search engines are found that help to find information from Qur'an. But most of the search engines or information retrieval systems are keyword based. Keyword based search can often lead to wrong and irrelevant results. To overcome this problem, semantic search is most useful in this case. The aim of this research is to develop an ontological semantic based method to retrieve the food related verses and concepts from holy Qur'an by using natural language query. In this work, triplet extraction algorithm has been used for generating triple, protege OWL editor 4.3 version for creating food ontology and for query by SPARQL Apache Jena fuseki server is used. Quranic data have been collected from translated English version of the consecrated Qur'an by Sahih International and Quran.gov.bd.

**Paper ID – 047**

### **Design of Rotor for Single-Phase Induction Motor to Improve Startability in Refrigerator Application**

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**Abstract:** This article proposes an improved rotor design method to attain a better starting ability to single-phase induction motor (SPIM) used in household refrigerator applications. The proposed model introduces reduced slot area of the rotor and thus, improving starting torque capability. Then, the reduced inner diameter of the rotor diminishes some frictional losses of the SPIM and therefore, helps to improve efficiency. And the torque-ratio per rotor volume (TRV) of a SPIM has a vital role to improve the starting ability as TRV is varied by electrical loading, magnetic loading, rotor height, outer diameter (OD), weight, and aluminum fill factors with the same stator. To examine the consequences of this study, an analytical simulation is carried out first, and then the simulation is validated by finite element analysis (FEA) to get a proper flux distribution model of the SPIM. Then, prototypes of the SPIM are made and tested with a dynamometer to verify the efficiencies and other electromechanical parameters practically. Finally, compressor prototypes are made and tested to examine the actual results. By getting the proper flux distribution of the FEA model, dynamometer results, and compressor efficiencies, this could be said, the proposed method is valid and reliable.

Paper ID – 050

## Chaotic Singer Grasshopper Optimization Algorithm for Solving Combined Economic and Emission Dispatch

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**Abstract:** In this paper, a Chaotic Singer Grasshopper Optimization Algorithm (CS-GOA) is proposed to solve the Combined Economic and Emission Dispatch optimization problem. The premier objectives of CEED problem are to find the minimum fuel cost of power generation for the lowest possible pollutant emission, which is achieved simultaneously by a proper distribution of power generation duty among the generators. Price Penalty Factor (PPF) methodology is used to transform CEED into a single-objective optimization problem. A Chaotic Singer version of Grasshopper Optimization Algorithm is proposed and tested for solving CEED. The performance assessment tests consist of four different benchmark test systems with complexities such as different load demands and Valve-point loading of turbine. The attained simulation results highlight the superiority of CS-GOA in solving CEED problem in aspects of reduced fuel cost, emission and rapid convergence.

Paper ID – 052

## Classification and Performance Analysis of Cancer Microarrays Using Relevant Genes

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**Abstract:** Cancer, being one of the deadly diseases, is increasing its number of cases every year. A recent popular cancer identification study is carried out with microarray gene data. This type of data can be used to observe gene expression in cells, which helps to analyze several thousands of genes at a time. Analysis of such gene expression helps in cancer identification and classification. It facilitates selection of proper treatments and drug developments. Gene expression data sets for ovarian, leukemia and central nervous system (CNS) cancer have been analyzed in this research using several popular ML and data mining techniques such as Support Vector Machine (SVM), Naïve Bayes (NB), Decision Tree (DT), Random Forest (RF) and K-Nearest Neighbors (kNN) algorithms after we could find out the most relevant set of gene using feature selection techniques- Genetic Search Algorithm (GA), Evolutionary Algorithm (EA) and Multi-objective Evolutionary Algorithm (MOEA). The ultimate goal of this work has been to discover the minimal set of features for a classification model without detrimentation the classification accuracy. In this work, MOEA and SVM together provide the best outcome with maximum accuracy.

Paper ID – 053

## Design and Implementation of IGBT Based Single Phase Multiconverter for Industrial Load Control

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**Abstract:** Multiconverter operates as cycloconverter, cycloinverter, controlled AC-DC converter, and AC voltage controller. This paper represents the design, operation, and hardware implementation of an IGBT-based

multiconverter prototype. The presented single-phase multiconverter prototype has output frequencies of 10Hz, 12.5Hz, 16.67Hz, 25Hz, 50Hz, 100Hz, 150Hz, 200Hz and 0Hz with 230V load handling capability; which makes it more useable in real-life scenarios. The multiconverter circuit is modeled, analyzed, and simulated in MATLAB/Simulink. The Arduino nano microcontroller-based electronic circuit is used to generate the firing pulses. A laboratory prototype is developed to simultaneously control the rms as well as the average value of output voltage and frequency of the power supplied to the load. Experimental results are presented to validate the theoretical design, analysis, and simulation results.

Paper ID – 054

## An Adaptive System for Detecting Driving Abnormality of Individual Drivers Using Gaussian Mixture Model

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**Abstract:** Abnormal driving of a driver often leads to many undesirable situations. To avoid such circumstances, this paper proposes a driver-adaptive system that can detect abnormality within one's own driving style. To achieve such a feat, firstly, a soft clustering approach is proposed to determine the driving style in three categories - aggressive, moderate, and protective. Then, it proposes an algorithm to analyze the driving profile and detect the variation of abnormality of the driver. Statistics of different vehicle kinetic characteristics, i.e., velocity, space and time headway, acceleration, jerk factor, etc., are considered for the clustering process. Maximal Information Coefficient (MIC) is used to select the important features. Analyzing the results of different clustering algorithms such as Gaussian Mixture Model (GMM), FCM, and K-means, we used GMM in the proposed system for determining real-time driving style. The actual driving style is determined using the long-term driving history of the subject vehicle. Using GMM's soft clustering properties, the current deviation is measured by comparing the real-time driving style to the actual style. A learning factor is accommodated to update the actual style in every cycle so that the proposed system can adapt to the driver's skill-changing state. Real-life driving depends on real-time human decisions. Therefore, we have used the reconstructed NGSIM I-80 real-life traffic data to build and validate the proposed system.

Paper ID – 055

## Analysis of a Hexagonal Lattice Photonic Crystal Fiber Biosensor Based on Surface Plasmon Resonance

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**Abstract:** A simple gold-coated hexagonal lattice photonic crystal fiber (PCF) biosensor is proposed in this article. COMSOL Multiphysics software is used for numerical performance study of the recommended sensor with the Finite Element Method (FEM). Gold as plasmonic layer that is chemically stable can be set externally on the fiber structure through the chemical vapor deposition method (CVD). Numerically it is found that the proposed biosensor can identify analyte refractive index (RI) in the range 1.33-1.41. To increase sensitivity and produce birefringence, air holes are removed in the first ring of the PCF biosensor. The proposed biosensor displays the maximum wavelength sensitivities of 11500 nm/RIU and 11000 nm/RIU for *x*-polarization and *y*-polarization modes, respectively. The sensitivity is also measured by amplitude sensitivity analysis. The maximum amplitude sensitivities are 1755.81 RIU<sup>-1</sup> and 1792.40 RIU<sup>-1</sup> for *x*-polarization and *y*- polarization, respectively. Moreover, sensor resolutions are 1.14×10<sup>-5</sup> RIU and 9.70×10<sup>-6</sup> RIU for *x*-polarization and *y*-polarization, respectively.

Paper ID – 057

## Ultra-Wide Refractive Index Range Photonic Crystal Fiber Based Sensor with Gallium Doped Zinc Oxide Coating

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**Abstract:** A refractive index (RI) sensor with an ultra-wide detection range (1.24-1.40) based on photonic crystal fiber (PCF) utilizing surface plasmon resonance (SPR) is proposed and analyzed which works in the near-infrared (NIR) wavelength region (1160-1840 nm). The sensor structure consists of 20 air-holes with a square-shaped core that renders easy fabrication. The full-vectorial-based finite element method (FEM) is used to build and investigate the impact of various geometric values on the sensor's sensing characteristics. To the best of our knowledge, this is the first-ever PCF-SPR sensor based on Gallium doped Zinc Oxide (GZO). The designed sensor achieves enhanced wavelength sensitivity (WS) of 17000 nm/RIU (Refractive Index Unit) and amplitude sensitivity (AS) of -135.817 RIU<sup>-1</sup>. Besides, the sensor exhibits higher detection accuracy such as wavelength resolution of  $5.88 \times 10^{-6}$  RIU<sup>-1</sup> and amplitude (ampl) resolution of  $7.36 \times 10^{-6}$  RIU. Due to ultra-wide detection range, higher sensitivity, use of alternative plasmonic material (GZO), lower material cost, outer annular detection channel proposed sensor is suitable to identify unknown RI of various samples in sensing applications.

Paper ID – 059

## Recognition of Basic Handwritten Math Symbols Using Convolutional Neural Network with Data Augmentation

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**Abstract:** In the ever-updating digital world, automatic handwritten math symbols classification (HMC) plays many vital roles in the advancement of computer-aided systems. It is the main foundation of perfecting one of the most challenging tasks out there: recognizing handwritten mathematical formulas. As with the other similar automated handwritten characters classifications tasks, HMC also faces various difficulties while attempting to correctly classify images. As people tend to have distinct types of handwriting styles and unique ways to write symbols, a simple character may have infinite versions of itself. In our research, we focused on the classification of such images of numerous handwritten mathematical symbols. For this classification, we have developed a convolutional neural network (CNN) model and worked with three different datasets to test our model's efficiency. We introduced different data augmentation techniques to construct various versions of the already available images. This created a virtual mimicry of people's tendency to write the same character in many styles. Our CNN model of 11 layers (6 were convolutional layers) worked to classify 16 classes (each denoting a mathematical symbol or digit) and had an accuracy of 98.71%, 99.01%, and 99.85% respectively on three publicly available datasets. To our knowledge, our model performed better than every other research work in this field. Considering this remarkable success, we are bent on working further on this and creating a fully working app that would eventually be able to automatically classify handwritten mathematical formulas.

Paper ID – 066

## A Real-Time End-to-End Bangladeshi License Plate Detection and Recognition System for All Situations Including Challenging Environmental Scenarios

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**Abstract:** Automated License Plate Detection and Recognition (ALPDR) system is a technology that automatically detects and recognizes the license plate from a video or an image. An ALPDR system is usually a 3 steps process;

license plate detection, segmentation of characters, and finally recognition. For an effective ALPDR system, every step of the process should be highly accurate and robust. This is a very active research field and many researchers are working towards building an effective ALPDR and proposed various recognition systems for Bangladeshi license plates. In this paper, we propose a real-time end-to-end ALPDR system for Bangladeshi vehicles. Our proposed system has three sub-systems which are Detection, Segmentation, and Recognition. For the detection of license plate, we have used a real-time detection model called You Only Look Once (Yolov4) and achieved a very high accuracy of 99.89%. For segmentation, we have implemented an existing greedy graph-based segmentation algorithm which has 99.52% overall accuracy. For recognition, we have developed a Convolutional Neural Network (CNN) based model which achieved a 99.33% f1-score and is quite generalized. Moreover, we have created the largest Bangladeshi-Licence-Plate dataset consisting of 5087 diverse images of vehicles captured from the streets of Bangladesh.

**Paper ID – 070**

### **Optimization and Sensitivity Analysis of a Single Core Low Loss PCF Sensor**

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**Abstract:** This study focuses on designing a D-shaped SPR-based PCF sensor and performing its numerical investigation. The analysis was done using the finite element method (FEM). We've used gold-TiO<sub>2</sub> as the plasmonic material to help incur the SPR. A virtual perfectly matched layer (PML) was added to absorb the outgoing waves in the simulation. This sensor shows a high sensitivity and accuracy to detect components inserted as analytes. The performance of the sensor is analyzed based on the sensor's wavelength and amplitude sensitivity. To optimize the structure for better performance, we altered the structural parameters, i.e., the gold layer thickness, titanium dioxide layer thickness, pitch size, and airhole diameters. The maximum achieved wavelength sensitivity ( $S_w$ ) and amplitude sensitivity ( $S_A$ ) is 19,000nm/RIU and 2561RIU<sup>-1</sup> respectively. The resolution for the maximum  $S_w$  is  $5.26 \times 10^{-6}$  and the figure of merit (FOM) is 118.75 \$RIU<sup>-1</sup>.

**Paper ID – 075**

### **An Efficient Adjustable Duty Control Based Current Limiter for Grid-Connected Solar PV System**

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**Abstract:** Solar photovoltaic (PV) is heavily integrated with the power system network through power electronic converters. Such power electronic converter-based distributed generators (DGs) increase the vulnerability of the system due to AC and DC side faults. This paper proposes an efficient adjustable duty-based controller of modified bridge fault current limiter (MBFCL) for solar PV integrated DG system. The advantages of the proposed approach are manifolds: simplest detection and control of system faults, autonomous duty to limit the fault current, and lossless operation during normal conditions. The detailed modeling for the MBFCL, solar PV, voltage source inverter (VSI) and DC-DC converter control, and fault detection and suppression control is presented. The MBFCL activation controller uses the simplest approach using point of common coupling (PCC) voltage and current. The

root-mean-square (RMS) current deviation at PCC is used to adjust the duty cycle of MBFCL. To study the efficacy of the proposed control approach, several disturbances are applied in the system. The proposed approach outperforms in suppressing fault current over without current limiter and with traditional control-based current limiter as verified by the simulation studies.

**Paper ID – 078**

**Non-invasive Deception Detection in Videos Using Machine Learning Techniques**

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**Abstract:** Deception detection has important clinical and legal implications. Detecting deception is very effective in criminal investigations, finding fake news, jurisprudence, law enforcement, and national security. Still, a reliable and Non-invasive deception technique is in progress. Deception detection using visual data is one of the most explored topics for burgeoning researchers. Several studies have been conducted on detecting deception using visual data. But most of them are based on courtroom trial data or mock criminal scenarios. In this paper, we have explored factual data set to identify deception from the subject's natural response to truth and lie by analyzing Facial Action Units (FAU). Firstly, we selected apex frames of a video sequence and incepted all possible feature sets. Secondly, we analyzed the result of five machine learning classifiers on selected important features for detecting deception. We observed that Support Vector Machine with Radial Basis Function kernel (SVM-RBF) outperformed among all with 61.54% cross-validated accuracy.

**Paper ID – 079**

**Improving Operating Voltage and Frequency Ranges in a Microcontroller-based Low-cost Oscilloscope**

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**Abstract:** Although microcontroller-based oscilloscopes are popular for their low-cost implementation and compact form factor, their main disadvantages are that they are limited in operation to low frequency and voltage ranges. We propose a novel design for such an oscilloscope that offers 3x improvement in the input frequency range and 20x improvement in the input voltage swing with 2x lower bias power than other microcontroller-based oscilloscopes. It can detect frequencies of high practical ranges with good clarity using preset coding of the microcontroller. It can be connected to input voltages on a variable range scale so that precision and accuracy can be maintained adaptively with both low or high voltages. The oscilloscope is auto-calibrated and has an external reset option. It is inexpensive and portable, as well as power-saving. We have performed experiments to validate the functionality of the oscilloscope, which reflects that the design is practically implementable.

**Paper ID – 085**

**A Case Study on the Cost-effectiveness of Net Energy Metering of Residential Grid Connected Photovoltaic in the Context of Bangladesh**

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**Abstract:** Increasing electricity generation without harming the environment is the foremost concern in recent times. The use of solar energy in the perspective of Bangladesh is very much appreciated due to environmental

reasons. If a solar plant is implemented, problems arise such as the costing of the panel with battery and wastage of energy during daytime due to excess generation compared to battery capacity. Net Energy Metering (NEM) with grid-connected PV can resolve these problems. The research in this paper focuses on using PVsyst to design a grid-connected home solar system that takes into account meteorological, technical, and loss aspects. The net energy exchange, as well as the cost-effectiveness of the implemented scheme, is determined by the Sustainable and Renewable Energy Development Authority (SREDA) net metering calculator after implementation. In the proposed case, it was found that the total investment of 22,545.63 USD will give a profit of 26,881.78 USD to the investor with a payback period of 6.85 years. The paper concludes that residential grid-connected solar is a nouveau concept within the setting of Bangladesh, which will help to tackle the excess demand for electricity with a good economic outcome.

**Paper ID – 095**

### **Design of a 7.5 MVA Automated Substation with Fault Analysis Using ETAP Software**

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**Abstract:** Substations are undeniably risk prone environments with a distinctive set of hazards often concealed from the eyes of general people. One footstep in the erroneous direction can lead people too near to functioning equipment, and even an accidental movement of an arm touching a control switch can put the entire area to a grinding halt. So, the study of safety factor is needed in establishing a substation. ETAP is the most extensive analysis tool for the design, automation, simulation, and operation of generation, distribution, and industrial power systems. The study of this work comprises the designing of 7.5 MVA (33/11kV) substation, selection of components, substation base plant with standard simulation – Load flow analysis, Short circuit calculation, Circuit breaker coordination, Protection device coordination.

**Paper ID – 096**

### **IoT Based Smart Waste Monitoring and Management System**

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**Abstract:** To keep our surrounding environment clean and healthy only two things are needed, the first one is the awareness of people and the other one is proper monitoring and management system of corresponding authority. In our country, due to a lack of public awareness and proper management from an authority, the environment is becoming polluted day by day. A vast implementation of technology has appeared in a waste management system in developed countries so that they can handle this huge work very easily. The authority of our country uses outdated technology, for that reason their process cannot adapt to our ever-increasing population and problems. To make our existing waste management system efficient and effective, we have proposed a viable solution named Smart Waste Monitoring and Management System based on the socio-economic status of Bangladesh. The proposed project is a website-based dustbin and air quality regulation system which can be used to establish an efficient and smart garbage management protocol. The proposed website contains real-time data visualization of the garbage level inside and the irritating gas level around the dustbin. Our proposed system is a solution that has a perfect collaboration of manpower and effective technology. If the authority decides to implement this system, it is likely to bring about a prominent improvement in this sector in Bangladesh.

Paper ID – 098

## Estimation of ZnO Nanoparticles Crystallite Parameters at Different Compression Temperatures

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**Abstract:** In this work, ZnO films were processed utilizing a standard blade coating procedure at different compression temperatures (50 to 90 °C temperature at 120 MPa compression). The X-ray Diffraction (XRD) technique is used to characterize the films. The crystallite sizes, microstrains, and dislocation densities of the ZnO nanoparticles (NPs) sample were studied using several methods, including the Modified Scherrer method, the Wagner-Agua (W-A) method, and the Halder-Wagner (H-W) method, based on XRD data. The results were compared to observe the effects of compression temperatures on various structural parameters. From the analysis, it is evident that ZnO nanoparticles are crystallite in nature with a hexagonal wurtzite phase. The crystallite size calculated from the Modified Scherrer method, the H-W, and the W-A methods match very well, are greatly inter-correlated, and range from 12.7 to 15.29 nm. The dislocation density and lattice strain exhibited an inverse relationship with crystallite size. The crystallinity improves gradually up to 70 °C with increasing compression temperatures, then decreases. However, impacts on various crystallite components caused by various temperatures at 120 MPa pressure are also utilized to characterize the Dye-sensitized solar cells (DSSCs) behavior. The photovoltaic performance of the 70 °C temperature 120 MPa compressed cell was shown to be better where the average crystallite size was comparatively large.

Paper ID – 099

## Bangla-ExtraSum: Comparative Analysis of Different Methods in Automated Extractive Bengali Text Summarization

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**Abstract:** Text summarization is one of the most exciting fields for modern researchers. Data is increasing every day. Summarization is one of the most essential strategies for storing information from the data. Though several approaches for summarising English texts have been developed, only a few notable works have been done for Bangla. In addition, there are just a handful of Bangla Extractive Summarization datasets available. In this paper, we introduce different approaches to text summarization that can capture the main context from text using semantic and contextual relations between sentences. The necessity of semantic relations between sentences while doing summarization is displayed here and also demonstrated transformer model and word2vec model assistance in summarization field. 500 articles and two human-generated summaries for each article are proposed in this paper. Finally, five different types of models and the comparison of their performance in two different datasets are shown. Our designed model gets a 0.68 f-score in the existing dataset and a 0.63 f-score in our dataset.

## A Convolutional Neural Network for End-to-End Structural Prediction and Lane Detection for Autonomous Vehicle

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**Abstract:** Automated road lane recognition in real-time is an essential aspect of a smart vehicle safety system. The driver assistance system is the most significant advancement for intelligent automobiles. The vision-based driver assistance system of intelligent vehicles provides automatic road lane detection. This driver aid technology helps to prevent traffic accidents, increases safety, and improves the flow of traffic. This paper proposes a novel approach for recognizing road lane and road border markings in the development of autonomous vehicle navigation. At first, it transforms the image of the RGB street scene to a gray image and then uses the flood-fill technique to identify the gray image's related components. Following that, the road region, which is the largest connected component in the labeled image, is extracted using the maximum width and number of pixels. Finally, the outer region is excluded, and the road lane and road border markers are separated from the associated components. The numerical results demonstrate the applicability of the proposed algorithm on both straight and slightly curved road scene photos under various daylight circumstances and the presence of road shadows. The driver support system consists of a camera support system that captures real-time pictures of the vehicle environs and displays pertinent information to the driver. As a result, intelligent vehicles automatically collect information about the road lane and the vehicle's position relative to the lane. The system employed by smart vehicles thus offers the means of alerting drivers who swerve off the lane without using the blinker. Smart vehicles will therefore clearly improve traffic safety if they are extensively adopted.

## The Role of IoT in Digitalizing Mining Sector of Bangladesh

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**Abstract:** Mining is expected to play an important part in Bangladesh's economic development, regardless of the country's economy, with potential outcomes in terms of business, manufacturing, and employment. Recent developments in technologies such as the Internet of things (IoT) and Artificial Intelligence (AI) have paved the way for digitalizing the mining sector. When these technologies are deployed in the mining industry, the results acquired may be used immediately to support process optimization, machine health, worker safety, and asset management. Similarly, mine digitization is expected to provide significant possibilities and benefit Bangladesh's Industrial growth. However, digital mining is difficult to implement in reality owing to constraints in communication, data management, and storage infrastructure. Furthermore, the mining companies' inclination to remain with outdated methods rather than depending on experimental novel technologies hinders development. This paper briefly describes the architecture of mine IoT, different applications and potential challenges to enable mine digitalization in the perspective of Bangladesh.

Paper ID –106

## Driving Range Prediction of Electric Vehicles: A Machine Learning Approach

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**Abstract:** Due to the immense progress of green energy technology, the popularity of electric vehicle (EV) is increasing day by day. The rapid transition from internal combustion engine-based vehicle to battery-driven vehicle creates another issue that is limited storage capacity of batteries. Researchers are working hard to improve the storage capacity of battery through use of advanced materials. Meanwhile, the accurate prediction of driving range of EV has become a topic of interest for the researchers. In this paper, multiple regression machine learning algorithms are used to predict the electric vehicle range. Among the models, Multiple Linear Regression (MLR) gives the best R squared value of 0.973 and the lowest RMSE value of 39.67 in predicting the EV range. The result is compared with other machine learning models.

Paper ID – 107

## Impact of Trace-Based Mobility Models on the Energy Consumption of Delay-Tolerant Routing Protocols

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**Abstract:** In Delay-Tolerant Network (DTN), nodes' energy consumption depends highly on their movement pattern since energy-constrained nodes move in a "Store-Carry-and-Forward" paradigm for data communication. Energy must be expensed efficiently, selecting a suitable mobility model for successfully delivering messages in DTN. Mobility models are generally two types: one is synthetic mobility, and the other is trace-based mobility. In this research, the impact of trace-based mobility on the energy consumption for delay-tolerant routing protocols is evaluated in terms of the average remaining energy and the number of dead nodes. Here, three trace-based mobility models: MIT Reality, INFOCOM, and Cambridge Imotes are considered. Shortest Path Map-Based Movement from synthetic mobility is also investigated in this research for better analysis. These mobility models are implemented for five delay-tolerant routing protocols: Epidemic, Spray and Wait, PROPHET, MaxProp, and RAPID and simulated in the Opportunistic Network Environment (ONE) simulator using a similar simulation environment. Simulations are performed by varying message generation intervals, message Time-To-Live (TTL), and buffer size, respectively, while others remain fixed. From the outcomes of simulations, we have finally found that INFOCOM trace on MaxProp protocol has the minimum value of average remaining energy, while Spray and Wait protocol with MIT Reality has the maximum value of average remaining energy. Apart from this, Shortest Path Map-Based Movement for MaxProp protocol measures the highest number of dead nodes, and Spray and Wait Protocol in Cambridge Imotes computes the least number of dead nodes.

Paper ID – 111

## AllerHybrid: A Hybrid System to Predict the Allergen Using K-mer and Physicochemical Properties

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**Abstract:** A protein can be an allergen if it is sequentially or structurally similar to other allergens. Because of allergy people are suffering from physically and economically. For this reason there are various existing allergen

prediction tools. Most of the existing allergen prediction tools are either alignment-based or alignment free. But none of the existing tools is based on both except the AllerCatPro. But the accuracy of AllerCatPro is very low which is only 84%. That's why we recommended a hybrid model based on Artificial Neural Network (ANN) and SVM using k-mer of protein sequence and structural physicochemical properties of amino acids. Which can detect the allergen protein 94.28%. Which is also able to detect allergenicity of short length and distantly related protein.

Paper ID – 112

### **Best Eleven Forecast for Bangladesh Cricket Team with Machine Learning Techniques**

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**Abstract:** Cricket is one of the most well-known team sports in the world. Machine learning algorithms have a significant impact on sports analysis, and cricket is no exception. With the help of Machine learning algorithms, we may create new methodologies, predict the outcome of a game, measure the player's performance, and pick the squad for the next matches by anticipating the player's performance. As a result, predicting individual and team performance became an intriguing topic for researchers, and only a few works have been done on it, with a few downsides. This study attempts to anticipate the most suitable players for a particular game to be organized. To predict the perfect players for the match to be played, we suggest a machine learning approach. This study and project aimed to identify the squad of eleven players for the Bangladesh (ODI) cricket team. We forecast the squad for Bangladesh (ODI) cricket team using Support Vector Machine, Naive Bayes, and Random Forest machine learning algorithms. We obtained 94% accuracy for the batsman and 93% for the bowler.

Paper ID – 113

### **Demand Side Management in a Model House for Better Load Profile in the Perspective of Bangladesh**

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**Abstract:** Demand Side Management (DSM) has a crucial position in helping consumers to make the correct choice on their energy usage to reduce the overall power demand, peak load demand, and have a better load profile. Energy conservation has always been an essential part of DSM. In this work, we have tried to visualize the load profile of a model house before and after using DSM methods. A model house has been simulated in Matlab/Simulink for this purpose. Three DSM methods were applied in the model house. Various key results such as total power consumption, 24-hour load profile, and total unit (kWh) consumption with and without applying DSM are presented from the simulation data. This study will help to grow awareness about the benefits of DSM and change our view on the efficient use of power among Bangladeshi consumers.

Paper ID – 116

## A Universal Energy Harvesting System for Ultra-Low Power Management and IoT Applications

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**Abstract:** This paper reports the architecture and realization of an autonomous energy scavenging system operating in intermittent mode. The system consists of a self-conducted power management circuit (PMC), an energy harvesting device, a battery charging circuit, and an electronic load. This circuit is developed herein to achieve a stable output power with a wide input-output range. The PMC can adapt, preserve, and smartly regulate the driving of the electronic load in the absence of an external voltage source. The self-powered energy scavenging system is intended for use in circumstances where the generated power is insufficient to directly drive the load, e.g., Internet of Thing (IoT) applications. Using the suggested PMC in this work, experimental outcomes expose that the storage capacitor voltage was essentially constant at 3.3V for various inputs ranging from 850mV to 4V.

Paper ID – 118

## HDM-Chain: A Secure Blockchain-based Healthcare Data Management Framework to Ensure Privacy and Security in the Health Unit

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**Abstract:** In conventional medical data monitoring systems are suffering key challenges in phases of information immutability, traceability, transparency, observation, data validation, access permission, reliability, privacy, and safety. Personal Health Records (PHR) have various advantages globally, but at PHRs data is ruled to essential safety and privacy concerns. This paper suggests a method to implement a reliable clarification to these points. Traditionally sophisticated methods trading with the security of health records ordinarily makes information inaccessible system to patients. Certain methods struggle to adjust information reliability, patient desire, and regular communication with supplier information. Blockchain (BC) resolves the preceding difficulties from it shares data in a decentralized and transactional way. The utilize of BC could support the healthcare division to adjust the accessibility, privacy, and security of PHRs. This document suggests a BC framework to efficiently and securely collect and keep health records. It represents a reliable and skilled means of achieving healthcare data for patients, physicians, and security insurance agencies while defending the patients of information. The goal of this activity is to show how the suggested system fits the safety requirements of participants (patients), physicians, and third performances and discusses privacy and safety attention in the medical division.

Paper ID – 120

## Integrating Cloud Computing in E-healthcare: System Design, Implementation and Significance in Context of Developing Countries

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**Abstract:** Cloud computing in the medical sector refers to the method of storing, maintaining, and processing electronic health records and relevant services on cloud servers that are accessible over the internet. The flexibility of cloud computing makes it a practical approach for enhancing the quality, dependability, and efficiency of medical services, as well as increasing patient-doctor interaction and safeguarding patient anonymity if proper measures are taken. Furthermore, cloud strategies facilitate healthcare technologies such as computerized healthcare records,

remote appointments, mobile applications, patient portals, IoT devices, and big data analytics, enabling trouble-free scalable solutions. Integrating cloud computing technologies can especially be beneficial in increasing the efficiency of healthcare services in developing countries where physical health infrastructure is usually limited. As such, the objective of this work is to explore the feasibility of incorporating cloud and distributed computing in e-healthcare through an extensive requirement analysis and user study. Then, the smart healthcare system will be compared with traditional database-centric healthcare systems and a prototype system will be designed and implemented based on the findings. Finally, we focus on finding the usability and user acceptance of such systems and challenges that lie with integrating cloud services to e-healthcare systems for the general user demographic of developing countries through extensive usability evaluation.

Paper ID – 126

## Survey on Characteristics of Lightning Injuries in Remote Area of Bangladesh and Its Prevention

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**Abstract:** Lightning strikes are obvious in Bangladesh due to geographical location and it has very high potentiality to cause injuries even deaths. Lightning strike affects almost all internal body system due to the fact that huge amount of energy is passed internally through the victim body within an extremely short time. Males are subjected to receive more struck by lightning comparing with the female counterpart. Maximum lightning victims are from the age group of 18 to 50 years. The most occurrence of lightning injuries are observed in the afternoon and evening hours (46.67%) and interesting observation is found that the rate of injuries increases from morning to evening and there is a sharp decline at night. Most lightning victims are farmers as they are exposed to open areas which were 40.00%. The highest lightning injuries are identified in May in Bangladesh whose percentage is 33.33%. The highest number of victims was during the pre-monsoon season. Among the casualties, 43.33% (n=13) of the victims seek treatment from village doctor or homeopathic practitioner or traditional healers which is followed by government hospital whose percentage is 20.00%. Rest medical treatment is taken from private clinic, medicine shopkeeper and others means like health assistant, NGO service providers, etc. In the human body, the leg was marked the most common site lightning casualties in Bangladesh. In the present study cardio-respiratory failure is the prime cause of death. Illiteracy, adequate knowledge on lightning safety and awareness agricultural economy, deforestation, climate change, global warming, etc. are the main causes of lightning-related injuries in Bangladesh. Lightning injuries can be reduced to a limited scale if people are aware about lightning safety.

Paper ID – 129

## A Self-supervised Convolutional Neural Network Approach for Speech Enhancement

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**Abstract:** Enhancement of speech means modifications to the speech which is degraded by noise. Speech enhancement leads to improvement in the intelligibility of speech to human listeners. Deep learning techniques have drawn tremendous attention for speech enhancement in recent years which require clean speech along with noisy speech for training purpose. However, availability of clean speech signal naturalistic scenarios is challenging. To ameliorate it, this study proposes a deep neural network-based speech enhancement approach without the requirement of clean speech to train the model called self-supervised learning. In this proposed framework, two CNN-based speech enhancement models have been deployed for two noisy conditions (babble noise and machinery noise). This work has been accomplished on two different datasets: one from IEEE speech corpus distorted with

real-time noise and another one from recorded speech signals from a naturalistic environment. Experimental result demonstrates that the proposed framework achieved significant improvement in both subjective and objective measures.

**Paper ID – 135**

## **A Deep CNN Based Kaggle Contest Winning Model to Recognize Real-Time Facial Expression**

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**Abstract:** In face-to-face interactions, facial expressions convey nonverbal details. Since the early 1990s, researchers have been increasingly interested in automatic facial expression recognition, which is critical in human-machine interfaces. Traditional machine learning methods often necessitate a time-consuming procedure for identifying features and yield mediocre results. We propose efficient deep Convolutional Neural Networks (CNNs) that are capable of accurately interpreting the semantic information available in faces without the need for hand-designing feature descriptors in an automated manner in this research paper, which makes use of recent advances in deep learning. We employ a range of loss functions and training techniques in order to learn CNNs with high classification efficiency. Using the renowned Facial Expressions Recognition (FER-2013) collection of data from the Kaggle facial expression recognition contest, the experimental findings show that our suggested networks outperform state-of-the-art techniques. On the contrary, to the competition's winning model, our proposed networks' parameter count is drastically reduced, resulting in an increase in average output speed of a significant magnitude and making the suggested networks a better fit for real-time applications.

**Paper ID – 136**

## **DURISE- Deblurring of Underwater Image Search Engine by CBIR**

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**Abstract:** Content or substance based image recovery (CBIR) has ended up a primary investigate range in interactive media applications. In the literature, there's part of papers centering on the content-based image recovery in arrange to extricate the semantic information inside the inquiry concept. The CBIR strategies utilized in the image looking ranges vary by the user interaction and preparing fashion in inquiry image input. This paper applies the visual location to submerged pictures include extraction to work out the vigor issue, which is conducive to a more steady and closer to human cognitive component include extraction calculation for a better view. In expansion, within the preparation of underwater images pretreatment, we apply dim channel earlier “Deblurring” to the submerged images preprocessing handle to expel cloudiness and improve the differentiate of submerged pictures. The outcomes about moreover appear that the strength and the property of real-time include extraction based on visual saliency discovery and dark picture defogging calculation has been enormously progressed with deblurring the blurred image.

**Paper ID – 138**

## **Analysis of CNL-UNet for Efficient Biomedical Image Segmentation**

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**Abstract:** Biomedical image segmentation has a lot of significance in disease detection and diagnosis. Many researchers proposed many deep learning architectures such as U-Net, SegNet, DualChexNet, DualANet for

biomedical image segmentation. Recently, a novel lightweight architecture namely CNL-UNet is proposed for multimodal biomedical image segmentation. The CNL-UNet used the CNL module, res-path, and transfer learning for effective biomedical image segmentation. In this paper, we made an in-depth analysis of the CNL-UNet to prove its robustness on multimodal biomedical image segmentation. We experimented in detail with the various components of the CNL-UNet. We made eight combinations of the CNL-UNet by removing or adding these components and experimented with these eight combinations on the ultrasound and MRI datasets. The results show that the CNL module helps the model to reduce the false outputs and gain high precision, recall, and F1 score. The res-path has a remarkable contribution to provide precise segmentation and increasing the performance of the model. And also, transfer learning plays an important role in faster convergence and also in increasing the performance of the network. In essence, this experiment increases the confidence of the CNL-UNet regarding its remarkable performance on multimodal biomedical image segmentation.

**Paper ID – 139**

### **Comparison of Condition Numbers and Ranks of the MIMO Channel at 77 GHz Carrier Frequency**

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**Abstract:** The millimeter wave (mmWave) frequency bands as well the Multiple-Input Multiple-Output (MIMO) technology are gaining significant attraction in the wireless communication system to accommodate the escalating wireless traffic. It is hard to imagine a day without wireless communication in versatile applications that ranges from cellular communication to astronomical explorations. In this paper, the performance of 2×2 and 4×4 MIMO channels at 77 GHz are analyzed for an Urban Micro (UMi) cell scenario in a non-line of sight (NLOS) environment using the NYUSIM simulator. The foliage loss, outdoor to indoor (O2I) penetration loss are considered along with other environmental parameters during the simulation of both co-polarized and cross-polarized MIMO systems. Simulation results including power delay profile (PDP), path loss, condition number, the rank of the channel matrix, and channel capacity are considered to assess the performance of MIMO channels. Moreover, the findings also address the feasibility of spatial multiplexing for the MIMO channels.

**Paper ID – 140**

### **Revisiting Deep Learning Models for Road Lane Detection**

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**Abstract:** This paper revisits the prominent deep-learning based lane-detection (DLLD) models and their datasets. Deep learning has redefined the limits of the recent computer-vision based models for the emerging intelligent transportation system with assisted/self-driving. However, these models are not readily applicable to the irregular and complex lanes in the developing and underdeveloped countries. In support of this development and validation of the DLLD models, a balanced mix of varying roads and scene-conditions, including the rural, suburban and urban areas of the developing and underdeveloped countries, different traffic, weather and lighting conditions, moving artefact (i.e., motion-blurring), and irregular and unmarked lanes are determined. In light of these conditions, we then analyse the merits and limitations of promising DLLD models and available datasets. Finally, the avenues and need for the future development of those models and datasets are suggested to ensure their real-time and universal applicability to the unstructured and complex road-lane scenarios, for the safer roads and better traffic.

Paper ID – 141

## An IoT-based System for Air Pollution Data Analysis and Visualization

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**Abstract:** Air quality has become the most concerning matter around the world. The World air quality report 2021 claimed that South Asia, including Bangladesh, is the worst air polluted country, where Dhaka is the second most polluted city. Air pollution causes everybody to see the dilemma as it causes severe diseases related to the lungs, which can be acute or chronic. Good air quality depends on the particular amount of different substances within a range in the air; otherwise, it becomes a matter of concern. These measurements rely on various ingredients such as the rate of CO, CO<sub>2</sub>, NO<sub>2</sub>, Alcohol, Benzene, Particular Matter, Dust, and so on. Our primary purpose is to build an IoT-based model to collect data from the sensors. We have used five parameters for monitoring pollution. These are the smoke, CO, particular matter, temperature, and humidity. A real-time monitoring system is developed for the front-end that allows knowing the current situation. This work also includes the data analysis, which predicts the condition according to the previous data with a machine-learning model. A comparison of various prediction algorithms, including performance measures and test case analysis, is presented. We also analyze the correlation between Air Quality Index (AQI) and weather conditions (temperature and humidity) for different locations and times.

Paper ID – 142

## Finding Efficient Machine Learning Model for Hand Gesture Classification Using EMG Data

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**Abstract:** Innovation in technology, increasing computing ability, and the invention of small devices have significantly influenced today's life in different dimensions. Surface Electromyography (sEMG) records the electrical activity of skeleton muscles when it is placed on the hand. Hand gesture identification has become an important field of study in recent years especially controlling prostheses and other applications. So, the study of sEMG data has become pertinent as it can collect the electrical activity of muscles and help to find an efficient model that can identify different hand gestures efficiently. In this work, we have studied a number of traditional classification algorithms and deep learning classification techniques with a variety of parameters to find the most efficient model. Our findings disclose the fact that tree-based classification methods and LSTM work better for classifying EMG data. Considering all the factors, the Random Forest classifier is the optimal model and gives 99.43% accuracy with the lowest misclassification error. Moreover, LSTM gives 99.19% accuracy with a low misclassification error. Therefore, if we can train the model with a huge amount of data, Random forest can identify the pattern very well and outperform others. This model can be used in controlling devices like prostheses, digital wheelchairs, etc. with human activity.

Paper ID – 144

## Cochleagram Based Speaker Identification Using Noise Adapted CNN

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**Abstract:** The process of recognizing a human based on one's voice is called speaker identification. Speech signals being susceptible to significant variations, it is a quite challenging task and conventional speaker identification (SID) systems perform poorly under different noisy environments. This study presents a robust speaker

identification system based on auditory-inspired features called cochleagram. Cochleagram is generated using a gammatone filterbank having 128 channels from frequency 50 to 8000 Hz. A convolutional neural network (CNN) is trained with a combination of cochleagrams constructed from clean and a fixed noise added over speech samples at a certain signal-to-noise ratio, referred as noise adapted CNN. The proposed model was then tested for different noises at different levels of SNRs. Experimental results showed that the proposed system showed better performance than the existing neurogram based method under noisy conditions particularly at very low SNRs for text-dependent as well as text-independent corpora.

**Paper ID – 145**

## **Estimating Traffic Density on Roads Using Convolutional Neural Network with Batch Normalization**

**Mahmudul Hasan<sup>1</sup>, Sunanda Das<sup>2</sup> and Md. Nafis Tahmid Akhand<sup>3</sup>**

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**Abstract:** Traffic Jam is one of the major problems of modern urban life. Regardless of the socio-economic structure of a country, almost all the countries of the world suffer from this problem. An obvious solution to this problem seems adding new and wider roads. But instead of having more roads, the cities which manage their traffic flow more efficiently are relatively good at managing traffic jams. That is why one of the best ways to tackle the problem of traffic jam can be by developing a traffic management system that can take input data from around the city and analyze that data to provide the most efficient solution to traffic. This study attempts to use computer vision along with machine learning and artificial intelligence to make a system that can determine the density of traffic from images taken by the traffic cameras mounted at the intersections. The traffic images were obtained from the API provided by Land Transport Authority, Singapore. After investigating various advanced deep learning methods, we finally built our model based on Convolutional Neural Network (CNN). Our proposed model outperformed existing models in terms of different performance metrics and achieved an accuracy of 86.56% and top 2 accuracy of 99.06%.

**Paper ID – 148**

## **Non-linear Behaviour Investigation of Accumulation Mode Silicon Nanowires for Biosensing Application**

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**Abstract:** We investigate the conduction mechanism of the accumulation silicon nanowires (SiNWs) with different bias polarities, NW thicknesses and substrate voltages ( $V_{SUB}$ ). The intention is to appraise in depth the hole conduction characteristics of SiNWs, to understand the variable electrical behavior of SiNWs and to assess the biosensing potential. Bias dependent modulation of the top surface accumulation layer is observed either in the source side (for positive drain voltages) or in the drain side (for negative drain voltages) which results in the diode or transistor like output characteristics of SiNWs. SiNWs exhibit prominent drain induced barrier lowering effect (DIBL) with positive drain biases ( $V_D$ ) whereas this effect is trivial for the negative drain bias application. It is also found that the substrate voltage significantly changes NWs' characteristics and for the accumulation mode SiNWs the subthreshold characteristic degrades with the negative substrate voltages. Scaling of the SiNW thickness results in the well-known improvement of the subthreshold slopes of SiNWs but the relative comparison exhibits that the p-type SiNW's subthreshold behavior is superior when  $V_D$  is negative. While the thinnest SiNW exhibits the best subthreshold characteristic, this investigation reveals that if a thick SiNW is used for economic reason there is an available bias window to improve thick SiNWs' subthreshold characteristics for the sensitive operation as biosensor.

Paper ID – 149

## Developing a Machine Learning Based Support System for Mitigating the Suppression Against Women and Children

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**Abstract:** Violence against women and children has emerged as a significant and growing concern worldwide. To avoid violence, various machine learning (ML) approaches could be used to estimate future violence. The main motive of this study is to provide a central platform for victims, store victim data in a database. In this research, we propose a system that is a web-based tool that stores data on violence against women and children in a database and generates crime forecast results by evaluating the collected data using machine learning techniques. The victim can also get proper information about their rights from this web application. A statistical analysis was carried out on certain datasets and few machine learning model were implemented and the best performed model was decided based on some performance measurement metrics where XG Boost (XB) performed well among others (R-squared test 0.99). Ultimately the XB model has been utilized to generate the forecasting crime report, thereby reducing the level of crime. Government and other law enforcement agencies can predict the future consequences of violence from the system and help victims to get proper justice and settlement. This web application is a support system that may greatly assist women in many parts of their daily lives while also resuming violence against women and children.

Paper ID – 152

## A Deep Ensemble Approach for Recognition of Papaya Diseases Using EfficientNet Models

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**Abstract:** Diseases of papaya impeded quality production and caused severe financial damages to growers. An efficient diagnosis approach for papaya diseases is enormously desired to control and prevent the spread of diseases. At first, using a dataset of 138980 images of affected and healthy leaves and fruits of papaya which was generated with image augmentation techniques from 13898 collected images, eight models of EfficientNet between B0 and B7 were trained via transfer learning technique to recognize eight diseases. Afterward, fine-tuned versions of the three best-performing models were selected for ensemble learning such as EfficientNet B5, B7, and B6, which achieved 98.13%, 96.93%, and 96.87% accuracy under the test set of 6931 images, respectively. The deep ensemble model showed more effective recognition performance than single models, and test accuracy increased by 1.61%. The experimental result demonstrates that the proposed ensemble model can recognize papaya diseases more efficiently than single models of EfficientNet.

Paper ID – 153

## Optimization of Reconfigurable Intelligent Surface for M2M Communications over Cellular Networks

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**Abstract:** Combined optimization of position and phase shift of reconfigurable intelligent surface (RIS) in machine-to-machine (M2M) communications is performed to maximize the throughput of the M2M as well as cellular

networks. A novel deep Q network (DQN) algorithm is proposed, which reduces complexity in optimizing the RIS position and its phase shift. Simulation results show that the proposed algorithm can obtain a higher sum-rate contrasting to the existing algorithm and therefore can be used to achieve a better quality of service (QoS) at M2M receivers and the evolved node B (eNB).

Paper ID – 162

## Online Review Based Sentiment Classification on Bangladesh Airline Service Using Supervised Learning

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**Abstract:** Air travel is one of the most used transit modes in our daily lives. It is, therefore, no wonder that more and more people share their experiences with airlines via online evaluations on the Web. Sentiment analysis may be used to understand people's attitudes or sentiments by utilizing sites that provide opinion-rich data. In this work, we worked on a customized dataset including online reviews for 4 major Bangladesh Airlines, performed a multiclass sentiment analysis, and compared the classifiers. This method begins with pre-processing procedures used to clean the reviews and balanced the review data using the Pegasus model's oversampling mechanism. System choices use various machine learning techniques to integrate feature engineering and word embedding for deep learning. The analysis was carried out 3 different machine learning (Decision Tree, Random Forest, and XGBoost) and 3 different deep learning classification strategies (CNN, LSTM, BERT). The test set's output is the tweet sentiment (positive/negative/mixed) using a three-class dataset, and the performance in terms of accuracy is calculated. Based on the results, we have achieved the best accuracy 83% in terms of BERT. The accuracies were determined to compare each categorization technique, and the total sentiment count for all four airlines of Bangladesh was displayed.

Paper ID – 163

## Design and Analysis of Miniature Type Impulse Based UWB Transmitter in 90 nm CMOS for Medical Application

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**Abstract:** Ultra-wideband (UWB) has piqued interest for uses in target location, radar, and wireless communications, particularly in the medical field. The major feature that makes IR-UWB system more popular is that it does not require carrier signals always. IR-UWB can operate with narrow Gaussian monocycle pulses to represent information. In light of these benefits, this work proposes a new ultra-wide band (UWB) transmitter system based on impulses that has a low power consumption and a simple architecture. The designed transmitter is implemented using 90nm CMOS technology and simulated in Cadence tools. A voltage-controlled oscillator (VCO), a simple on-off keying (OOK) modulator, a Gaussian pulse generator, a Differentiator and a differential amplifier make up the transmitter. The sketched UWB transmitter operates under a low power supply and the transmitter generates 359.44 mV output pulse swing and the pulse width of 100 ps for the Gaussian mono pulse. The given topology is functional and suited for usage in short-range wireless communication and medical applications due to its enhanced output voltage and low power consumption when compared to other circuits.

Paper ID – 164

## Medical Specialty Classification from a Bangla Dataset: A Token Level Approach Using Several Machine and Deep Learning Algorithms

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**Abstract:** With the outbreak of the current pandemic, the health care sector is going through significant changes throughout the world. Doctors and patients are preferring online services from both ends to avoid unnecessary hassles and risks of contamination. As a result, Electronic Health Records (EHR) are getting inundated in large numbers. For proper and easy maintenance of the system, sorting of the text-based records according to medical specialty is a primary concern and automation is a key requirement for achieving the purpose. As a matter of fact, the machine as well as deep learning methods can work significantly with proper training and accurate data. Correspondingly, the models can be able to understand the context of each patient in their natural language and provide with classified medical specialization of the respective dataset. Here, we have used the Bangla language for the training of the machine and deep learning models and achieved an accuracy of 82% using the Bidirectional LSTM model. Although complete dependence on the machine for the healthcare sector is contentious, it can definitely be a very good prospect in a world where each sector is being digitalized every now and then.

Paper ID – 165

## Design and Construction of Biogas Plant from Human Excreta at Remote Island of Bangladesh and Its Socio-Environmental Benefits

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**Abstract:** Presently, the number of Rohingya is about one million in Bangladesh. The rehabilitation of Rohingya refugees is done at Cox's Bazar. Due to different reasons, the Government of Bangladesh (GoB) planned to rehabilitate 103,200 Rohingya refugees at Bhashan Char on November 2017 and in December 2020, around 20,000 Rohingya has already relocated to this island. In island, there remains the cooking challenge which is likely to affect forestry of the locality. Sensing the challenge, the GoB has decided to produce biogas for cooking from human waste. From the study it is seen that from human excreta of 103,200 Rohingya refugees, approximately 3054 m<sup>3</sup> biogas can be produced per day. Quantity of biogas plants are 240 units. Each single plant has the capacity of 8 m<sup>3</sup> gas production capacity and digester capacity is 14 m<sup>3</sup>. From that amount of biogas, 2880 burners can be supplied to the people for their three meal cooking purpose. The construction guarantee is 10 years unless it affected by natural calamities of disasters like cyclone, earthquake, fire or man-made sabotage. Appliance warranty for gas burner, nipple and gas supply pipe is 1 year. The free service for routine checking, maintenance is for 1 year and there will be free user training. However, this renewable source of energy will not only mitigate the cooking challenge but also it will address the environment and social aspects. Therefore, biogas production from human excreta for cooking food in coastal island Bhashan Char will definitely strengthen the rehabilitation plan of Rohingya refugees.

Paper ID – 168

## A Review on Predicting Autism Spectrum Disorder (ASD) Meltdown Using Machine Learning Algorithms

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**Abstract:** Autism Spectrum Disorder (ASD) is a well-known mental disorders that prevails in the ability of a person's social communication. The significance of early diagnosing drew the attention of researchers to use

different machine learning- based procedures. Many analyses are done with the help of machine learning techniques to foresee meltdowns of autism together with Support Vector Machines, Random Forests, Naive Bayes, K-nearest Neighbors and many more. This paper gives a wide-spread review of 40 papers applying machine learning in predicting ASD, along with algorithms for data analysis and classification. More than 80 research papers are considered, and the articles are assembled from the internet. Finally, 41 research articles are copied up with the prerequisites in this study. The main goal of this review is to distinguish and mark out the machine learning trends in ASD literature and show the way to researchers curious in expanding the core of predicting ASD data and observe momentous research patterns in the field of machine learning. This paper will be a guideline to future researchers who are willing to work in the field of predicting ASD meltdown.

**Paper ID – 175**

**A Study on the Performance Analysis of Hybrid Diversity Combining Techniques for Rayleigh and Rician Fading Channels under AWGN**

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**Abstract:** In order to deal with multipath propagation, diversity combining is used, where hybrid combining provide better outcomes in comparison with basic combining systems. Consequently, two new hybrid diversity combining schemes SC-MRC and SC-EGC are investigated in this study. In this research work, data is transmitted from a single transmitting antenna and received by 4 distinct antennas for pure combining (MRC, SC, EGC) and 4 modules having 2 antennas per SC module (4 x 2) in hybrid combining (SIMO). Comparison between hybrid SC-EGC and SC-MRC has also been observed for 2 SC modules having 2, 3 and 4 antennas each. The most robust modulation technique, Binary phase shift keying (BPSK), was taken into consideration. The data was conveyed through Rayleigh and Rician fading channels and a performance analysis was done for the BER response in both cases for every possible combination of diversity combining ventures under flat fading conditions. Among them SC-MRC hybrid combining and Rician fading channel brought out a more prominent result as anticipated.

**Paper ID – 178**

**Theoretical Investigation for Growth of High Quality GaN on Epitaxial Graphene**

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**Abstract:** GaN is one of the most important semiconductors with highly attractive properties. Efforts have been made for decades to grow high-quality GaN crystals, however, the quality is not good as Si crystal. This paper reports the theoretical possibilities of growing high-quality GaN on epitaxial graphene (EG). According to our findings, growing GaN on EG is really promising due to their hexagonal symmetry and weak van der Waals interaction of graphene. Furthermore, the quality of GaN crystals improves significantly as the number of bilayers increases.

**Paper ID – 179**

**A Deep Learning Based Approach for Real-Time Driver Drowsiness Detection**

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**Abstract:** Proper detection of driver drowsiness plays a key role to reduce the accidental rate in our country. Drowsiness occurs due to sleeping during driving. In this paper, a Convolutional Neural Network (CNN) model is

proposed to detect the drowsiness of the driver in real-time. The CenterFace algorithm is used for face detection in this paper along with Haar-Classifer that is used for eye feature extraction. The proposed model can handle unusual situations where the driver wears a glass or mask, with a good accuracy rate and detect whether the driver is drowsy or alert. The training accuracy is 97% and validation accuracy is 98%. The test accuracy for the non-glassed and glassed eye datasets is 97% and 92%. Moreover, our proposed method performs better in a real-time environment.

**Paper ID – 181**

### **Effects of Structural Variation for Improved Performance of a Vertical AlGaIn/GaN Superjunction HEMT**

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**Abstract:** A GaN-based vertical superjunction high electron mobility transistor (HEMT) is analyzed theoretically to improve specific on-resistance ( $R_{on}$ ) and breakdown voltage (BV). The Drain is vertically aligned with the Source and Gate in a vertical superjunction HEMT, where the width is divided into two pillars, p and n. Each of these pillars is referred to as a half pillar. The devices are simulated with a particular doping concentration of  $2.76 \times 10^{16} \text{ cm}^{-3}$  for p-pillar and  $1 \times 10^{16} \text{ cm}^{-3}$  for the n-pillar. With the decrease of half-pillar width and epilayer thickness ( $T_{epi}$ ),  $R_{on}$  decreased, while with the increase of half-pillar width and epilayer thickness, BV increased. The  $R_{on}$  was reduced to  $4.67 \text{ m}\Omega \cdot \text{cm}^2$  with a BV of 5050 V using the optimized design. These findings imply that the optimized structure of vertical superjunction HEMT contributes to better  $R_{on}$  and BV.

**Paper ID – 184**

### **A Single Stage Off-board EV Charger Based on CUK Topology**

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**Abstract:** A CUK topology based single stage single phase electric vehicle (EV) battery charger is introduced in this paper. The application area is commonly found EV three wheelers in Bangladesh and South East Asia. The converter simultaneously shapes the input AC current and controls the output charging DC current in a single stage with only a single control loop. No extra input filter is required. The topology is based on a single active switch CUK converter with low cost low frequency transformer. Complete analytical design process is explained. A small signal model and controller is developed for the charger. Converter design is verified through extensive simulations in PSIM. This converter is designed and tested for 48V/60V lead acid battery charging at approximately C/5 rate of around 12A. High power quality in terms of low THD and high power factor is achieved in the total operation range of the charger.

**Paper ID – 185**

### **The Gold Coated Plasmonic Refractive Index Sensor with Low Propagation Loss**

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**Abstract:** A refractive index (RI) sensor based on photonic crystal fiber (PCF) utilizing surface plasmon resonance (SPR) is modeled and numerically investigated. Gold, a chemically stable plasmonic material, is deposited on the outer surface of the sensor structure. The sensor has been designed with COMSOL Multiphysics, and its transmission characteristics have been studied with the finite element method (FEM). The sensor structure consists of 24 circular air-holes, out of which 14 are larger and 10 are smaller. The step-by-step optimized design shows enhanced sensing performance such as wavelength sensitivity of 22500 nm/RIU, amplitude sensitivity of -830.353

RIU<sup>-1</sup> and a figure of merit (FOM) of 321.42 RIU<sup>-1</sup>. In the case of accurate detection, the sensor reaches the highest level of  $4.44 \times 10^{-6}$  RIU<sup>-1</sup> in wavelength resolution and  $1.28 \times 10^{-5}$  RIU in amplitude resolution. The outer annular analyte channel, simple design, remarkable sensing performance, and very low propagation loss make the proposed sensor a viable candidate in sensing and biosensing.

**Paper ID – 187**

## **Speech Command Recognition System Using Deep Recurrent Neural Networks**

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**Abstract:** Speech command recognition has become increasingly relevant in the past few years. This study proposes a new speech command recognition system based on the Mel-frequency cepstrum coefficients (MFCCs) feature extraction method, a well-established approach for speech feature extraction and deep recurrent neural networks. In this work, we have compared different signal processing techniques such as wavelet packet decomposition (WPD), continuous wavelet transforms (CWT) and empirical mode decomposition (EMD) to decompose speech signals and extract MFCC features to train long short-term memory (LSTM) recurrent neural networks. Comprehensive studies on the performance of different network parameters and different signal processing strategies are presented in this paper. The proposed neural network model trained with MFCC features extracted from signals preprocessed using wavelet packet decomposition has performed better than raw speech data as well as both CWT and EMD preprocessing.

**Paper ID – 188**

## **Comparative Analysis of Hybrid Diversity Schemes under AWGN and Impulsive Noise Models for Rayleigh Fading Channels**

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**Abstract:** The widespread presence of impulsive noise caused by electro-mechanical switching devices, electromagnetic interference prompts the performance of diversity combining ventures. In this research work, we develop the performance survey in terms of BER (Bit error rate) versus SNR (Signal to noise ratio) over three wireless noise models; additive white Gaussian noise (AWGN), Middleton class-A and Symmetric alpha stable (S $\alpha$ S) noise model under Rayleigh fading channel. We aim to employ the probability density function (PDF) of the generated Class-A and S $\alpha$ S noise distribution to compare the better performance rate with parameter variation. Statistical analysis has been done in the presence of three noise models on the BER response of data transmission of SC-MRC (Hybrid Selection-Maximal ratio Combiner) and SC-EGC (Hybrid Selection-Equal Gain Combiner) techniques in SIMO (Single input Multiple Output) device. We verified that for each noise model hybrid diversity combining schemes show better performance. The theory is authenticated by our simulation results.

**Paper ID – 189**

## **An Efficient Switched-Capacitor Based Single DC Source Inverter with Selective Harmonic Elimination**

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**Abstract:** An efficient switched-capacitor based single dc source multilevel inverter topology is presented in this paper. Here, ‘n’ capacitors are connected in series to raise their charge up to 1/n part of the dc voltage source. Then,

( $n+3$ ) switches are used to choose different current paths to generate ( $2n+1$ ) levels in the output. As a reference circuit, an eleven level inverter ( $n = 5$ ) is used. Here, maximum two switches conduct in any mode, which reduced the conduction losses and improved the system efficiency. Besides, comparatively lower blocking voltages are found in the power switches of the proposed design, and the switching losses are reduced further by supplying low frequency signals to the gates. Moreover, a high frequency switching technique is also illustrated, where total harmonic distortion (THD) is reduced by using an LCL filter. Thereafter, selective harmonic elimination (SHE) method is applied to remove harmonic contents selectively. To validate these schemes, several simulations are executed in MATLAB. A comparative study of the reported inverter with the recently published structures reveals that the number of control drivers and switches are promisingly lesser. Therefore, the presented inverter topology can be commercially implemented in sustainable energy systems.

**Paper ID – 192**

### **A Case Study on Risk Prediction of Heart Failure Patients Using Random Survival Forest**

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**Abstract:** Fast diagnosis and risk assessment are crucial to providing timely care to heart failure patients. Understanding future risks can help clinicians make informed decisions regarding the intensity of treatment required. Identifying low-risk patients could also reduce patient anxiety and the additional cost of treatment. In this regard, we have utilized the Random Survival Forest model to create a risk prediction system for heart failure patients. A dataset collected from the Faisalabad Institute of Cardiology and the Allied Hospital in Faisalabad, Pakistan was used. The features that are most significant in terms of survival prediction of heart failure patients were identified to assist clinicians in decision making. We compared our model with other popular survival analysis tools like the Cox Proportional Hazard model. The experimental results show that our developed risk model outperforms the other methods as well as previous studies with a Harrell's Concordance Index of 0.81. Thus, our proposed approach can serve as a valuable tool for clinicians in properly interpreting the patients' records to make informed decisions regarding heart failure mortality prediction.

**Paper ID – 200**

### **Interpreting and Comparing Convolutional Neural Networks: A Quantitative Approach**

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**Abstract:** A convolutional neural network (CNN) is sometimes understood as a black box in the sense that while it can approximate any function, studying its structure will not give us any insights into the nature of the function being approximated. In other terms, the discriminative ability does not reveal much about the latent representation of a network. This research aims to establish a framework for interpreting the CNNs by profiling them in terms of interpretable visual concepts and verifying them by means of Integrated Gradient. The interpretability profiling has been done by evaluating the correspondence between individual hidden neurons and a set of human-understandable visual semantic concepts. An integrated gradient-based class-specific relevance mapping approach is proposed that verifies interpretability profiling. Moreover, it is insightful to examine the correlation between the different input classes in terms of an overlapping set of highly active neurons. The result suggests the existence of a structured set of neurons inclined to a particular class. Finally, network ablation is performed to illustrate the performance of the network based on our approach.

Paper ID – 201

## Design of an Integral Sliding Mode Controller-Based on a Hybrid Reaching Law for DC Microgrids

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**Abstract:** In this paper, a hybrid reaching law-integral sliding mode controller (HRL-ISMIC) is proposed to enhance the transient stability performance while maintaining power-sharing within DC microgrids. It is well-known that a constant DC-bus voltage is the main indicator to show the proper power balance in DC microgrids. Hence, keeping a constant DC-bus voltage is another key objective of this paper. To achieve the aforesaid objectives, the control of each microgrid unit's output power is necessary and this will be done using the proposed HRL-ISMIC. In this paper, the proposed DC microgrid comprises with a solar photovoltaic (PV) system, a battery, and DC loads. Afterward, to ensure the overall stability of each unit within the DC microgrid, the control Lyapunov theory is used. Finally, simulation results are presented to demonstrate the proposed controller's performance and a comparison result is also presented to illustrate the merit of the proposed controller.

Paper ID – 202

## A Hybrid Reaching Law Based Double-Integral Sliding Mode Controller Design to Mitigate SSR Effects in a DFIG-Based Wind Farm

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**Abstract:** To enrich the dynamic performance while eliminating the sub-synchronous resonance (SSR) effect which usually occurs in a series-compensated doubly fed induction generator (DFIG)-based wind farm, a double-sliding mode controller-based on a hybrid reaching law is proposed in this paper. As the rotor-side-converter (RSC) has a significant impact to eliminate the SSR effect compared with the grid-side-converter (GSC), the proposed controller is only designed for the RSC. To show the robustness of the proposed controller, external disturbances are also taken into consideration within the RSC dynamical model as the proposed controller has the robustness property against external and parametric uncertainties. Afterward, to ensure overall system's stability, external disturbances are bounded and the Lyapunov theory is applied to prove the stability. Finally, simulation studies are performed in the MATLAB/SIMULINK platform to demonstrate the usefulness of the proposed controller and compared with an existing controller.

Paper ID – 203

## Simulation of a Massive MIMO FSO System Under Atmospheric Turbulence

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**Abstract:** This paper aims to analyze the performance of a massive MIMO FSO system under atmospheric turbulence. Massive MIMO is a key technology for fulfilling the requirement of high-speed data transfer. Massive MIMO system has already been deployed at a small scale using the conventional RF transmission system. However, the RF transmission system has some limitations like bandwidth depletion, fragmentation, licensing restrictions. FSO system can be a good alternative to this. Some MIMO FSO models have already been suggested by the researchers. A maximum of 8×8 array of antennas has been used in those models. In this paper, a massive MIMO FSO model is simulated under different weather conditions with a large array of antennas (16×16 system). The performance of this system is compared with the performance of 4×4 and 8×8 systems. This model can successfully transmit data with a very low source power. The data transmission rate is also significantly improved with a large array of antennas.

Paper ID – 208

## Artificial Intelligence Based Real-Time Attendance System Using Face Recognition

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**Abstract:** The attendance system is important for school, college, university, office, and factory. In the academic field, attendance is recorded and updated manually in the teacher's notebook or any other application. In general, these types of systems waste time for both students and teachers. Also, other Job sectors use fingerprint attendance for arrival and departure, but the time between arrival and departure the employee can go outside anytime that he wants. So, this problem we can overcome using the unique feature of every human being on his face. In this proposed system, facial recognition technology is used to automatically take attendance. Sometimes when many people can come together. This system can able to detect multiple faces at a time. In this system, Face detection is done using DLib and ResNet-34 is used for face recognition. Using two cameras arrival and departure times of an individual are calculated sequentially. 96.03% accuracy observed by the camera-1 to recognize the face and at day time when light is off camera-2 shows the best accuracy 96.62%.

Paper ID – 210

## Automatic Detection and Recognition of Object to Help Visually Impaired People While Visiting Liberation War Museum in Bangladesh

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**Abstract:** This paper represents an analysis of object detection by multi-image classification and machine learning techniques for blind people. Our system has been developed based on Speech Recognition that helps blind people to know the information about the different components in the liberation war museum in Bangladesh. From the initial survey it concerned that most of the blind people are excited to know what is inside in the liberation war museum, but there is no automated system in the museum to recognize the object as an explanation for them. For this thoughtfulness, we built a model for visual imperial people that will detect automatically and that provide an explanation about the object by speech recognition technique. For the whole process, we used Different Machine Learning (ML) tools like Scikit-learn, Pandas, Matplotlib, Numpy, TensorFlow. For preprocessing images TensorFlow, for machine learning we have used Scikit-learn. For measuring the accuracy of our work we used five different Machine Learning (ML) algorithms K-Nearest Neighbor (KNN), Support Vector Machine (SVM), Decision Tree Classifier, Random Forest, Naive Bayes and most popular image processing algorithm Convolutional Neural Network (CNN) to find out which algorithm gave the highest accuracy. Finally, we detect museum spectacles by this algorithm which produced the highest accuracy.

Paper ID – 211

## Effect of Electric Vehicle Fast Charging Station on Residential Distribution Network in Bangladesh

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**Abstract:** Recent advancements in the development of electric vehicles (EVs) will lead to their rapid integration in the transportation sector of Bangladesh. Charging of EVs can be accomplished by either domestic slow charging or

public fast-charging station. This study investigates the impact of fast charging stations (FCSs) on a middle-income, urban residential distribution network in Dhaka. Bus voltage profile and the total loss have been investigated using load flow analysis considering parameters such as specification and number of EVs, charging pattern of EVs, hourly load profile, and seasonal variation. Finally, the placement of the FCS has been varied to identify the effect of location on the voltage profile and power loss of the investigated network. Finally, the critical EV penetration level in the studied network has been investigated that can be deployed without making additional modifications to the existing grid. The effect of EV integration on distribution networks during summer is found to be more detrimental than in winter. The placement of the fast-charging station plays a crucial role in the voltage profile of the grid as well as in the power loss of the system. Nonetheless, a low level of EV penetration does not jeopardize the operation of the system.

**Paper ID – 213**

### **Design of Inertial Measurement Unit in Attitude and Heading Reference System for Real-Time Maneuver Monitoring by Using Kalman Filter**

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**Abstract:** The presence of white noise originates complexity in the sensor acquisition process for any aviation technology. A miniature error in sensor data acquisition can create a colossal impact, as the sensor pitch varies within 15 degrees. Fluctuations in sensor data acquisition can be calibrated through implementing conventional signal conditioning techniques, nevertheless, the existing white noise cannot be eliminated. This research has investigated the performance of the Kalman filter in eliminating such white noise in the sensor data acquisition process. Here, the Kalman filter is used in conjunction with the Inertial Measurement Unit (IMU). The hybrid filtering approach produces a smooth reading of the aircraft's roll, pitch, and yaw readings, thus simulating a very accurate altitude simulation. This investigation suggests Kalman filter can significantly reduce white noise in such a sensitive application in the aviation field.

**Paper ID – 215**

### **Multimodal Decision Fusion of EEG and fNIRS Signals**

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**Abstract:** Fusion of electroencephalography (EEG) as a physiological signal and functional near-infrared spectroscopy (fNIRS) as a metabolic signal has enormous potentials in different applications of biomedical engineering. A decision fusion model of a multimodal system combines the output decisions or predictions of each unimodal classifier. The proposed study exploits a long short-term memory network (LSTM) classifier which classifies EEG and two parts of a fNIRS signal: oxyhemoglobin (HbO<sub>2</sub>) and deoxyhemoglobin (HbR) separately in 3 different classes of the cognitive tasks (ternary classification). The output decisions of LSTM classifiers are combined in a support vector machine (SVM) classifier. A receiver operating characteristic (ROC) curve measures the performance of the proposed model based on the fused decisions of the SVM meta classifier. The ROC and different performance evaluation parameters show that the proposed EEG-fNIRS decision fusion model based on LSTM and SVM classifiers outperforms any single modality. The improvement in detection rate for 26 subjects in decision-fused modality is +31.83%, +5.2%, +15.19% compared to EEG, HbO<sub>2</sub> and HbR alone respectively.

Paper ID – 216

## A Novel Authentication Mechanism for Securing Underwater Wireless Sensors from Sybil Attack

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**Abstract:** Underwater Wireless Sensor Networks (UWSN) has vast application areas. Due to the unprotected nature, underwater security is a prime concern. UWSN becomes vulnerable to different attacks due to malicious nodes. Sybil attack is one of the major attacks in UWSN. Most of the proposed security methods are based on encryption and decryption which consumes resources of the sensor nodes. In this paper, a simple authentication mechanism is proposed for securing the UWSN from the Sybil attack. As the nodes have very less computation power and energy resources so this work is not followed any kind of encryption and decryption technique. An authentication process is designed in such a way that node engaged in communication authenticate neighboring nodes by node ID and the data stored in the cluster head. This work is also addressed sensor node compromise issue through Hierarchical Fuzzy System (HFS) based trust management model. The trust management model has been simulated in Xfuzzy-3.5. After the simulation conducted, the proposed trust management mechanism depicts significant performance on detecting compromised nodes.

Paper ID – 217

## Improving Automatic Sign Language Translation with Image Binarisation and Deep Learning

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**Abstract:** Sign Language Translation (SLT) has been widely investigated to provide a futuristic solution to tackle human speech and hearing disability. Recent deep learning-based SLT models have redefined computer vision-based detection and classification to automatically translate the hand-gestured based sign language (SL) into natural language (NL) with higher accuracy. Unlike the existing models that directly learn from the natural image-sets, in this paper, we propose a 2D Convolutional Neural Network (CNN) model with customised hyper-parameters to be trained with binary SL image-sets. We thus introduce a binarisation step to preprocess the images of size 28×28 to feed the model. Preliminary results of our model trained with binarised image-set demonstrate its potential with an impressive classification accuracy of 99.99% on the NVIDIA Tesla K80 GPU environment (Google Colab) for an automatic SLT system.

Paper ID – 218

## PID, LQR, and LQG Controllers to Maintain the Stability of an AVR System at Varied Model Parameters

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**Abstract:** This research demonstrates the time-domain performance characteristics of proportional-integral-derivative (PID), linear quadratic regulator (LQR), and linear quadratic gaussian (LQG) controllers when the gain parameters and time constants of an automatic voltage regulator (AVR) system change. We tuned the amplifier and sensor block gains and scrutinized the change in the stability. Also, we investigated the system response while the time constant of the amplifier, exciter, generator, and sensor blocks are set to their maximum permissible limit. We determined the eigenvalues of the system and observed that the location of close loop poles is very much susceptible to time constant variations. The LQG controller provides a comparatively faster and stable response than LQR and

PID. When the gain parameters and time constant of the static AVR system is varied, the PID performance decreases significantly, but LQR and LQG can track the change rapidly. This analysis indicates that the impact of plant parameters to the controller response will be crucial while implementing the dynamic power system with distributed generators and interconnected grids.

**Paper ID – 225**

### **Performance Analysis of LSTMs and Fbprophet Models for Short Term Load Forecasting**

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**Abstract:** With the advent of smart grids, accurate electric load forecasting has become more essential since it may assist power companies in improving load scheduling and reducing surplus energy output. STLF is gaining popularity owing to its utility in energy usage, demand-side management, energy storage, peak load forecasting and minimize electricity production costs. This study offers four artificial intelligence-based models to enhance 168-hours prediction accuracy. These models are LSTM, bidirectional LSTM (Bi-LSTM), Conv2D LSTM and Fbprophet. The models are trained with hourly energy consumption data of four years. After training and testing, it is depicted that bidirectional LSTM can predict more precisely than other models with an MAPE of 3.59. The MAPE of Conv2D LSTM, LSTM and Fbprophet are found 3.95, 4.91 and 7.75 accordingly. Since bidirectional LSTM utilizes the LSTM regular model twice, they usually have more accuracy than conventional LSTM. The use of bidirectional LSTM may thus make the demand response system more efficient.

**Paper ID – 226**

### **Automated Diabetic Retinopathy Detection Using Transfer Learning Models**

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**Abstract:** Diabetic retinopathy (DR) is one of the most leading symptoms of vision-loss globally. Early detection and screening can halt its progression. Until date, ophthalmologists have manually screened DR, however, DR detection can be difficult in low-resource areas when there are few ophthalmologists available. Deep learning has recently been one of the most popular strategies for improving performance in a variety of fields, particularly medical image analysis and classification. It can be used to more effectively detect DR and so maintain vision. Transfer learning models are becoming increasingly commonly employed as a deep learning method, and they are quite effective. Two public datasets which contain 1115 retinal fundus images are used in this research. Our research proposed a binary classification of DR, which is done with five Transfer learning models Xception, InceptionResNetV2, MobileNetV2, DenseNet121, and NASNetMobile which achieved the highest validation accuracy of 86.25%, 96.25%, 93.75%, 81.25%, and 80.00% respectively.

**Paper ID – 228**

### **A Framework for Eye-Based Human Machine Interface**

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**Abstract:** To improve lifestyle, Human Machine Interface (HMI) plays a significant role. The human eye is one of the most prominent features of the face that shows useful information besides facial expressions, e.g., eye blink, eye motion and pupil motions. These can be used to create an eye-based platform to control different components that

can be beneficial for motor disable people. Besides biological activities, eye blinking can also be used for interaction. Most of the existing human machine interface required motion of physical organ, which are not feasible to use by motor disable people. Using eye blink command to interact with machine can give a solution. In this work, we present an eye-based HMI framework using eye blinks and computer vision techniques that can interact between humans and machines. The framework allows defining rules to map blink patterns to perform different activities. We have designed a framework with simple hardware interfacing that can extract blink information and use this information to control computer applications and household appliances. Evaluation results show that the system is highly effective in detecting human eye blink in real-time and can be used to interact with applications and machines easily.

#### Paper ID – 229

### Design of CanSat for Environmental Monitoring and Object Detection

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**Abstract:** This work presents the prototype design of an advanced level Can Satellite (CanSat) with a view to developing an experimental CanSat with meteorological and image processing applications. Reduction of air pollution, the capability of immediate response in natural calamities, and the overall development of complex aerospace projects are the main inspiration behind the concept of designing the CanSat. The CanSat is light in weight. A First Person View (FPV) camera, flight sensors that provide information about temperature, pressure, humidity, air quality, and network interfaces for data transmission are used in this system. Detection of humans and objects from the transmitted images has been achieved by YOLO v3 and YOLO v4 model. An analysis and comparison of meteorological aspects of important locations by processing the signals of the sensors in the system has been presented. The complete mission gives an overall error of 5-10%.

#### Paper ID – 230

### A Prototype of Multi-Functional Rescue Robot Using Wireless Communication

Md. Nahidul Alam<sup>1</sup>, Md. Saiam<sup>2</sup>, Abdullah Al Mamun<sup>3</sup>, Md. Musfiqur Rahman<sup>4</sup> and Umma Hany<sup>5</sup>

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**Abstract:** A rescuer robot is a robot that is basically designed to assist rescue efforts by searching, removing rubble, mapping, and by providing medical treatment or evacuating casualties. This paper presents a prototype of multi-functional robot and the purpose of it is to go to dangerous areas like collapsed places, areas attacked by terrorists to collect various data & sent it via wireless communication system for the next step. The main phenomenon of this robot is to help the rescuer team by providing various information which is very difficult & risk to collect via a human. Such as, if there is any gas leakage issues or ammunition or any human is alive inside the rubble etc. It is very risky for any man to go inside the rubble that's why this rescue operation system is divided into three major parts. They are 1. Quadcopter 2. Rover 3. Nanobot. Each of these parts has a live-action go pro camera whose output can easily available in the monitoring room. The quadcopter provides the mapping from above, Rover is going to start collect data and also remove small rubble at a time as it is containing a mechanical claw and nanobot at a time find a hole inside rubble and start searching, this nanobot also contains a thermal camera to see if there are any alive people stuck inside the rubble. The whole system operates wirelessly and sends the data of each second to the rescue team through wireless communication.

Paper ID – 232

## Performance Analysis of Initialization Algorithms of Deep Neural Network Based Coordinated Beamforming System for mmWave

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**Abstract:** As mmWave has a wide range of applications, it has drawn a significant amount of attention in recent years. It has already been introduced in the next generation wireless communication system. In practice, it shows some shortcomings and most of these are eliminated by introducing beamforming which utilizes the spatial diversity enabled by Massive MIMO. Still, there are a few challenges in designing an efficient system for highly mobile users and making sure proper coverage and reliability. In this research, a machine learning based coordinated beamforming technique has been explored that supports highly mobile applications in mmWave systems with massive antenna arrays. The optimization of the deep learning model itself can increase the system performance as well as reduce the computational time complexity. The purpose of this work was to optimize the deep learning model and recommend proper initialization method to maximize the system performance. We found that for Xavier normal initialization algorithm the effective achievable rate is highest for least amount of data.

Paper ID – 237

## Performance Analysis Through Image and Video Transmission for Alamouti Space Time Block Coding over Rayleigh and Rician Fading Channel

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**Abstract:** Space time block coding utilizes spatial diversity to transmit multiple copies of the same data through multiple transmission antennas, which ensures reliability and robustness of the data transmission. Due to spatial diversity, the system can combat against various channel impairments like multipath fading, doppler shift etc. In this paper, the performance of a Alamouti space time block coded system is analysed under Rayleigh and Rician fading channels through image and video transmission. The performance is analysed for different SNR values and different amounts of doppler shift under Rayleigh fading channel as well as for different k factor values under Rician fading channel. This investigation demonstrates that with Alamouti space time block coding the transmitted image and video can be reconstructed at the receiver end with substantial efficacy.

Paper ID- 242

## Thermal Simulation of 3D High Power GaN HEMT with a Low Cost Technique to Reduce Junction Temperature Due to Self Heating

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**Abstract:** HEMTs are highly promising for high speed devices because of its high electron mobility in a 2D channel. However, high junction temperature because of the self-heating effect near the junction severely limits its commercial application. In literature lots of works have been done to remove the excess heat generated near the junction. Highly expensive materials, such as diamond, SiC and sapphire have been used so far to drain the heat out of the junction. In this paper, we propose a comparatively cheap material, AlN based ceramics to replace the costly materials with a slight trade off in performance. Our device was simulated in COMSOL Multiphysics in a full 3D and the results were generated by solving the fundamental laws of physics numerically by the finite element method.

Paper ID – 245

## Performance Investigation of Multi-Constellation Global Network Satellite System (GNSS) Using Precise Point Positioning Over Bangladesh

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**Abstract:** Though recent study shows various algorithms that help finding the best Multi-GNSS Experiment (MGEX) data, similar work in the context of Bangladesh has still not been explored. In this study, the aim is to find out the station that provides the best MGEX data for performance analysis of GNSS signals over Bangladesh. During the research, ionospheric-free (IF) dual-frequency data were used to evaluate the performance of multi-constellation GNSS. For obtaining higher accuracy in multi-GNSS Precise Point Positioning, the IF model and Saastamoinen model are used. These models mitigate the GNSS signals ionospheric delays and tropospheric delays. The performance analysis was conducted using the MGEX data from five different IGS station around the world. The number of tracked satellites were highest for the data of India as it is the closest station near Bangladesh. The value of Position Dilution of Precision (PDOP) and Geometrical Dilution of Precision (GDOP) values were found the lowest for the data of India among the other countries considered for different combination of constellation. For triple constellation satellite system, the highest number of tracked satellites was twenty-one and the lowest value of PDOP and GDOP were 1.233448 and 1.394483 respectively hence greater accuracy in point positioning has been achieved.

Paper ID – 246

## Smart Meter Data Compression and Load Profile Classification Using UMAP and Random Forest

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**Abstract:** In this paper, the Uniform Manifold Approximation and Projection (UMAP) technique is applied to compress smart meter data. The Random Forest (RF) classification algorithm is then used on the compressed data to classify the load profiles into two distinctive user groups, namely residential electricity consumers and small and medium-sized enterprises (SMEs), based on the learned patterns by the machine learning model. Comparisons with the results of Principal Component Analysis (PCA), Non-negative Matrix Factorization (NMF), and Linear Discriminant Analysis (LDA) are made. The results demonstrate that our proposed technique achieves better compression ratio and classification accuracy compared to the above-mentioned methods.

Paper ID – 249

## Design and Analysis of Symmetric and Asymmetric Type Cascaded H-Bridge Multi-Level Inverters

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**Abstract:** A comparative analysis between symmetric and asymmetric type cascaded H-bridge (CHB) multilevel inverters (MLI) are presented in this paper. After that, the best topology with respect to power consumption, performance and cost effectiveness is identified between them. Here, multiple voltage sources of the same value are used in symmetric MLIs, whereas voltage sources of different values are used in asymmetric MLIs. Then, a

comparative analysis is done between thirteen-level symmetric and asymmetric type MLIs, and it is found that a lesser number of switches and voltage sources are required in asymmetric type CHBMLIs than that of the symmetric ones. The outputs of these two topologies are compared from the view of preparing a better sinusoidal waveform from each topology. Besides, the proposed asymmetric 13-level inverter is matched with the available structures in literature, and found that the essential switches and dc sources for the suggested design are considerably lower and more cost efficient. Eventually, the proposed asymmetric CHBMLI can be utilized in renewable power generation systems to achieve a cost-efficient power conversion process.

Paper ID – 250

### Performance Analysis of Graphene/ $\text{Al}_x\text{Ga}_{1-x}\text{N}$ Schottky Contact at Elevated Temperature

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**Abstract:** The performances of graphene/ $\text{Al}_x\text{Ga}_{1-x}\text{N}$  contacts have been analyzed for the temperature range of 300 to 500 K. Analytical investigation shows that for all the compositions of Aluminium (Al) in  $\text{Al}_x\text{Ga}_{1-x}\text{N}$ , the diodes display good forward characteristics for each temperature. The required forwarding voltage is found to decrease with the increase of temperature. However, deviation of conventional characteristics is found for the graphene/GaN and graphene/ $\text{Al}_{0.1}\text{Ga}_{0.9}\text{N}$  Schottky diodes. Moreover, graphene/ $\text{Al}_{0.2}\text{Ga}_{0.8}\text{N}$  Schottky diode allows the highest forward current density of  $6.5 \times 10^5 \text{Am}^{-2}$ . The contact resistivity is obtained smaller when the Al contents are 10% to 40%. These consequences have been attributed to the low efficiency of Al incorporation in  $\text{Al}_x\text{Ga}_{1-x}\text{N}$  alloy which is caused by parasitic gas phase reactions during the growth of this alloyed semiconductor. The results obtained here indicate that graphene/ $\text{Al}_x\text{Ga}_{1-x}\text{N}$  structure could be a potential candidate to be used as a Schottky rectifier; however, it needs proper investigation.

Paper ID – 253

### Design of I-V Scanner to Analyze the Effects of Partial Shading due to Soiling and Bird-dropping on PV Panels

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**Abstract:** In-field photovoltaic (PV) panel's performance degrades with time due to soiling. Although this degradation is expected to be reversed after cleaning, many cleaning techniques are inefficient close to the panel edges creating non-uniform shading. Partial or non-uniform shading on the PV module non-linearly decreases output power, degrades panel lifetimes, and therefore can be detrimental to the PV farm economics. In this paper, we have designed a simple I-V scanner to analyze the changes in the I-V and P-V characteristics curves of the PV panel. We use the I-V scanner to study and analyze partial shading conditions which emulate bird droppings and non-uniformly distributed soiling accumulation on the surface of PV module or panel. Finally, we summarize the results in terms of the maximum power point (MPP) of the PV panels under different shading conditions. We explain how panel-edge soiling bands (after cleaning) or bird droppings can suppress panel-array output—these should therefore be carefully addressed in solar farms for optimal operation.

Paper ID – 256

## Design and Analysis of a DGS Based UWB Monopole Antenna for Brain Tumor Detection

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**Abstract:** A defected ground structure (DGS) based ultra-wide band (UWB) monopole antenna is proposed for detecting human brain tumor. Here, by transforming the conventional antenna ground plane into DGS, the impedance bandwidth of the antenna is significantly increased to 4.02 GHz. The operating frequency of the antenna ranges from 2.94 GHz to 6.96 GHz. Furthermore, the antenna occupies a 3-D gain of 3.93 dB and a high radiation efficiency of 93.81% in the given bandwidth. The proposed antenna is geometrically planar, having a dimension of  $50 \times 50 \times 1.5$  mm<sup>3</sup>. The antenna is designed on Rogers RO3003 dielectric substrate with a relative permittivity of 3 and a thickness of 1.5 mm since it is flexible for high frequency applications. In addition, a six-layer human head phantom model comprising of skin, fat, bone, dura, cerebrospinal fluid (CSF) and brain with a tumor of 5 mm radius is proposed to evaluate the performance of the antenna in specified application maintaining the safety limit of specific absorption rate (SAR). The detection of brain tumor is assured with a drastic rise of current density and SAR compared to the normal healthy tissue. Therefore, this antenna might be used in microwave imaging based human brain tumor detection.

Paper ID – 259

## Functional Modification of Advanced Encryption Standard Algorithm by Perturbing the Diffusion and Confusion Properties

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**Abstract:** Advanced Encryption Standard (AES) is the most acceptable and widely used symmetric algorithm. However, cyber-attacks and security breaches are becoming very common day by day. Cyber attacks hit businesses all over the world, not only financially but also reputationally. That is why more robust security measures are needed to protect privacy and prevent data breaches. In this paper, we analyzed the traditional AES algorithm and proposed some enhancements. We modified both the diffusion and confusion section by employing modified key scheduling and cipher rounds. While making the encryption stronger, we did not compromise with the complexity and user-friendliness. Through simulation studies, we showed that the modified algorithm's avalanche effect is increased by 6%, and our proposed algorithm takes 35.23% less time than the original.

Paper ID – 261

## Data-driven Embedding with Pixel Repetition for High Capacity Reversible Data Hiding

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**Abstract:** This paper introduces a new data-driven paradigm of Pixel-Repetition (PR) based embedding for high-capacity Reversible Data Hiding (RDH). A simplified up-sampling with PR is applied to an input image that repeats each input pixel to create an image-block of size  $2 \times 2$  in the up-sampled image. Each up-sampled pixel is then proposed to get embedded in their least significant bits (LSBs) leaving the least possible most significant bits (MSBs). This consideration significantly maximizes embedding capacity, but it also increases the distance between

the original and embedded up-sampled pixels. To minimize these high variations in the embedded pixels, we also propose to determine the closer version of an embedded pixel from its original and (2's) complement versions. A flag-bit is reserved at the LSB of each up-sampled pixel to track which version is used during embedding for extraction of the embedded data-bits. For the pixel values of 2-bits or lesser, however, direct LSB embedding is used without any flag bit. The proposed data-driven embedding ensures better utilization of the redundancy as observed with an impressive embedding rate-distortion performance having more than 8% improvements in both the embedding rate and embedded image quality over the prominent PR-based schemes. Index Terms—Embedding capacity, data-driven embedding, data hiding, pixel repetition, imperceptibility, reversibility.

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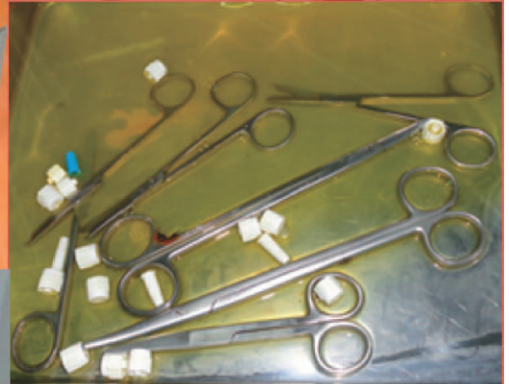
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## RURAL POWER COMPANY LIMITED

*Committed to enhance socio-economic development in rural areas of Bangladesh through reliable power generation*



Rural Power Company Ltd. (RPCL) was registered as a Public Limited Company from the Registrar of Joint Stock Companies & Firms on 31 December 1994 to alleviate severe power crisis of the Country. The Company was promoted by BREB and 5 (Five) Palli Biddyt Samities (PBSs) initially. The Company is presently generating 392 MW of Electricity from its 4 (Four) Power Plants namely- 1) Mymensingh 210 MW Combined Cycle Power Station 2) Gazipur 52 MW Dual-Fuel Power Plant 3) Raozan 25 MW Dual-Fuel Power Plant & 4) Gazipur 105 MW HFO Fired Power Plant. Present Shareholders of the Company are BREB & 17 PBSs.



Mymensingh 210 MW Power Station



Gazipur 52 MW Dual-Fuel Power Plant



Raozan 25 MW Dual-Fuel Power Plant



Gazipur 105 MW HFO Fired Power Plant

### 1. Mymensingh 210 MW Combined Cycle Power Station:

RPCL has been generating 210 MW of electricity from Mymensingh Power Station (MPS) at Shambhuganj, Mymensingh. MPS, in Phase-I, installed 70 MW Gas Turbine (GT) Generator, Commissioned in July 2000, in Phase-II, installed another 70 MW Gas Turbine (GT) Generator, Commissioned in April 2001 and in Phase-III, installed 70 MW Steam Turbine Generator (STG), Commissioned in July 2007. Presently Mymensingh Power Station is a Combined Cycle Power Plant with a capacity to generate & supply 210 MW of electricity to the National Grid.

### 2. Gazipur 52 MW Dual-Fuel Power Plant:

To expand the Company's operational capacity and business, RPCL constructed 52 MW Dual-Fuel Power Plant at Kadda, Gazipur. The plant has started its commercial operation in July, 2012.

### 3. Raozan 25.5 MW Dual-Fuel Power Plant:

To meet severe power crisis of the country, Government has taken short, mid and long term initiatives. As a part of these initiatives, RPCL has constructed 25.5 MW Dual-Fuel Power Plant at Raozan, Chattagram. The plant has started its commercial operation in May, 2013.

### 4. Gazipur 105 MW HFO Fired Power Plant:

By the Directives of Power Division, MoPEMR, the Company has established 105 MW HFO Fired Power Plant at Kadda, Gazipur. The plant has started its commercial operation in May, 2019.

**Joint Venture Companies of RPCL :** There are 03 (Three) joint venture companies of RPCL as follows:

#### i) B-R Powergen Ltd.:

B-R Powergen Ltd. is a joint venture Company of BPDB and RPCL and it has successfully set up 150 MW Dual Fuel Power Plant at Kadda, Gazipur and started commercial operation in August 2015.

#### ii) Bangladesh Power Equipment Manufacturing Company Ltd. (BPEMC):

RPCL has established a Smart Prepaid Meter Assembling & Electrical Equipment Manufacturing Company named- Bangladesh Power Equipment Manufacturing Company Ltd. (BPEMC) at Tongi, Gazipur joint venture with Shenzhen Star Instrument Co. Ltd., (Star Instrument), China. The Company already started its commercial operation in 2020.

#### iii) RPCL-NORINCO Intl. Power Ltd. (RNPL):

RPCL-NORINCO Intl. Power Ltd. is a joint venture Company of RPCL and Norinco International Cooperation Ltd., China. The Company is going to establish Patuakhali 1320 (660X2) MW Coal-fired Thermal Power Plant at Dhankhali, Kalapara, Patuakhali.

**On-Going Power Generation Projects:** In line with the Government's Power System Master Plan, RPCL has undertaken strategy to enhance its generation capacity up to 2730 MW by 2030. The Company has taken steps to install 1320 MW Coal based Power Plant at Kalapara, Patuakhali, 420 MW Dual Fuel (Gas/HSD) Combined Cycle Power Plant (CCPP) at Shambhuganj, Mymensingh and Madarganj 100 MW Solar Power Plant Project at Sheikh Hasina Solar Park, Jamalpur.

**Corporate Office: House # 19, Road # 1/B, Sector # 09, Uttara Model Town, Dhaka – 1230**

**PABX : 02-48957952, FAX: 02-48963229, Web: www.rpcl.gov.bd**



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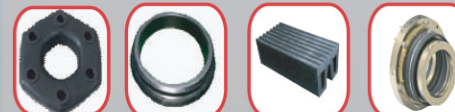
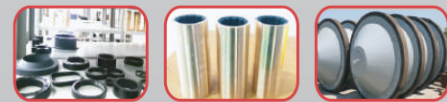
মান সম্মত রাবার যন্ত্রাংশ সরবরাহের মাধ্যমে কাস্টমারের সন্তুষ্টি অর্জনই আমাদের একমাত্র লক্ষ্য

- ★ স্যাম্পল অথবা ড্রইং প্রাপ্তি সাপেক্ষে যে কোন ধরনের রাবার লেপয়ার্স তৈরী করা হয়।
- ★ উন্নত কাঁচামাল ব্যবহার করে আন্তর্জাতিক মানের বিদেশী মেশিনে প্রতিটি রাবার লেপয়ার্স তৈরী করা হয়।
- ★ আধুনিক ল্যাবরেটরীতে প্রতিটি রাবার লেপয়ার্স নিরীক্ষার মাধ্যমে মান নিয়ন্ত্রণ করা হয়।
- ★ প্রতিটি রাবার আইটেম কোয়ালিটি কন্ট্রোল সেল দ্বারা Qualified হওয়া সাপেক্ষে সরবরাহ করা হয়।
- ★ আমাদের কার্যক্রম আন্তর্জাতিক ক্রাসিফিকেশন সোসাইটি **Bureau Veritas** দ্বারা সনদ প্রাপ্ত।



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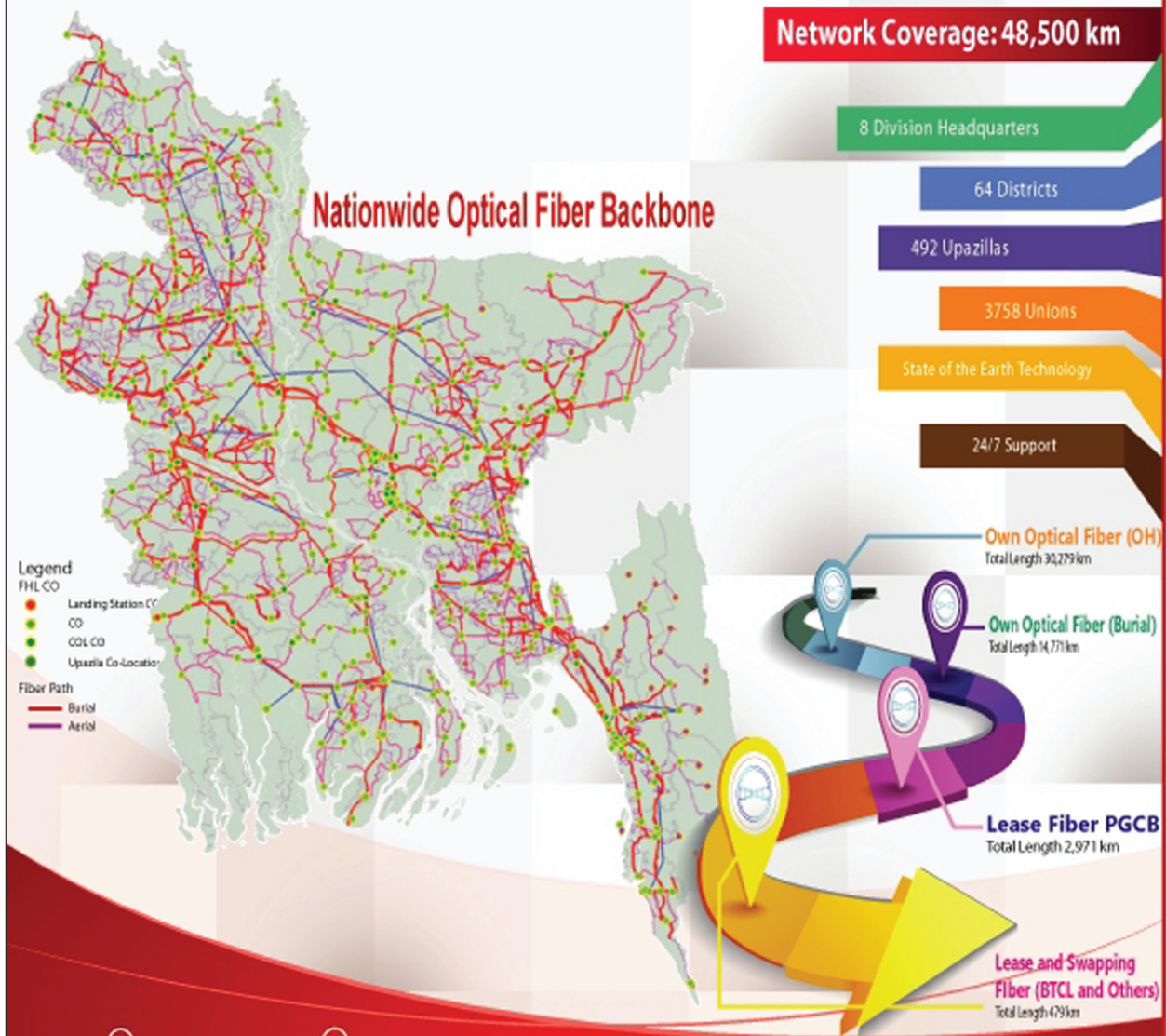
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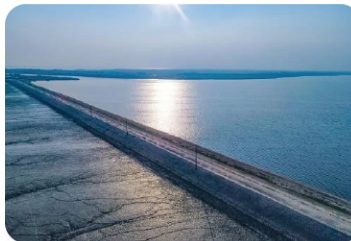
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