



2021 3rd International Conference on Sustainable Technologies for Industry 4.0

STI | 2021

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18-19 December 2021
Venue: Virtual Platform

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STI 2021

2021 3rd International Conference on Sustainable Technologies for Industry 4.0

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CONTENTS

Messages	02-08
Keynote Speakers	09-17
Invited Speaker	18
About the Faculty of Science and Engineering of GUB	19-21
STI 2021 Committee	22-24
STI 2021 TPC Members	25-27
STI 2021 Brief Program Schedule	28
STI 2021 Program Schedule for Keynotes and Invited Speeches	29-30
STI 2021 Program Schedule for Technical Sessions	31-35
Abstracts of Accepted Oral Papers	36-58
Abstracts of Accepted Poster Papers	59-62
Photo Gallery	63-66
Workshop on Healthcare Challenges based IoT Sensors & Video	67
STI Expo	68
Conference Partners and Sponsors	69-72
Notes	73-75



MESSAGE



Professor Dr. Muhammed Alamgir

Member

University Grants Commission of Bangladesh (UGC)

It gives me immense pleasure to know that an International Conference on Sustainable Technologies for Industry 4.0 (STI 2021), hosted by the Faculty of Science and Engineering of Green University of Bangladesh, will now be held for the third time during 18-19 December, 2021 at the university's permanent campus in Purbachal American City, Rupganj, Narayanganj. I hope this conference, an experience sharing avenue for the scholars, academicians, professionals and industry experts, will improve the knowledge and skills of the relevant stakeholders.

The industrial sectors of Bangladesh have grown significantly in recent years. In Bangladesh, the implementation of industrial development plans is generating opportunities both for the private and governmental sectors to produce entrepreneurs and expand their businesses. Such a tendency of development goes hand in hand with the government's urgent attempt to realize the vision of "Digital Bangladesh" as a means of speeding up the country's economic prosperity and growth. In the fourth-generation industrial revolution, using technology isn't everything; we need to innovate and produce sustainable technology, and it's a very important milestone for the country to reach. A conference like this may be a fantastic way for researchers to share their expertise and experiences. Our youth will get the opportunity to discover fresh information about cutting-edge technology from world-renowned professionals. The GUB family may gain notoriety and recognition if such an event is successfully organized.

A new window of immense potential has opened up in areas such as education, health, trade, business, social welfare, and so on, thanks to concerted efforts by both the public and private sectors for establishing high speed Internet connectivity across the country. The development of Bangladesh's technical industry is a welcome sign in this respect. The Internet of Things (IoT), Artificial Intelligence (AI), Machine Learning (ML), Big Data Processing, Cloud Computing, Smart Grid, Real-Time monitoring and control systems, and computer aided design and manufacturing technologies may all help Bangladesh for becoming a regional technology center.

I would like to express my appreciation to all concerned working or cooperating directly or indirectly for holding this conference successfully. My profound thanks to all teachers and employees of Green University of Bangladesh for being the pioneer of organizing such a fantastic conference on a topic very much related to need of the present time.

On behalf of the University Grants Commission of Bangladesh, I am pleased to declare that UGC will provide continuous support in organizing such an intellectual event.

Finally, I wish all the success of the STI 2021 international conference.

A handwritten signature in black ink, appearing to read 'Alamgir'.

Professor Dr. Muhammed Alamgir



MESSAGE



Prof. Dr. M. Alamgir Hossain

Vice President (Academic Affairs and Research) &
Professor of Artificial Intelligence
Cambodia University of Technology and Science
Phnom Penh, Cambodia

I am delighted that the International Conference on Sustainable Technologies for Industry 4.0 (STI 2021) will be held during 18-19 December 2021 at the Permanent Campus of Green University of Bangladesh, organized by the university's Faculty of Science and Engineering. I am well aware that the past two STI conferences have been hugely successful. Therefore, I would like to express my heartfelt greetings and best wishes to the organizers and stakeholders involved with this event on this auspicious occasion.

Under the visionary leadership of Honorable Prime Minister Sheikh Hasina, we have made the once dreamt Digital Bangladesh a reality. Digital Bangladesh does not simply mean widespread use and accessibility of ICT. Digital Bangladesh means more efficient, competitive, good governance, social equity, inclusivity, and prosperous Bangladesh. Our heartfelt belief is that the vision of Bangabandhu Sheikh Mujibur Rahman, the Father of the Nation, can be realized with the help of the proper, effective implementation of digital technologies across all spheres.

It is imperative to mention that even during the difficult economic scenario because of the pandemic, the government has taken highly effective measures to keep the education, health, agriculture, courts and supply systems running. I am delighted to know that the Green University of Bangladesh has also tackled this difficult period efficiently by keeping all the academic programs running smoothly and progressing in research and development activities simultaneously.

As a nation growing and adapting rapidly to the ever-changing needs of the time, Bangladesh aims to be well prepared for the Fourth Industrial Revolution. Therefore, I believe that the STI 2021 conference will act as a platform to disseminate the information of scientific achievements, sustainable and innovative technological and industrial developments in the relevant fields that can enable us to reap the benefits of Industry 4.0 to its full potential.

I congratulate and thank the Faculty of Science and Engineering, Green University of Bangladesh (GUB), for organizing such an auspicious event.

I wish the International Conference on Sustainable Technologies for Industry 4.0 (STI 2021) a grand success.



Prof. Dr. M. Alamgir Hossain



MESSAGE



Mohammed Abdullah Al-Mamun

Chairman, Board of Trustees
Green University of Bangladesh

It is my immense pleasure to share that the Faculty of Science and Engineering of Green University of Bangladesh (GUB) has arranged an international conference titled "International Conference on Sustainable Technologies for Industry 4.0 (STI 2021)" consecutively for the third time during 18-19 December 2021 at the permanent campus of GUB located in Purbachal American City, Rupganj, Dhaka. On behalf of the organizers, I would like to express my heartfelt greetings to you to participate in the blissful occasion. As a leading private university in Bangladesh, GUB always motivates young researchers and has built a good research oriented environment in different fields.

To the best of my knowledge, STI 2021 is focused on Pattern Recognition, Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP), Internet of Things (IoT), Computer Vision, Image Processing, Concurrence of 5G, Data Mining, Big Data Analytics, Renewable Energy, Biochemical Engineering, Sustainable Nanotechnology, Smart Technology and relevant fields. These fields are the driving forces of fourth industrial revolution. The aim of this conference is to share scientific, technological as well as engineering knowledge and ideas among the scientists, scholars, industry practitioners and researchers around the globe. I hope STI 2021 will be the visitant for researchers, industry professionals and practitioners to represent their scientific achievements and sustainable innovative industrial developments in the relevant fields. Moreover, it will be a great opportunity for our young researchers and academicians to learn about new ideas from the experts.

I pay my gratitude to the respected Vice Chancellor, General Chair and Organizing Chair of the conference, all the faculty members and staff of the Faculty of Science and Engineering for organizing such a wonderful conference for the third time. A successful arrangement of such an event may bring name and fame for the GUB family. I pledge to continue my supports for events like this.

I wish a grand success for the 3rd International Conference on Sustainable Technologies for Industry 4.0 (STI 2021).

A handwritten signature in black ink.

Mohammed Abdullah Al-Mamun



MESSAGE



Prof. Dr. Md. Golam Samdani Fakir

Vice-Chancellor
Green University of Bangladesh

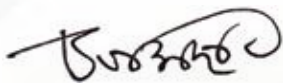
It's my great pleasure to share my gratitude to the Faculty of Science and Engineering for hosting International Conference on Sustainable Technologies for Industry 4.0 (STI-2021) for the 3rd time in a row at Green University of Bangladesh during 18-19 December 2021. The key objective of this conference is to create a focal point for the presentation and debate of related research findings both from the industry and the academia. It will include a variety of interesting and topical issues in Computer Science and Engineering, Electrical and Electronic Engineering, Textile Engineering, and other related sustainable technologies. I believe that the scientific and engineering research agenda aimed at sustainable technology development is timely.

We must increase the quality of our education to worldwide levels to address the challenges of globalization. Attendees will benefit academically, technically, and in a number of other ways from this conference. Researchers have access to a platform where they may interact with one another and build academic-industry connections.

I am confident that STI-2021 will be a colorful and successful event. Academically, technically, and in a variety of other ways, the attendees will gain from this conference. This type of meeting is also expected to foster cooperation among scholars at home and abroad, as well as to establish collaborations between academia and industry. I want to express my gratitude to the STI-2021 general chair, organizing chair and the entire team for their tireless work in planning, organizing and hosting this conference.

Success of this conference will not be made without the attendees and volunteers. I would like to give my heartiest thanks to all the authors, speakers, attendees and volunteers for making this success. I also want to extend my sincere gratitude to all the foreign participants at our beautiful campus.

Thank you all for staying with us!



Prof. Dr. Md. Golam Samdani Fakir



MESSAGE



Prof. Dr. Md. Abdur Razzaque

General Chair
STI 2021

It is an immense pleasure for me to welcome you to the 2021 3rd International Conference on Sustainable Technologies for Industry 4.0 (STI), taking place in the permanent campus of Green University of Bangladesh at Purbachal American City, Dhaka, Bangladesh, during 18-19 December 2021. This flagship event is organized by the Faculty of Science and Engineering, Green University of Bangladesh.

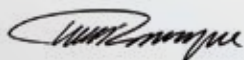
Considering current pandemic situation, the Organizing Committee decided to run STI 2021 in blended mode for the safety and well-being of all participants. To provide the maximum flexibility for the participants, the STI 2021 conference will include online technical presentations, as well as live plenary sessions. In this year, STI received a total number of 168 submitted papers, out of which 66 papers were accepted for presentation and publication in the IEEE Digital Library, yielding an acceptance rate of 39%. Every paper was gone through double-blind peer review process by experts and the average number of reviews for each submission was 2.6. The submitting authors originate from 35 countries including US, UK, Germany, China, Japan, Malaysia, Australia, etc., submitted by 416 authors in total. About 107 Technical Program Committee Members and 210 reviewers from 20+ countries contributed their scholarly efforts to ensure quality reviews. In 3 different tracks, this conference will cover Artificial Intelligence in Autonomous Vehicles, Machine Learning (ML), Internet of Things, Cloud and Edge Computing, Data Mining Techniques for Business Intelligence, Big Data Analytics and Blockchain Technologies, Smart Grid, Robotics, Nuclear Physics and Biochemical Engineering, Signal Processing, Telecommunications and RF engineering, Sustainable Nanotechnology and Materials Science, and Smart Textiles and Clothes which are the driving forces of fourth industrial revolution.

The STI 2021 conference aims to present theoretical and empirical studies that contribute to developing a better understanding of Sustainable Technologies for Industry 4.0. The Fourth Industrial Revolution or Industry 4.0 is both an opportunity and a challenge to enhance global manufacturing output to meet the rising human needs without hurting the environment. Industrial automation, connection and aggregation of different data in corporate information systems are phenomena that need to be studied in-depth, such studies would make them contribute to the new business strategy, bringing concrete benefits. However, it is not possible to talk about innovation and industry without reference to sustainable innovation and development.

Around nine distinguished Keynote Speakers and one invited speaker will inspire us in Focus Sessions, giving a glimpse of cutting edge, state of the art issues. Prof. Tarek Abdelzaher, IEEE Fellow from University of Illinois, Urbana Champaign; Amit K. Gupta, Head of Rolls-Royce Electrical, Singapore; Giancarlo Fortino, IEEE Fellow, University of Calabria, Italy; Prof Ai-Chun Pang, IEEE Fellow of National Taiwan University; Prof Ashraf Alam, IEEE Fellow of Purdue University, USA; Sajal K. Das, IEEE Fellow of Missouri University of Science and Technology, USA; Tapan Saha, IEEE Fellow of University of Queensland, Australia, Chanchal Roy, Professor, University of Saskatchewan, Canada; Zhi Chen, PhD, Wuhan Textile University, China & Moniruddoza Ashir, PhD, Technical University of Dresden, Germany are expected to share their valuable thoughts.

Finally, I would like to thank all authors, presenters, panelists, reviewers, technical and organizing committee members for their hard work, passion and commitment to shape an interesting and high-quality program.

Wish you a warm welcome and an enjoyable STI 2021!



Prof. Dr. Md. Abdur Razzaque



MESSAGE



Prof. Dr. Md. Fayzur Rahman

Treasurer
Green University of Bangladesh

INTERNATIONAL CONFERENCE ON SUSTAINABLE TECHNOLOGIES FOR INDUSTRY 4.0 (STI) addresses two vital aspects - “Sustainable Technology” & “Industry 4.0”. Sustainable technology is an umbrella term that describes innovation that considers natural resources and fosters economic and social development. The goal of these technologies is to drastically reduce environmental and ecological risks and to create a sustainable product. Industry 4.0 refers to the Fourth Industrial Revolution that encompasses smart industries, smart grids, artificial intelligence, robotics, the Internet of Things, autonomous vehicles, real-time healthcare, 3-D printing, nanotechnology, biotechnology, materials science, energy storage, quantum computing, etc.

The “Global Challenges” call for a new understanding of growth and responsibility. We are confronted with major problems resulting from the unbridled exploitation of our habitat. The continuous growth in the world’s population and the global economy as well as the increasing demand for energy will continue to place a huge demand on natural resources. The wise management of the Earth’s resources and environment, consistent with the principles of sustainable development, is indispensable for “Our Common Future”.

A transnational and trans-institutional effort is required to confront the global challenges. Internationally coordinated action is needed and is vital in protecting our living space “Earth”, preserving our natural resources for current and future generations, finding solutions for an aging society, preparing our cities for the next century!

STI 2021 strives to contribute to the solution of the “Global Challenges” within the context of science and engineering.

A successful event can be a source of massive inspiration. I wish a grand success of this conference - STI 2021. In addition, I wish everyone a most fruitful day with interesting and stimulating discussions and exchange of knowledge so that we can, together, envisage a sustainable future.



Prof. Dr. Md. Fayzur Rahman





MESSAGE



Prof. Dr. Md. Saiful Azad

Organizing Chair of STI 2021
Dean (Acting), Faculty of Science and Engineering
Green University of Bangladesh

It is a great honor to welcome you all to the 2021 3rd International Conference on Sustainable Technologies for Industry 4.0 (STI 2021), which is organized by the Faculty of Science and Engineering (FSE), Green University of Bangladesh (GUB) during 18-19 December, 2021. This event is financially co-sponsored by ICT-division, Ministry of Communications and Information Technology, Government of the People's Republic of Bangladesh alongside the hosting organization — GUB.

I would like to take this opportunity to welcome all the participants, authors, academics, experts, reviewers, industry personnel, and keynote speakers to this grand event on behalf of the organizing committee. This event is the first conference in Southeast Asia on Sustainable Technologies for Industry 4.0, which focuses heavily on smart manufacturing, interconnection between physical production and operations with smart digital technology, machine learning, and big data to create a more holistic and better-connected ecosystem for companies that focus on manufacturing and supply chain management. In addition, this is the only conference in Bangladesh, which is technically co-sponsored by the IEEE Computer Society, Washington, D.C., USA. Furthermore, with each subsequent edition, the involvement of international participants is increasing, e.g., 2019 — 20 countries, 2020 — 22 countries, and 2021 — 35 countries. Last but not the least, in every edition of STI renowned researchers have joined us as keynote speakers, including seven (7) IEEE fellows in the latest edition of STI.

I would like to thank all the faculty members and staff of FSE for their constant support and tireless endeavors. Here, it is noteworthy to mention that alongside STI, FSE is providing other platforms to its members to conduct and showcase their research contributions. For instance, it is regularly publishing the GUB Journal of Science and Engineering (GUBJSE) from 2014, which is currently indexed/abstracted in J-Gate, Google Scholar, BanglaJOL, Copernicus, and others.

In conjunction with the STI, we are organizing another flagship event for the first time, called 'STI EXPO – 2021' to create a common platform for researchers and industry practitioners to discuss, plan, and suggest the activities that would facilitate the implementation of Industry 4.0 in Bangladesh.

Finally, I would like to thank all the keynote speakers, authors, presenters, panelists, reviewers, session chairs, technical and organizing committee members for their hard works, passion, and commitment to ornate this high-quality program. We hope that this conference will bring benefits to the participants academically and technically as well as open the doorway of further collaborations with researchers and industrialists all over the world.

Wish you a warm welcome and enjoyable STI 2021!

Prof. Dr. Md. Saiful Azad





KEYNOTE SPEAKER

Tarek Abdelzaher

IEEE Fellow
University of Illinois
Urbana Champaign, USA

Challenges in Real-time Edge AI

Abstract

Advances in neural network revolutionized modern machine intelligence, but important challenges remain when applying these solutions in IoT contexts; specifically, in cost-sensitive applications and at the point of need on lower-end embedded devices. The talk discusses challenges in offering real-time machine intelligence services at the edge to support IoT applications in resource constrained environments. The intersection of IoT applications, real-time requirements, and AI capabilities motivates several important research directions. For example, how to support efficient execution of machine learning components on low-cost edge devices while retaining inference quality and offering confidence estimates in results? How to reduce the need for expensive manual labeling of IoT application data? How to improve the responsiveness of AI components to critical real-time stimuli in their physical environment? How to prioritize and schedule the execution of intelligent data processing workflows on edge-device GPUs? How to exploit data transformations that lead to sparser representations of external physical phenomena to attain more efficient learning and inference? The talk discusses challenges in edge AI applications from a real-time computing perspective.

Biography

Tarek Abdelzaher received his Ph.D. in Computer Science from the University of Michigan in 1999. He is currently a Sohaib and Sara Abbasi Professor and Willett Faculty Scholar at the Department of Computer Science, the University of Illinois at Urbana Champaign. He has authored/coauthored more than 300 refereed publications in real-time computing, distributed systems, sensor networks, and control. He serves as an Editor-in-Chief of the Journal of Real-Time Systems for over 10 years, and has served as Associate Editor of the IEEE Transactions on Mobile Computing, IEEE Transactions on Parallel and Distributed Systems, IEEE Embedded Systems Letters, the ACM Transaction on Sensor Networks, and the Ad Hoc Networks Journal, among others. Abdelzaher's research interests lie broadly in understanding and influencing performance and temporal properties of networked embedded, social and software systems in the face of increasing complexity, distribution, and degree of interaction with an external physical environment. Tarek Abdelzaher is a recipient of the IEEE Outstanding Technical Achievement and Leadership Award in Real-time Systems (2012), the Xerox Award for Faculty Research (2011), as well as several best paper awards. He is a fellow of IEEE and ACM.





KEYNOTE SPEAKER

Amit K. GUPTA

PhD CEng Fellow [IEEE IET IES]
Head of Rolls-Royce Electrical
Singapore

Electrification in the Aerospace Industry

Abstract

Electrification is being hailed as a pillar of the so-called Fourth Industrial Revolution. Along with digitalization, it's touted as the harbinger of new efficiencies in supply chains and the platform for new public policy. It will radicalize the design of everything from our power grids and roadways to vehicles and urban centers. Electrification offers the opportunity for sustainable growth, reduced carbon emissions, and a new, fundamental change in the way we power the world around us. The vision of Rolls-Royce Electrical is to be a world-class provider of electrical power and propulsion systems and thus to champion electrification.

Electrification of aircraft bears the promise of more efficient, silent, and sustainable flight—reducing fuel consumption and operating costs for aircraft operators. Power density, reliability, weight, volume, and fault tolerance are of paramount importance for aerospace-intended electrical machines and drives. We tackle these challenges with proven systems integration, systems engineering expertise, and professional and experienced flight test and flight operations capability of our team. We have built our long-standing expertise with propulsion systems in the MW class for marine and industrial applications, and have become a world leader in the development of MW power for hybrid-electric aircraft in the regional aircraft class. Electrification also opens new markets like sub-megawatt propulsion for commuter aircraft and urban air mobility that enable us to grow value beyond today's core markets and scope of supply. Ongoing developments in the field of More Electric Aircraft technology to eliminate hydraulic, pneumatic, and gearbox-driven aircraft subsystems will contribute to further reduction in fuel consumption and operational costs. Join this session to understand the direction that electrification will take in the aerospace industry.

Biography

Amit K. Gupta holds a bachelor's degree in electrical engineering from the Indian Institute of Technology (IIT)-Roorkee and a Ph.D. in Electrical Engineering from National University of Singapore (NUS). Since August 2012, he is leading Rolls-Royce Electrical at Rolls-Royce Singapore Pte Ltd. He is Director of the Electrical Programme at Rolls-Royce@NTU Corporate lab and Rolls-Royce Director for the Electrical Power System Integration Lab @ NTU (EPSIL@N). He has been granted 32 patents and published more than 135 papers in international conferences and journals. He has received many awards, including IEEE R10 Industry-Academia collaboration award (2016), Vestas Innovation excellence award (2009), IEEE McMurray Award for Industry Achievements in Power Electronics (2021) and Prize paper from the IEEE Industrial Applications Society's (IAS) - IPCC (2005), IET Premium Awards (2019). He is an Associate Editor for IEEE Transitions on Power Electronics and plays an active role in organizing electrical power engineering conferences in Asia. He is Fellow of IEEE – USA, IET - UK, IES - Singapore, and a Chartered Engineer - Engineering Council (UK).



KEYNOTE SPEAKER

Giancarlo Fortino

IEEE Fellow

University of Calabria, Italy

Pushing Intelligence to the Edge of Internet of Things: A new Paradigm enabling Next-Generation Smart Systems of Systems

Abstract

Internet of Things will not be only a new worldwide network interconnecting trillions of (smart) devices but, most importantly, a platform (system of systems) where to develop a new wave of (cyber-physical) services for humans and machines. In this context, in order to build IoT systems, the so-called IoT-Edge-Cloud continuum paradigm is having tremendous focus from the research community as well as from the industry. This paradigm can therefore be an enabler to push intelligence from the core of the network to its edge: from centralized data mining to embedded machine learning in tiny IoT devices to federated machine learning involving networks of edge devices. Moreover, methodologies are emerging to support analysis, design, implementation and evaluation of solutions involving mining and machine learning at the IoT edge. In this talk, we will focus on IoT from both the architectural and machine learning at the edge perspectives. Finally, some use cases will be discussed related to mobile edge computing, ambient assisting living environments, and intelligent transportation systems.

Biography

Giancarlo Fortino (IEEE Fellow 2022) is Full Professor of Computer Engineering at the Dept of Informatics, Modeling, Electronics, and Systems of the University of Calabria (Unical), Italy. He received a PhD in Computer Engineering from Unical in 2000. He is also distinguished professor at Wuhan University of Technology and Huazhong Agricultural University (China), high-end expert at HUST (China), senior research fellow at the Italian ICAR-CNR Institute, CAS PIFI visiting scientist at SIAT – Shenzhen, and Distinguished Lecturer for IEEE Sensors Council. He is the chair of the PhD School in ICT, the director of the Postgraduate Master course in INTER-IoT, and the director of the SPEME lab at Unical as well as co-chair of Joint labs on IoT established between Unical and WUT, SMU and HZAU Chinese universities, respectively. He is Web of Science Highly Cited Researcher 2020 and 2021. Currently he has 19 highly cited papers in WoS, and h-index=62 with 14500+ citations in Google Scholar. His research interests include wearable computing systems, e-Health, AI and Internet of Things, and agent-based computing. Fortino is currently the scientific responsible of the Digital Health group of the Italian CINI National Laboratory at Unical. He is author of 550+ papers in int'l journals, conferences and books. He is (founding) series editor of IEEE Press Book Series on Human-Machine Systems and EiC of Springer Internet of Things series and AE of premier int'l journals such as IEEE TAFCC-CS, IEEE THMS, IEEE IoTJ, IEEE SJ, IEEE JBHI, IEEE SMCM, IEEE OJEMB, IEEE OJCS, Information Fusion, JNCA, EAAI, etc. He organized as chair many int'l workshops and conferences (100+), was involved in a huge number of int'l conferences/workshops (500+) as IPC member, is/was guest-editor of many special issues (70+). He is cofounder and CEO of SenSysCal S.r.l., a Unical spinoff focused on innovative IoT systems. Fortino is currently member of the IEEE SMCS BoG and of the IEEE Press BoG, and chair of the IEEE SMCS Italian Chapter.



KEYNOTE SPEAKER

Ai-Chun Pang

IEEE Fellow

National Taiwan University, Taiwan

Edge Intelligence for B5G/6G and IoT

Abstract

Driven by the visions of the Internet of Things and 5G communications, recent years have seen a paradigm shift in mobile computing, from the centralized cloud computing toward the concept of computing at the edge. This concept pushes the mobile computing, network control and storage to the network edges, in order to enable computation-intensive and latency-critical applications at the resource-limited mobile devices. In the edge computing platform, mobility of end devices (e.g., vehicles and mobile phones), variety of user applications, and heterogeneous wireless network technologies incur critical challenges to network management and resource allocation. With the recent advance in artificial intelligence (AI), many AI tools, like machine learning, are not only the key enablers of emerging applications but also utilized to solve the problems mentioned above. The promised gains of computing at the edge and AI have motivated extensive efforts in both academia and industry on developing the technologies. This talk will focus on the orchestration between AI and computing at the edge. It considers AI as the application of the edge and a technique to solve the issues of network management and resource allocation of the edge. We will discuss current advancement in network management and resource allocation utilizing AI techniques. After that, we will discuss how the edge can provide AI service to realize emerging IoT applications. Finally, this talk will elaborate further on open research challenges.

Biography

Ai-Chun Pang received the B.S., M.S. and Ph.D. degrees in Computer Science and Information Engineering from National Chiao Tung University, Taiwan, in 1996, 1998 and 2002, respectively. She joined the Department of Computer Science and Information Engineering, National Taiwan University (NTU), Taiwan, in 2002, and is now a Professor and Associate Dean of the College of Electrical Engineering and Computer Science, NTU. She is also the co-founder of OmniEyes Inc. (a startup company focusing on edge-AI technology for mobile video platform). Her research interests include wireless and mobile networking, edge computing, and IoT. Dr. Pang is currently the editor of IEEE Transactions on Mobile Computing, IEEE Transaction on Vehicular Technology, IEEE Transactions on Network and Service Management, IEEE Transactions on Emerging Topics in Computing, and ACM Transactions on Cyber-Physical Systems. She co-authored the book “Wireless and Mobile All-IP Networks” published by John Wiley. She is an IEEE Vehicular Technology Society (VTS) Distinguished Lecturer in 2018-22, and received VTS Women’s Distinguished Career Award in 2020. She is a Fellow of the IEEE.





KEYNOTE SPEAKER

M. Ashraful Alam

IEEE Fellow
Purdue University, USA

Reliable Sensing with Unreliable Sensors: Reimagining the Possibilities and Redefining the Limits

Abstract

Electronic devices, be it a computer or a communication laser, or a clinical sensor, used to have it easy: Located in temperature/humidity-controlled rooms, monitored by expert technicians, plugged into unlimited power sources, they demonstrated impressive performance and high accuracy. No longer. Today, an implantable sensor for smart agriculture may be left buried in the dirt for a year or more with a limited energy budget, without calibration or any temperature control. A wearable sweat sensor, an insulin pump, or a brain implant needs to function regardless of the variation in body temperature, biofouling of cannula sites, or degradation of the membrane. In this talk, I will discuss our initial efforts to develop a collection of physical and statistical techniques to create the theoretical foundation of self-calibrating, ultra-high signal-to-noise ratio, electrochemical sensors that provides reliable sensing with unreliable sensors without access to the ground truth. Our approach involves rethinking sensors as a communication channel with time as an active variable and borrowing techniques from social media to ferret out fake news.

Biography

Professor Alam holds the Jai N. Gupta professorship at Purdue University, where his research focuses on the physics and technology of semiconductor devices. From 1995 to 2003, he was with Bell Laboratories, Murray Hill, NJ, as a Member of Technical Staff in the Silicon ULSI Research Department. Since joining Purdue in 2004, Dr. Alam has published over 300 papers and he is among the top-20 contributors on diverse topics involving transistors, reliability, biosensors, and solar cells. He is a fellow of IEEE, APS, and AAAS. His awards include the 2006 IEEE Kiyo Tomiyasu Medal for contributions to device technology, 2015 SRC Technical Excellence Award for fundamental contributions to reliability physics, and 2018 IEEE EDS Award for educating, inspiring and mentoring students and electron device professionals around the world. More than 450,000 students worldwide have learned some aspect of semiconductor devices from his web-enabled courses.





KEYNOTE SPEAKER

Sajal K. Das

IEEE Fellow

Missouri University of Science and Technology, USA

Securing Cyber-Physical and IoT Systems in Smart Living Environments

Abstract

Our daily lives are becoming increasingly dependent on a variety of smart cyber-physical infrastructures, such as smart cities and buildings, smart energy grid, smart transportation, smart healthcare, and so on. Alongside, smartphones and sensor enabled Internet of Things (IoT) devices are empowering humans with fine-grained information and opinion collection through crowdsensing about events of interest, resulting in actionable inferences and decisions. This synergy has led to what is called cyber-physical-social (CPS) convergence with human in the loop, the goal of which is to improve the “quality” of life. However, CPS and IoT systems are extremely vulnerable to failures and security threats. This talk will highlight unique research challenges in securing such systems, followed by novel defense mechanisms. Our proposed frameworks and solutions are based on a rich set of theoretical and practical design principles, such as secure data fusion, uncertainty reasoning, information theory, prospect theory, reputation scoring, and belief and trust models. Two case studies will be considered: (1) Security forensics and lightweight statistical anomaly detection in smart grid CPS to defend against organized and persistent adversaries that can launch data falsification attacks on smart meters using stealthy strategies. The novelty of our approach lies in a newly defined information-theoretic metric to quantify robustness and security, thus minimizing attacker’s impact on customers and utilities with low false alarm rates;(2) Secure and trustworthy decision making in mobile crowd sensing based smart transportation to detect false/spam contributions due to users’ selfish and malicious behaviors. Based on cumulative prospect theory and reputation/trust model, our approach prevents revenue loss owing to undue incentives and improves operational reliability and decision accuracy. The talk will be concluded with directions for future research.

Biography

Sajal K. Das is an IEEE Fellow, and a professor of Computer Science and Daniel St. Clair Endowed Chair at Missouri University of Science and Technology, USA where he was Computer Science Department Chair during 2013-2017. He served the National Science Foundation as a Program Director in the Computer Networks and Systems division during 2008-2011. His transdisciplinary research interests include wireless and sensor networks, mobile and pervasive computing, cyber-physical systems and IoT, UAVs, and others. He has published 350+ research articles in high quality journals, 475+ papers in refereed conference proceedings, and coauthored 4 books. His h-index is 94 with more than 36,100 citations according to Google Scholar. He received many awards and serving as the founding Editor-in-Chief of Elsevier’s Pervasive and Mobile Computing Journal, and as Associate Editor of several journals including the IEEE Transactions on Dependable and Secure Computing, IEEE Transactions on Mobile Computing, and ACM Transactions on Sensor Networks.



KEYNOTE SPEAKER

Tapan Saha

IEEE Fellow

University of Queensland, Australia

Challenges and opportunities of Solar PV integrations to national grid

Abstract

Many countries are extensively integrating solar PV generations into their distribution and transmission grids to meet their renewable energy targets and also to reduce carbon emissions. At the University of Queensland, our research team has been involved in a number of solar PV integration projects, which include both small scale rooftop PV installations in distribution networks and large scale solar farms in transmission networks. This keynote speech will present some key outcomes and solutions from our research projects in PV integrations and energy managements.

Biography

Tapan Saha was born and brought up in Bangladesh. He studied in BUET, IIT Delhi and the University of Queensland (UQ) where he received his PhD in 1994. He has been with the University of Queensland since 1996, where he has been a Professor of Electrical Engineering since 2005. He has previously worked with BUET for three and half years and with James Cook University in Australia for two and half years. Currently he is the Discipline Leader of Power, Energy & Control Engineering at UQ, Founding Director of Australasian Transformer Innovation Centre & Leader of UQ Solar and UQ industry 4.0 Energy TestLab. He is a Fellow of IEEE and a Fellow of the Institution of Engineers Australia. He is an IEEE Power & Energy Society Distinguished Lecturer. Prof. Saha has successfully supervised 50 PhD students as the principal supervisor. He has received extensive funding from Australian competitive agencies, state and federal governments and electricity industry. He has published more than 600 papers in IEEE, IET & Elsevier Journals and peer reviewed conferences.





KEYNOTE SPEAKER

Chanchol Roy

Professor

University of Saskatchewan, Canada

Clone Detection and Benchmarking in Big Code

Abstract

Copying a code fragment and then reusing it by pasting and adapting (e.g., adding/modifying/deleting statements) is a common practice in software development, resulted in a significant amount of duplicated code in software systems. On the other hand, duplicated code poses a number of threats to the maintenance of software systems such as clones are the #1 “bad smell” in Fowler’s refactoring list. Software clones are thus considered to be one of the major contributors to the high software maintenance cost, which could be up to 80% of the total software development cost. The era of Big Data has introduced new applications for clone detection. For example, clone detection has been used to find similar mobile applications, to intelligently tag code snippets, to identify code examples, and so on from large inter-project repositories. The dual role of clones in software development and maintenance, along with these many emerging new applications of clone detection, has led to a great many clone detection tools and analysis frameworks. In this talk, I will outline our experience in developing clone detection tools from large-scale inter-projects code repositories using even a desktop machine with standard hardware configurations. I will then also talk about how do we evaluate such large-scale clone detection tools using our BigCloneBench, a clone benchmark of more than eight million manually validated clone pairs in 25 thousand Java projects.

Biography

Chanchal K. Roy is Co-Director of Software Research Lab and Professor of Software Engineering/Computer Science at the University of Saskatchewan, Canada. He is the lead and Program Director of an NSERC CREATE graduate program on Software Analytics Research and a co-lead of the Data Management and Repository group of an NSERC Canada First Research Excellence Fund (CFREF) on Food security. He has published more than 180 refereed publications, with many of them in premier software engineering conferences and journals that have been cited more than 8,000 times. Dr. Roy works in the broad area of software engineering, with particular emphasis on software clone detection and management, software evolution and maintenance, recommender systems in software engineering, automated software debugging, and big data analytics in software engineering. He has received many awards, including Most Influential Paper (a.k.a. Test of Time awards) awards at SANER 2018, ICPC 2018 and SANER 2021, New Scientist Research Award of the College of Arts and Science of the University of Saskatchewan and the University wide New Researcher Award, Outstanding Young Computer Science Researcher Award (2018) by CS-Can/Info-Can, and others. Dr. Roy’s recent work on a new way of searching Stack Overflow was featured in Stack Overflow blogs which then subsequently was featured in most of the major tech news websites and blogs such as ACM Tech news, TechRepublic, Hacker News, SD Times, and reddit.



KEYNOTE SPEAKER

Zhi Chen, PhD

Wuhan Textile University, China

Silica composite microcapsules for functional finishing of textiles: encapsulation and release properties

Abstract

Silica composite microcapsules with different structures containing hollow, core-shell, yolk-shell, porous, tree-ring type or other special shapes, can be prepared by using hyperbranched silica precursors (PEOS) and their modifications (PEG-PEOS or C16H33-PEOS) as stabilizers of oil-in-water, water-in-oil or double emulsions. Functional liquids including fragrance, mosquito repellent or bacteria inhibition can also be synchronously encapsulated by silica shells formed by proceeding of hydrolysis and condensation. Without any additional surfactants, by adjusting the degree of modified groups, the monodispersed particles with different sizes can be easily obtained. To repair the deficiency for weak obstructions of thin shells, the assisting free-radical polymerization of adapted monomers inside significantly enhanced the encapsulation efficiency of liquids and achieved their controllable release, which satisfied requirement of basic high-temperature processing, such as polymer blending and textile finishing. The nanostructured organic-inorganic hybrid sol-gel coatings were successfully integrated onto the surface of polyester fibers by combination of twin polymerization and PEOS chemistry with superhydrophobic performance.

Biography

Zhi Chen received a bachelor's degree from chemistry department of Xiamen University, a master's degree from Fudan University, and his Ph.D. degree from RWTH-Aachen university, Germany, major in macromolecular chemistry and physics. He is currently a full-time teacher in College of Materials Science and Engineering, Wuhan Textile University. His current research interests include organosilicon materials, supramolecular self-assembly, functional microcapsules, colloids and interfaces, free-radical polymerization etc. During his postdoc period in DWI - Leibniz Institute for Interactive Materials, Aachen, Germany, he participated in BMWi/AiF projects (IGF 19959 BG, 19892 N and 19620 N) and EU project (EMR 60). His partial results were published on ACS Applied Materials & Interfaces, Macromolecules, Langmuir, Journal of Colloid and Interface Science, etc.





INVITED SPEAKER

Moniruddoza Ashir, PhD

Technical University of Dresden, Germany

Functionalisation of fibre-reinforced plastic composites

Abstract

Fiber-reinforced plastics (FRP) are increasingly being used in moving components due to their high specific stiffnesses and strengths in addition to the ability for specifically tailored properties. Current developments display a trend towards kinematic systems, which are employed in mechanical engineering, especially in textile machinery, as well as in logistics, automation technology and automotive engineering, where their low mass makes FRP a particularly suitable material. With the increasing application of kinematic systems, there is also a growing demand for simple, weight-saving and cost-effective solutions for special kinematics that can generate requirement-specific movements and forces based on energy- and material-efficient actuator principles, taking into account the lightweight design concept. In this presentation, alternative approaches in terms of innovative textile-based adaptive FRP with structurally integrated shape memory alloys are designed, implemented, tested and evaluated in comparison with conventional technical solutions. They include the development of novel approaches and technological solutions both for the reproducible setting of a suitable boundary layer between the shape memory alloy in wire form and the surrounding fiber composite material and for the fully automatic integration of the textile-processable actuator into the textile reinforcement structure.

Biography

Dr.-Ing. Moniruddoza Ashir is working as a postdoctoral fellow, research associate and tutor for DAAD fellows at the Institute of Textile Machinery and High Performance Material Technology, Technical University of Dresden, Germany. He graduated from the College of Textile Technology (now Bangladesh University of Textiles) securing the first class third position. Later, he worked as the Production Officer (full time) in a textile factory and lecturer (part time) at a private university in Bangladesh. Dr. Ashir obtained the prestigious DAAD scholarship in 2011. In December 2013, he completed his M. Sc. Degree in Textile and Ready-made Clothing Technology. He received his doctorate in Mechanical Engineering in October 2020. Dr. Ashir is the author of 27 peer-reviewed journal papers as the first author. He presented his research findings in different international conferences in Australia, Austria, Belgium, China, Greece, Germany, Italy, Portugal, Slovenia, Turkey and UK. Three of his patent applications have already been published. His field of research is the technical textiles especially functionalization of fiber reinforced plastics by means of shape memory alloys for the fabrication of adaptive structures.



FACULTY OF SCIENCE & ENGINEERING

Welcome to the Faculty of Science and Engineering, Green University of Bangladesh. It was founded in 2003 and now, it encompasses three departments, namely Computer Science and Engineering (CSE) — established in 2003; Electrical and Electronic Engineering (EEE) — established in 2003; and Textile Engineering (TEX) — established in 2008. At present, Prof. Dr. Md. Saiful Azad, an academic leader and a devoted researcher, is appointed as the dean the faculty.

Green University of Bangladesh (GUB) believes in offering quality education to all the students through their trained and experienced faculty members. For that, GUB arranges a four (4) months long training session, entitle “Certificate Course in Teaching and Learning (CTL)” for all the newly recruited faculty members, which is conducted by Prof. Dr. Md. Golam Samdani Fakir, honorable Vice-Chancellor of Green University of Bangladesh. Alongside teaching, GUB encourages their faculty members to conduct research in order to contribute to their respective research areas and enhance their knowledge thereby. For facilitating research, GUB offers research grants to their faculty members.

The Faculty of Science and Engineering (FSE) is also providing several platforms to conduct and showcase their research contributions. For instance, the FSE is regularly publishing a journal, named “GUB Journal of Science and Engineering (GUBJSE)” from 2014, which is currently indexed/abstracted in J-Gate, Google Scholar, BanglaJOL, Copernicus, and others. The FSE also organizes an international conference regularly, named “International Conference on Sustainable Technologies for Industry 4.0 (STI)”. The 1st edition of STI (STI 2019) was held during 24-25 December where 12 distinguished keynote speakers, 200+ authors, 100+ senior academicians, 30+ industry practitioners from 20+ countries around the World had gathered. The 2nd edition of STI (STI 2020) was held during 19-20 December where 12 distinguished keynote speakers, 290+ authors, 100+ senior academicians, 30+ industry practitioners from 20+ countries around the World had gathered. This year, the latest edition of STI (STI 2021) is happening in an extensive manner, which can be realized from this conference proceedings.

Department of Computer Science and Engineering

The degree program of Bachelor of Science in Computer Science and Engineering is accredited by Board of Accreditation for Engineering and Technology Education (BAETE) of Institution of Engineers Bangladesh (IEB). The Department of CSE has started Outcome Based Education (OBE) System since Spring 2019. The department is conducting courses, examinations, thesis/project, internship, industrial training, etc. following the guidelines of OBE system. The chairperson role of this department is currently looked after by Prof. Dr. Md. Saiful Azad.

Total number of students in both day and evening batches is 2153. Among them, the day batch consists of 1632 and the evening batch consists of 521 students, respectively.

There are 63 faculty members including one distinguished professor, two professors, three associate professor, six assistant professors, and fifty-one lecturers. In addition, one assistant professor, two senior lecturers and nine lecturers are now on leave to pursue their higher studies in USA, Europe, Canada, Australia, and so on.

One of the main aspects of Computer Science and Engineering course is that almost all of the theory courses are associated with corresponding lab courses. Right now, we have nine fully equipped laboratories for the students of Computer Science and Engineering such as Research Laboratory, Multimedia & Graphics Laboratory, Programming Laboratory, Networking Laboratory, Database and Knowledge Engineering Laboratory, Hardware Laboratory, Artificial Intelligence and Machine Learning Laboratory, Cloud Computing Laboratory, Cyber Security Laboratory.



According to the guideline of University Grants Commission (UGC) of Bangladesh & BAETE requirements, we have reviewed and prepared our 144 credits length B.Sc. in CSE curriculum recently taking comments of both academic and industry experts.

A two-day long competitive programming event, titled “US-Bangla Airlines – Green University Inter-University Programming Contest (IUPC)”, was organized by the Department of CSE in October 2018. The key objective of the contest was to attract new talents to programming and introduce them to programming contests. The prize-giving ceremony was graced by Prof. Dr. M. Yusuf Ali Mollah, Member of UGC; Prof. Dr. Md. Golam Samdani Fakir, VC of GUB; eminent scientist and writer Prof. Dr. Muhammed Zafar Iqbal and veteran academician Prof. M. Kaykobad.

In every year, CSE department organizes a gala ICT event titled “CSE Carnival”. This festival includes various events like Inter-Departmental Programming Contest (IDPC), Industrial talk, Workshops, Career counseling session for CSE graduates, Project showcasing and competition, Gaming contest, and Cultural program which helps our students to be more competitive.

The department has academic and industrial collaborations with reputed institutions at home and abroad.

Department of Electrical and Electronic Engineering

In 2018, the B.Sc. in Electrical and Electronic Engineering (EEE) degree program got the most prestigious accreditation from Board of Accreditation for Engineering and Technical Education (BAETE), Institute of Engineers Bangladesh (IEB). Department of EEE started Outcome Based Education (OBE) System since Spring 2019. This department is now lead by Dr. ASM Shihavuddin, a talented, experienced and devoted academician.

Total number of students in both day and evening batches is 1547. Among them, the day batch consists of 683 and the evening batch consists of 864 students, respectively.

At present, there are 60 faculty members including one distinguished professor, one professor, four associate professors, five assistant professors, and forty-nine lecturers. In addition, one assistant professor and nine lecturers are now on leave to pursue their higher studies in USA, Europe, Canada, Australia, and so on.

This department has already established 17 laboratories. Each and every semester, the department is upgrading and improving the laboratories by new equipment's and hence the experiments are performed properly. The EEE department has already established Electrical Circuit Laboratory, Analog Electronics Laboratory, Digital Electronics Laboratory, Industrial Electronics Laboratory, Microprocessor and Interfacing Laboratory, Electrical Machines Laboratory, Power System Protection and Switchgear Laboratory, Measurement and Instrumentation Laboratory, Control Systems Laboratory, Digital Signal Processing Laboratory, VLSI Laboratory, Data Communication and Computer Networks Laboratory, Telecommunication Engineering Laboratory, Microwave Engineering Laboratory, Computer Laboratory, Physics Laboratory, Chemistry Laboratory.

The department is now working on Outcome Based Education (OBE) which is very important in the challenging world of the 21st century. Therefore, the syllabus of EEE Department has been designed so that it can cover a broad range of disciplines related to the different fields of Electrical Engineering. The whole degree is of 144 credit hours.

EEE department organizes a ceremony titled “EEE Day” every year. During the EEE day program, the department organizes job fair, where a number of industries participate. They collect CV's from students. The students are sent to visit different industries every semester. To earn industrial experience they are placed in industries for two months regularly. As per the requirement of OBE, Integrated Design Project has been incorporated into curriculum.

Department of Textile Engineering

The Textile Engineering Department of Green University of Bangladesh started its journey from 2008. Since its inception, the Department has been playing a dominant role in offering quality education. At present, Department of Textile Engineering of the Green University is a leading Department for Textile Engineering education in Bangladesh.

Total number of students in both day and evening batches is 671. Among them, the day batch consists of 418 and the evening batch consists of 253 students, respectively.

At present, there are 20 faculty members including two professors, two associate professors, and sixteen lecturers. In addition, one Assistant professor and four lecturers are now on leave to pursue their higher studies. The textile engineering department is currently lead by Prof. Dr. Nitai Chandra Sutradhar, a legendary academician in the field of textile education in Bangladesh.

The Bachelor of Science in Textile Engineering program is designed to give students the fundamentals of the latest Textile Engineering to develop a broader view leading to a more intelligent approach to industrial and organizational problems. In addition to theoretical lectures, this program offers extensive laboratory practice, field trips, research projects, and an industrial internship facility in modern textile mills.

The major focus of the B.Sc. in Textile Engineering curriculum is on four major areas – Yarn Manufacturing, Fabric Manufacturing, Wet Processing, and Apparel Manufacturing. Undergraduate students specialize in one of these groups without compromising fundamental knowledge in Textile.

The existing syllabi of the regular four-year B.Sc. in Textile Engineering program and the B.Sc. in Textile Engineering program for diploma holders have been reviewed and updated in 2018 based on guidelines of the UGC. The whole degree is of 161 credit hours.

The Department has eight well-equipped laboratories and highly qualified and experienced faculty members having degrees from home and abroad. The Department has been offering regular B.Sc. in Textile Engineering courses of four year duration and B.Sc. in Textile Engineering courses for Diploma holders.

Textile Engineering Department is in the process of introducing Outcome Based Education (OBE) system. In 2018, an IEB evaluation team visited the department giving a positive response.

The Department has academic collaboration with leading Textile Departments at home and abroad to facilitate student exchange, scholarship, joint research, and credit transfer.

Permanent campus

The permanent campus of Green University of Bangladesh is now under construction at Purbachal American City. It will be one of the largest private university campuses in Bangladesh with improved facilities for the students. The Green University Permanent Campus at Purbachal American City includes Separate Academic Buildings for conducting classes and laboratories, Administrative Building, Hostel for local and international students, Country's one of the largest IT Center, Multipurpose Hall, Modern Conference Hall, IT-based Library, Different laboratories, Indoor and outdoor games facilities, Playgrounds, Medical Center, Cafeteria, Gymnasium and Transport facilities for the students, etc.

At present, total number of students in both day and evening batches in Faculty of Science and Engineering of permanent campus is 1013. Among them the Department of Computer Science & Engineering consists of 495, Department of Electrical & Electronic Engineering consists of 355 and Department of Textile Engineering consists of 163 students respectively.

At present, there are six laboratories in permanent campus including Programming Laboratory, Networking Laboratory, Multimedia & Graphics Laboratory, Electrical Circuit Laboratory, Physics, and Chemistry laboratory.



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BRIEF PROGRAM SCHEDULE | STI 2021

Time	Event
DAY 1 – Saturday, 18 December 2021	
08:30 AM - 09:30 AM	Conference Highlights and Greeting Exchanges
09:30 AM - 10:15 AM	Inaugural Session
10:15 AM - 11:00 AM	Keynote 01: Sajal K. Das, IEEE Fellow, Missouri University of Science and Technology, USA
11:00 AM - 11:15 AM	Health Break
11:15 AM - 12:00PM	Keynote 02: Chanchal Roy, Professor, University of Saskatchewan
12:00 PM - 01:00 PM	Parallel Technical Sessions (T1)
01:00 PM - 02:00 PM	Prayer and Lunch Break
02:00 PM - 02:45 PM	Keynote 03: Amit K. GUPTA, PhD, IEEE Fellow, Head of Rolls-Royce Electrical, Singapore
02:45 PM - 03:30 PM	Keynote 04: Tapan Saha, IEEE Fellow, University of Queensland, Australia
03:30 PM - 04:30 PM	Industrial Panel Discussion: STI EXPO 2021
03:30 PM - 04:45 PM	Parallel Technical Sessions (T2)
04:45 PM - 05:15 PM	Keynote 05: Zhi Chen, PhD, Wuhan Textile University, China
05:15 PM - 05:45 PM	Prayer & Health Break
05:45 PM - 06:15 PM	Invited Talk 01: Moniruddoza Ashir, PhD, Technical University of Dresden, Germany
06:15 PM - 07:00 PM	Advisory and Organizing Committee Meeting

DAY 2 – Sunday, 19 December 2021	
08:30 AM - 09:00 AM	Conference Highlights and Greeting Exchanges
09:00 AM - 09:45 AM	Keynote 06: Tarek Abdelzaher, IEEE Fellow, University of Illinois
09:45 AM - 10:30 AM	Keynote 07: M. Ashraful Alam, IEEE Fellow, Purdue University, USA
10:30 AM - 10:45 AM	Health Break
10:45 AM - 12:00 AM	Parallel Technical Sessions (T3)
12:00 AM - 01:15 PM	Parallel Technical Sessions (T4)
01:15 PM - 02:00 PM	Prayer & Lunch Break
02:00 PM - 05:00 PM	Workshop on Healthcare Challenges based IoT Sensors & Video
02:00 PM - 03:30 PM	Interactive Poster Session
03:30 PM - 04:15 PM	Keynote 08: Giancarlo Fortino, IEEE Fellow, University of Calabria, Italy
04:15 PM - 04:30 PM	Health Break
04:30 PM – 05:15 PM	Keynote 09: Ai-Chun Pang, IEEE Fellow, National Taiwan University
05:15 PM - 06:30 PM	Prayer Break and Socialization
06:30 PM - 07:30 PM	Award Giving Ceremony



PROGRAM SCHEDULE FOR KEYNOTE SESSIONS | STI 2021

Day - 1

<p>D1K1</p> <p>Saturday, 18 Dec 2021 10:15 AM – 11:00 AM Room# Seminar Hall (302) Online</p>	<p>Keynote 01: Securing Cyber-Physical and IoT Systems in Smart Living Environments</p> <p>Sajal K. Das, IEEE Fellow Missouri University of Science and Technology, USA</p> <p>Session Chair: Prof. Dr. Hafiz Md. Hasan Babu</p>
<p>D1K2</p> <p>Saturday, 18 Dec 2021 11:15 AM – 12:00 AM Room# Seminar Hall (302) Online</p>	<p>Keynote 02: Clone detection and Benchmarking in Big Code</p> <p>Chanchal Roy, Professor University of Saskatchewan, Canada</p> <p>Session Chair: Prof. Dr. A. B. M. Alim Al Islam</p>
<p>D1K3</p> <p>Saturday, 18 Dec 2021 02:00 PM – 02:45 PM Room# Seminar Hall (302) Online</p>	<p>Keynote 03: Electrification in the Aerospace Industry</p> <p>Amit K. GUPTA, PhD CEng Fellow [IEEE IET IES] Head of Rolls-Royce Electrical, Singapore</p> <p>Session Chair: Prof. Dr. Muhammed Fayyaz Khan</p>
<p>D1K4</p> <p>Saturday, 18 Dec 2021 02:45 PM – 03:30 PM Room# Seminar Hall (302) Online</p>	<p>Keynote 04: Challenges and opportunities of Solar PV integrations to national grid</p> <p>Tapan Saha, IEEE Fellow University of Queensland, Australia</p> <p>Session Chair: Prof. Dr. Md. Fayzur Rahman</p>
<p>STI EXPO 2021</p> <p>Saturday, 18 Dec 2021 03:30 PM – 04:30 PM Room# Online</p>	<p>STI EXPO 2021: Required Technological Transition to Achieve Sustainable Development for Emerging Economy</p> <p>Industrial Panel Discussion Mr. Md. Noor A Alam, Elite Hitech Industries Mr. Tasfin Alam, Daraz Bangladesh Limited Mr. Sk Sunjur Ahmed, BRAC Bank Limited Mr. Md. Shamsul Haque, BRACNet Limited</p> <p>Session Chair: Prof. Dr. Md. Golam Samdani Fakir</p>
<p>D1K5</p> <p>Saturday, 18 Dec 2021 04:45 PM – 05:15 PM Room# Seminar Hall (302) Online</p>	<p>Keynote 05: Silica composite microcapsules for functional finishing of textiles: encapsulation and release properties</p> <p>Zhi Chen, PhD Wuhan Textile University, China</p> <p>Session Chair: Prof. Dr. Nitai Chandra Sutradhar</p>



D111 Saturday, 18 Dec 2021 05:45 PM – 06:15 PM Room# Seminar Hall (302) Online	Invited Talk 01: Functionalisation of fibre-reinforced plastic composites.
	Moniruddoza Ashir, PhD Technical University of Dresden, Germany Session Chair: Prof. Dr. Shah Alimuzzaman

PROGRAM SCHEDULE FOR KEYNOTE SESSIONS | STI 2021

Day - 2

D2K6 Sunday, 19 Dec 2021 09:00 AM – 09:45 AM Room# Seminar Hall (302) Online	Keynote 06: Challenges in Real-time Edge AI
	Tarek Abdelzaher, IEEE Fellow University of Illinois, Urbana Champaign Session Chair: Prof. Dr. Mohammad Kaykobad

D2K7 Sunday, 19 Dec 2021 02:00 PM – 02:45 PM Room# Seminar Hall (302) Online	Keynote 07: Reliable Sensing with Unreliable Sensors: Reimaging the Possibilities and Redefining the Limits
	M. Ashraful Alam, IEEE Fellow Purdue University, USA Session Chair: Prof. Dr. Quamrul Ahsan

Workshop Sunday, 19 Dec 2021 02:00 PM – 05:00 PM Room# Online	Workshop on Healthcare Challenges based IoT Sensors & Video
	Md. Atiqur Rahman Ahad, Senior Member, IEEE Osaka University, Japan Session Chair: Prof. Dr. Mohammad Shamsul Arefin

D2K8 Sunday, 19 Dec 2021 03:30 PM – 04:15 PM Room# Seminar Hall (302) Online	Keynote 08: Pushing Intelligence to the Edge of Internet of Things: A new Paradigm enabling Next-Generation Smart Systems of Systems
	Prof. Giancarlo Fortino, IEEE Fellow University of Calabria, Italy Session Chair: Prof. Dr. Md. Monirul Islam

D2K9 Sunday, 19 Dec 2021 04:30 PM – 05:15 PM Room# Seminar Hall (302) Online	Keynote 09: Edge Intelligence for B5G/6G and IoT
	Ai-Chun Pang, IEEE Fellow National Taiwan University Session Chair: Prof. Dr. Abu Raihan Mostofa Kamal

STI 2021 PROGRAM SCHEDULE FOR TECHNICAL SESSIONS | STI 2021

Day - 1 : Technical Session - 1

D1T1P1 Saturday, 18 Dec 2021 12:00 PM – 01:00 PM Room# Online		Parallel Session 1: Computer Vision and Pattern Recognition Session Chairs: <ul style="list-style-type: none"> • Prof. Dr. Mohammad Shorif Uddin • Prof. Dr. Mohammad Abu Yousuf
Sl. No.	Paper ID	Paper Title
1.	5	Real Time Action Recognition from Video Footage
2.	86	Smart Mirror for Personalized Content Delivery through Facial Emotion Recognition
3.	123	An AI-based Security System using Computer Vision and NLP Conversion System
4.	134	Real-Time Anomaly Detection and Classification from Surveillance Cameras using Deep Neural Network
D1T1P2 Saturday, 18 Dec 2021 12:00 PM – 01:00 PM Room# Online		Parallel Session 2: Computational Linguistic and Natural Language Processing Session Chairs: <ul style="list-style-type: none"> • Prof. Dr. Md. Moshikul Hoque • Dr. Ahmedul Kabir
Sl. No.	Paper ID	Paper Title
5.	8	Natural Language Query to SQL conversion using Machine Learning Approach
6.	95	Aspect Based Sentiment Analysis for Bangla Newspaper Headlines
7.	112	Bangla Music Genre Classification Using Fast and Scalable Integrated Ensemble Boosting Framework
8.	120	Comparative Analysis of Different Text Summarization Techniques Using Enhanced Tokenization
D1T1P3 Saturday, 18 Dec 2021 12:00 PM – 01:00 PM Room# Online		Parallel Session 3: Advances in device and sensor technology Session Chairs: <ul style="list-style-type: none"> • Prof. Dr. Samia Subrina • Dr. Sajid Muhaimin Choudhury
Sl.	Paper ID	Paper Title
9.	24	Design and analysis of a unique Photonic Crystal Fiber in terahertz regime for chemical sensing application
10.	27	Design and Performance Testing of an E-bicycle
11.	99	Effect of Dopants on ZnO Surface for Electronic Properties and Gas Sensor Application
12.	110	Design and Analysis of Circular Lattice PCF Biosensor -Based on Surface Plasmon Resonance





Day - 1 : Technical Session - 2

D1T2P1 Saturday, 18 Dec 2021 03:30 PM – 04:45 PM Room# Online		Parallel Session 1: Artificial Intelligence and Machine Learning Session Chairs: <ul style="list-style-type: none"> • Prof. Dr. Syed Akter Hossain • Dr. Sejuti Rahman
Sl.	Paper ID	Paper Title
13.	20	A Robust and Efficient Numeric Approach for Relation Database Watermarking
14.	32	Semi-supervised Subspace Learning via Constrained Matrix Factorization
15.	52	Classification Using Random Forest on Imbalanced Credit Card Transaction Data
16.	57	An Ensemble Approach of Supervised Learning Algorithms and Artificial Neural Network for Early Prediction of Diabetes
17.	153	Accurate Identification of Potholes on The Road using Federated Learning

D1T2P2 Saturday, 18 Dec 2021 03:30 PM – 04:45 PM Room# Online		Parallel Session 2: Deep Learning, Image Processing, Medical Imaging Session Chairs: <ul style="list-style-type: none"> • Prof. Dr. Hasanul Kabir • Prof. Dr. Forhad Rabbi
Sl.	Paper ID	Paper Title
18.	77	CNN-based Deep Learning Approach for Micro-crack Detection of Solar Panels
19.	94	Multi-Classification of Brain Tumors via Feature Level Ensemble of Convolutional Neural Networks
20.	100	Investigating the Robustness of Deep Neural Network Based COVID-19 Detection Models Against Universal Adversarial Attacks
21.	139	Cascaded 3-Stage Nuclei Segmentation using U-net, Faster-RCNN and SegNet for Higher Precision
22.	158	Automated Detection of Lung Cancer Using MRI Images

D1T2P3 Saturday, 18 Dec 2021 03:30 PM – 04:45 PM Room# Online		Parallel Session 3: Systems & Security Session Chairs: <ul style="list-style-type: none"> • Prof. Dr. M. Shamim Kaiser • Dr. Muhammad Golam Kibria
Sl. No.	Paper ID	Paper Title
23.	61	DocBook: Online Interactive Health-Care System
24.	72	A Hybrid Approach to Detect Injection Attacks on Server-side Applications using Data Mining Techniques
25.	121	STRIDE-based Cyber Security Threat Modeling for IoT-enabled Precision Agriculture Systems
26.	142	A Behavioral Trust Model for Internet of Healthcare Things using an Improved FP-Growth Algorithm and Naive Bayes Classifier
27.	160	IoT Based Multidimensional Mushroom Waste Management System in Urban Area



Day - 2 : Technical Session - 3

D2T3P1 Sunday, 19 Dec 2021 10:45 AM – 12:00 PM Room# Online		Parallel Session 1: Wireless and Mobile Networking Session Chairs: <ul style="list-style-type: none"> • Prof. Dr. Md. Obaidur Rahman • Dr. Md. Golam Rabiul Alam
Sl.	Paper ID	Paper Title
28.	76	Enhancing Quality of Experience of 5G Users Exploiting Deep Q-Learning
29.	155	Prediction of Energy Harvesting in Solar Powered Small Cells Networks
30.	159	A Triple T-topped Planar Antenna for 5G/WiMAX Applications
31.	164	Starfish Routing Backbone on the Optimal Elliptical Ring-canal in Sensor Networks

D2T3P2 Sunday, 19 Dec 2021 10:45 AM – 12:00 PM Room# Online		Parallel Session 2: Signal processing applications for Industry 4.0 Session Chairs: <ul style="list-style-type: none"> • Prof. Dr. Rezwon Khan • Prof. Dr. Md. Farhad Hossain
Sl.	Paper ID	Paper Title
32.	44	Design and Comparative Performance Analysis of a Circular Microstrip Patch Antenna with Different Modifications
33.	56	Effects of Tumor Radius, Metabolic Heat Rate and Heat Transfer Coefficient on the Temperature Distribution of Tumor Affected Breast
34.	81	Tumor Detection by Rectangular Microstrip Patch Antenna

D2T3P3 Sunday, 19 Dec 2021 10:45 AM – 12:00 PM Room# Online		Parallel Session 3: Efficient design in Control and Power Systems Session Chairs: <ul style="list-style-type: none"> • Prof. Dr. A H M Abdur Rahim • Dr. Tawhidul Alam
Sl.	Paper ID	Paper Title
35.	35	Modelling and Viability Study of a Biomass Power Plant Fired with pteris vittata in Bangladesh
36.	36	Impact of wind power plant in Bangladesh power system stability
37.	39	A Robust Double Integral Sliding Mode Controller Design Based on an Adaptive Power Reaching Law for Mitigating SSR Problems
38.	41	Design of a Robust Integral Sliding Mode Controller Based on an Enhanced Reaching Law for DC Microgrids

D2T3P4 Sunday, 19 Dec 2021 10:45 AM – 12:00 PM Room# Online		Parallel Session 4: Power Electronics for smart applications Session Chairs: <ul style="list-style-type: none"> • Prof. Dr. Md. Ashraful Hoque • Dr. Ashik Ahmed
Sl.	Paper ID	Paper Title
39.	31	Gate Driving Complexity Reduction of a H- Bridge Connected Silicon Controlled Rectifier
40.	84	An Efficient Protection Scheme for VSC-HVDC System with Modified Bridge Limiter Controller
41.	148	Performance Projection of GaN HEMT: Bias and Temperature Dependent Study of 3rd-Order Intermodulation Distortion
42.	149	Design and Modelling of Grid Connected Multilevel Inverter for Microgrid Applications



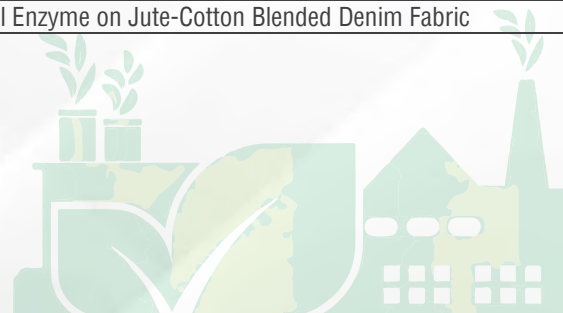
Day - 2 : Technical Session - 4

D2T4P1 Sunday, 19 Dec 2021 12:00 PM – 01:15 PM Room# Online		Parallel Session 1: HCI, Algorithms, and Blockchain Session Chairs: <ul style="list-style-type: none"> • Prof. Dr. Lafifa Jamal • Prof. Dr. Md. Motaharul Islam
Sl.	Paper ID	Paper Title
43.	53	Head Gesture and Voice based Learning App for Children with Autism of Nepal
44.	62	Forecasting the COVID-19 pandemic in Bangladesh using ARIMA model
45.	113	An Intelligent Application for Preventing the Counterfeit Medicines through a Distributed Blockchain
46.	132	An Online Reversed Bangla Sign Language Learning System

D2T4P2 Sunday, 19 Dec 2021 12:00 PM – 01:15 PM Room# Online		Parallel Session 2: IoT and Cloud Computing Session Chairs: <ul style="list-style-type: none"> • Prof. Dr. Md. Al Mamun • Prof. Dr. Md. Shariful Islam
Sl.	Paper ID	Paper Title
47.	17	IoT Based Biometric Home Security Management and Alert System
48.	19	IoT Based Smart and Secured Mobile Charging Station in Public Place
49.	103	Reputation Aware Fair Worker Selection in Collaborative Software Crowdsourcing
50.	108	QoE Aware Optimal Deployment of Virtual Network Functions in 5G Hybrid Cloud

D2T4P3 Sunday, 19 Dec 2021 12:00 PM – 01:15 PM Room# Online		Parallel Session 3: Renewable Energy & Sustainability Session Chairs: <ul style="list-style-type: none"> • Prof. Dr. Abdul Hasib Chowdhury • Dr. Nahid-Al-Masood
Sl.	Paper ID	Paper Title
51.	43	Reducing levelized cost of energy using gas generator in off-grid wind-PV hybrid system
52.	60	Application of Predictive Maintenance in Industry 4.0: A Use-Case Study for Datacenters
53.	144	Threads Scheduling and Load Balancing with Loop Iteration in Multicore Processors: A Case Study with OpenMP
54.	165	Critical Analysis and Performance Evaluation of Solar PV-System Implementing Non-Isolated DC-DC Converters

D2T4P4 Sunday, 19 Dec 2021 12:00 PM – 01:15 PM Room# Online		Parallel Session 4: Textile Engineering Applications Session Chairs: <ul style="list-style-type: none"> • Prof. Dr. Lal Mohan Boral • Prof. Dr. Ummul Khair Fatema
Sl.	Paper ID	Paper Title
55.	2	Characterization of Heat Insulating Ceramic Fiber Raw Material for Industrial Furnace Insulation
56.	37	Advantages of using CAD/CAM system over Manual System in Apparel Production
57.	92	Analyzing the Effect of Neutral Enzyme on Jute-Cotton Blended Denim Fabric



Interactive Poster Session

<p>D2IPS Sunday, 19 Dec 2021 02:00 PM – 03:30 PM Room# Online</p>		<p>Interactive Poster Session Judges Panel:</p> <ul style="list-style-type: none"> • Prof. Dr. Md. Mamun-Or-Rashid • Prof. Dr. Ashik Ahmed • Dr. Md. Abu Layek • Dr. Maheen Islam • Dr. Md. Selina Sharnin • Dr. Tushar Kanti Saha • Dr. Taskin Jamal • Dr. Kafiul Islam • Dr. Saad Bin Arif • Dr. Md. Samiullah • Dr. Abdullah Al Hadi • Dr. Md. Mazharul Haque
Sl.	Paper ID	Paper Title
1.	29	Analyzing The Effect of Linear Density on the Characteristics of CVC (90:10) Mélange Yarn
2.	38	Trend Analysis of Garments Printed Products among European and North American Consumers
3.	47	Smart Ceiling Fan: An Application of Ambient Intelligence
4.	64	A More Effective Approach to Student's Academic Performance Prediction Using Data Mining Techniques
5.	70	SMART: An Improved Wireless Body Area Network
6.	116	A Survey on the Inclusion of IoT in Agriculture for Soil monitoring
7.	127	Distribution of Rice Through Valid Fingerprints
8.	128	Texture Recognition for Color Image Using Enhanced Adjacent Local Directional Ternary Pattern
9.	135	GreenBot: A Human-Robot Interaction System for Exploring Information Using Face Image and Voice Recognition for Green University of Bangladesh Perspective
10.	154	A High-Performance Handover Cell Selection Mechanism in 5G Ultra-Dense Networks





ABSTRACTS | STI 2021

Day- 01: 18 Dec 2021, Time: 12:00 PM, Technical Session- 01, Parallel Session- 01

Venue: Online Platform, Session Chairs: Prof. Dr. Mohammad Shorif Uddin, Prof. Dr. Mohammad Abu Yousuf

PID: 05

Real Time Action Recognition from Video Footage

Tasnim Sakib Apon, Mushfiqul Islam Chowdhury, Md Zubair Rezaz, Arpita Datta, Syeda Tanjina Hasan, Md. Golam Rabiul Alam

Abstract – Crime rate is increasing proportionally with the increasing rate of the population. The most prominent approach was to introduce Closed-Circuit Television (CCTV) camera-based surveillance to tackle the issue. Video surveillance cameras have added a new dimension to detect crime. Several research works on autonomous security camera surveillance are currently ongoing, where the fundamental goal is to discover violent activity from video feeds. From the technical viewpoint, this is a challenging problem because analyzing a set of frames, i.e., videos in temporal dimension to detect violence might need careful machine learning model training to reduce false results. This research focuses on this problem by integrating state-of-the-art Deep Learning methods to ensure a robust pipeline for autonomous surveillance for detecting violent activities, e.g., kicking, punching, and slapping. Initially, we designed a dataset of this specific interest, which contains 600 videos (200 for each action). Later, we have utilized existing pre-trained model architectures to extract features, and later used deep learning network for classification. Also, we have classified our models' accuracy, and confusion matrix on different pre-trained architectures like VGG16, InceptionV3, ResNet50, Xception and MobileNet V2 among which VGG16 and MobileNet V2 performed better.

PID: 86

Smart Mirror for Personalized Content Delivery through Facial Emotion Recognition

Gayanga Kuruppu, Nipunu Wijesinghe, and Priyantha Kumarawadu

Abstract – As technologies emerge to integrate many devices and appliances in a smart home environment, smart mirrors have a potential of being used for personalized content delivery to smart home users. In this study, we have developed a smart mirror using internet of things and deep learning technologies to provide users daily news updates and current events based on the user emotion. In addition, the smart mirror will also display current weather information based on the location, calendar information, to-do-list, traffic updates, currency rates, reminders, etc. The proposed smart mirror is powered by a Raspberry Pi and provides facial emotion classification using a FER CNN deep learning model. The deep learning emotion classification model was implemented on an embedded device with minimum computational resources and was able to classify emotions to three emotion labels: happy, sad and neutral with training and validation accuracies of 84.17% and 81.69% respectively. Furthermore, the proposed system proved that it could deliver personalized content based on user emotion, as it recorded an experimental accuracy of 80% when it was tested with 60 test-cases from 10 different pre-registered users of the system.



PID: 123**An AI-based Security System using Computer Vision and NLP Conversion System**

Md. Rajaul Karim, Punam Chowdhury, Latifur Rahman and Sumaya Kazary

Abstract – In this 21st century, ensuring the security of a place is one of the most crucial things. We have to use either manual or semi-autonomous entrances and human security guards in most of the security systems. Many sophisticated apartments are still now using a traditional security system to ensure safety. Besides, monitoring only by the camera in a certain area is not a better solution to confirm safety. A lot of paperwork has been proposed to make security system as efficient as possible. But a few methods have been proposed an intelligent security system with integrated hardware and automation. The proposed methodology has emphasized building a robotics ecosystem of security that control entrances to give access to authentic people, making decisions and taking actions in any circumstances automatically by itself. These tasks are being performed based on a collective method of image processing, natural language processing, supervised learning, IoT, automation and web server technology. This robotic system is capable of memorizing previously identified humans with their information, talking with users in a local language, gathering necessary information and detecting everything with the user. By this method, there has been proposed a solution to overcome the limitations of a manual or semi-autonomous security system and provide intelligent AI-based security with a robotic ecosystem at a minimum cost.

PID: 134**Real-Time Anomaly Detection and Classification from Surveillance Cameras using Deep Neural Network**

Md. Mijanur Rahman, Mst. Sadia Afrin, Md. Atikuzzaman, Muhammad Aminur Rahaman

Abstract – With increasing security threats, anomaly detection and classification are highly recommended work nowadays. Anomaly detection and classification from surveillance videos are more complex tasks due to the prevalence of anomalous activity. There are still some exceptional problems that require advanced approaches. Deep learning has recently made it possible to detect and classify anomalies in a critical way. In this paper, we have proposed a fine-tuned ResNet-50 model to learn anomalous patterns by exploiting 14 types of anomalous images. In our approach, we have first augmented the image data before passing it to the model. Instead of a fully connected layer, we have added an average pooling layer, dropout layer, flatten, dense layer, and dense layer followed by an activation function (softmax). We also introduce a new dataset that consists of 10483 real-world anomalous images, with 14 realistic anomalies, including abuse, fire, road accident, robbery, suicide attempt, etc. Increasing the classification performance, such baselines demonstrate that it is incredibly tough for our dataset and opens up more opportunities for future work¹. In terms of accuracy, our proposed model can acquire 100% accuracy for anomaly detection, and for anomaly classification, on average, it acquires 79.69% accuracy with a computational cost of 61.45 milliseconds per frame.




Day- 01: 18 Dec 2021, Time: 12:00 PM, Technical Session- 01, Parallel Session- 02

Venue: Online Platform, Session Chairs: Prof. Dr. Md. Moshikul Hoque, Dr. Ahmedul Kabir

PID: 08
Natural Language Query to SQL conversion using Machine Learning Approach

Minhazul Arefin, Kazi Mojammel Hossen and Mohammed Nasir Uddin

Abstract – Natural Language Processing is a computer science and artificial intelligence topic concerned with computer-human language interactions and how computers are designed for processing and exploring a variety of natural language data, in particular. The Structured Query Language for non-expert users is usually a challenging database storage, they may not know the database structure. For database applications to improve the interaction between database and user, a new intelligent interface is therefore necessary. The concept of utilizing a natural language instead of a structured query language has led to the creation of the natural language interface to database systems as a new form of processing procedure. The aim of this research is to build a query generating process using an algorithm for the machine learning to represent information according to user's demands for answering query and obtaining information. For the conversion of Natural Language Query into Structured Query, we utilized a lowercase conversion, removing escaped words, tokenization, PoS tagging, word similarity, Jaro-Winklar matching algorithm, and the method Naive Bayes.

PID: 95
Aspect Based Sentiment Analysis for Bangla Newspaper Headlines

Md. Nasir Hossain Hridoy, Mohammad Mohitul Islam, Ayesha Khatun

Abstract – Aspectbased sentiment analysis means recognizing an aspect in a given content and afterwards perform sentiment analysis of the content regarding that aspect. Sentiment analysis in the Bengali language advances and is also viewed as a significant examination interest. Because of shortage of assets like appropriately commented on the dataset, dictionary, for example, tagger and so on aspectbased sentiment analysis barely has been done in the Bengali language. This research paper aims to find the Bangla newspaper headlines sentiment based on the aspect. Everywhere in the world, people would like to read newspaper headlines first and set up their minds with a summary of the news content instead of reading the news article. This impact may be positive, negative, or neutral. There are many approaches to find the true sentiment among them. Here We use aspectbased sentiment analysis. However, using the small training classifiers dataset for this analysis in Multinomial and Bernoulli Naïve Bayes, Logistic Regression (LR), SGD Classifier, SVM, Random Forest, MLP Classifier and Voting Classifier. In our experiment Bernoulli Naïve Bayes performed better, resulting in the highest F1 score of 70.75.

PID: 112
Bangla Music Genre Classification Using Fast and Scalable Integrated Ensemble Boosting Framework

Rizwan Hasan, Sohrab Hossain, Fahim Irfan Alam and Mannpreet Barua

Abstract – Music genres are helpful means for recommending songs of preferences by containing characteristics related to instruments, musical rhythms and harmonic structure and melodies of the song. Song listeners often face difficulty in finding desired tracks due to the vast volume of available music data. So, in this context, machine learning-based approaches can contribute in developing sophisticated method that can classify music genres and eventually building recommendation systems for online streaming services. In this paper, we propose an integrated framework that considers musical features from both time and frequency domain and after necessary preprocessing stages, incorporates into a boosting model for classification. We incorporate CatBoost as an ensemble learning model due to the obvious benefits of increased speed, reduced overfitting and the ability to assign greater weights to certain samples, and minimal variance sampling. We evaluated our proposed framework on a Bangla music dataset and discovered some noteworthy results that support the effectiveness of our proposed integrated model. A remarkable characteristic of such an integrated machine learning model, which is a significant contribution to the Bangla Music Industry in the era of Industrial Revolution 4.0, is its ability to analyze information from multidimensional data in a self-optimized approach with strong decision-making abilities.

PID: 120**Comparative Analysis of Different Text Summarization Techniques Using Enhanced Tokenization**

Tanzirul Islam, Mofazzal Hossain, MD. Fahim Arefin

Abstract – As a huge amount of data is being generated everyday, text summarization is a must-have technique to obtain the required information concisely. Summaries reduce reading time. When it comes to researching documents, summaries make the job easier. The challenge of creating a short and fluent summary while retaining important information content and overall meaning is known as automatic text summarization. As a huge amount of data is being generated everyday, text summarization is a must-have technique to obtain the required information concisely. It is simple to deal with summarization in the other languages like English, Turkish, Arabic. But due to the diverse and complex nature of the Bangla language, not much has been done on the technique of summarizing the Bangla text. Given the importance of text summarization, this paper focused on the creation of an extraction-based summary approach that works on Bangla text documents. Here we apply different kind of model for generating a summary for a single bangla text document. As compared to other outcomes, our experimental results are outstanding and people who read the summary evaluated them. Further development of these methods will undoubtedly deliver fascinating results. This can also contribute significantly in the effort to build smart machines, which form the basis of industry 4.0.

Day- 01: 18 Dec 2021, Time: 12:00 PM, Technical Session- 01, Parallel Session- 03

Venue: Online Platform, Session Chairs: Prof. Dr. Samia Subrina, Dr. Sajid Muhaimin Choudhury

PID: 24**Design and analysis of a unique Photonic Crystal Fiber in terahertz regime for chemical sensing application**

Md. Mostakim Rahman, Engr. S. M. Anowarul Haque, Md. Rakibul Islam, Abu Sonam, and Ali Karim Adnan

Abstract – The designing and analysis of a unique hybrid reuleaux triangular core photonic crystal fiber with a circular lattice for terahertz (THz) wave guidance are presented in this study. The numerical properties of the proposed structure are investigated using COMSOL5.5, which is a Finite Element Method based software (FEM). For an ideal core diameter of 200 μm loaded with fluid Benzene and Ethanol, numerical analysis is performed. The relative sensitivity of 79.5% with a confinement loss of $9.76 \times 10^{-11} \text{ cm}^{-1}$ was found for the operating range of 1.6 THz. The PCF sensor is a simple and non-complex device that can be made to work seamlessly in the laboratory. Since our designed PCF works across a diverse range of THz frequency spectra, it has the potential to be widely used in a variety of industrial applications.

PID: 27**Design and Performance Testing of an E-Bicycle**

Aryan Gandhi, Sohrab R. Mistri and Dr. A. K. Gangrade

Abstract – Fuel-based vehicles have a significant impact on the environment, natural resources, and health of an ecosystem. E-Bicycles are a viable option as they are an eco-friendly costeffective mode of transport. A consumer market gap of EBicycles with high maximum speed and good starting torque is identified. This paper discusses the design process, fabrication, and testing of an E-Bicycle. Further, the results compare the power consumption of the E-Bicycle at different speeds. The data presented in this paper can be incorporated into a predictive model for commercial E-bicycles that advise the user in real-time, the ideal speed to maximize their range based on the remaining onboard battery percentage.

**PID: 99****Effect of Dopants on ZnO Surface for Electronic Properties and Gas Sensor Application**

Farzana Alam, Md. Solaiman Mia and Suhana Mohamed Sultan

Abstract – In this paper, we have presented the preparation, characterization and simulation of a Zinc Oxide (ZnO) based gas sensor with the effect of different dopants by first principles calculation. The Non Equilibrium Green's Function (NEGF) and Density Functional Theory (DFT) have been used to build and simulate the models on ATK-VNL software package. We have exposed the energy band gaps and established that the dopant on pure ZnO has a substantial role on band structure. It has been revealed that pure ZnO is sensitive towards Group III and Group VII elements (Aluminum and Fluorine respectively) by replacing a single Oxygen and a single Zinc atom individually from the bulk structure. We have detected considerable increase on the Fermi energy level (EF) when applying the dopants on the ZnO nano surface. The estimated Fermi levels were -3.4464 eV, -3.1921 eV and -3.075495 eV for pure ZnO, Fluorine-doped and Aluminumdoped ZnO, respectively. Fluorine-doped ZnO exhibits a 67% sensitivity toward CO gas revealed which is higher compared to pure and Al-doped ZnO which are 28% and 56% respectively.

PID: 110**Design and Analysis of Circular Lattice PCF Biosensor -Based on Surface Plasmon Resonance**

Mushfica Hossain, S. M. Abu Sufian Sunny and Tanvir Ahmed

Abstract – We present a model of circular frame photonic crystal fiber (PCF) biosensor and numerically characterizing its performance. The sensor is established on surface plasmon resonance (SPR) that can develop in metal-dielectric area of PCF. The sensor can be utilized to find out different biological substances by measuring the refractive index (RI). This PCFSPR bio-sensor can monitor a RI range of 1.31 to 1.40, which is a respectable range. The role of plasmonic material used in the PCF-SPR in this sensor is performed by gold, which is positioned on the external surface boundary of the fiber structure to facilitate manufacture. The unknown biological sample can be found by introducing it on the outer face of the metal coating. The sensor is quantitatively investigated using the COMSOL Multiphysics, a finite element method-based software. Changes in pick amplitude of loss spectrum and the corresponding wavelength shift are used to investigate sensor performance. The capability study of the sensor shows that the highest wavelength sensitivity is 12100 nm/RIU, the resolution is 8.26×10^{-6} RIU, and the highest amplitude sensitivity is 1921 RIU-1, the resolution is 5.21×10^{-6} RIU.



Day- 01: 18 Dec 2021, Time: 03:30 PM, Technical Session- 02, Parallel Session- 01

Venue: Online Platform, Session Chairs: Prof. Dr. Syed Akter Hossain, Dr. Sejuti Rahman

PID: 20**A Robust and Efficient Numeric Approach for Relation Database Watermarking**

Mehdi Hassan Jony, Fatema Tuj Johora, Jannatul Ferdous Katha

Abstract – Sharing relational databases on the Internet creates the need to protect these databases. Its output in substantial losses to the data storing systems because of unauthorized access to information that could lose novelty. The research associations use the research databases to mine new information about the research works of the relational databases that are available for free. It is a great challenge to maintain authenticity because these databases are vulnerable to security issues. Watermarking is a candidate solution that fully protects databases shared with the receiver. The protection of relational database ownership that may continue to evolve against the various aquatic mechanisms shared with the recipient that arouses appetite for attacks and must continue to evolve so that they can have database knowledge to support their decision-making system is effective. The relational database based on Virtual private key Watermarking using numeric attribute) involves embedding the same watermark in the same properties in different places in the same place. Therefore, data attackers cannot remove watermarks from data. The proposed strategy is to work by inserting watermark bits in such a way that it causes minimal distortion in the data and the data usability must remain intact after the data is watermarked. The proposed strategy is to work by inserting watermark bits in such a way that it causes minimal distortion in the data and the ability to use the data after watermarking the data must remain intact. The existence of a primary key is the main feature or compulsory item for most of the strategies. Our method provides solutions no primary key feature where the integrating search system of the database remains intact after watermarking distortion.

PID: 32**Semi-supervised Subspace Learning via Constrained Matrix Factorization**

Viet Hang Duong, Manh Quan Bui and Jia Ching Wang

Abstract – This paper adopts the matrix factorization approach by improving the NMF model to build a semisupervised learning framework (DCNMF) that integrates the linear discriminate analysis (LDA) and base cone volume constraints. The proposed DCNMF is a subspace learning model in which the basic cone volume of the learned subspace is minimized and data dimensionality is reduced so that minimizing the distance within-class samples and maximizing the distance between-class samples. The proposed method is evaluated by experiments on two cases of face recognition tasks, namely, various numbers of training data and different subspace dimensionalities.

PID: 52**Classification Using Random Forest on Imbalanced Credit Card Transaction Data**

Hafija Aktar, Md Abdul Masud, Nusrat Jahan Aunto, and Syed Nazmus Sakib

Abstract – The aim of the paper is to perform an optimum solution of imbalance classification problem on a real-life scenario like a fraudulent transaction data. The credit card fraudulent datasets are significantly skewed because the number of genuine financial transactions is higher than the number of fraudulent transactions. The term imbalanced dataset refers to a skewed distribution of data objects in which the instances in classes are not evenly distributed. As the distribution of known classes is biased or skewed, instances of one of the two classes are higher than the other. The main objective of this research is to improve testing accuracy in imbalance classification problem. For this purpose, a combination of Random Forest (RF) classifier and repeated stratified k-fold, grid search cross-validation, Synthetic Minority Oversampling Technique (SMOTE), and Random Under-Sampling (RUS) are applied to perform classification. From the experimental results, it is reported that the RF with grid search cross-validation provides the maximum performance in classification accuracy on a highly imbalanced credit card transaction data.

**PID: 57****An Ensemble Approach of Supervised Learning Algorithms and Artificial Neural Network for Early Prediction of Diabetes**

Fahmida Rahman Liza, Md Samsuzzaman, Rezaul Azim, Md. Zulfiker Mahmud, Chinmay Bepery, Md. Abdul Masud, Bahauddin Taha

Abstract – Diabetes mellitus, is a long-term illness that impairs the body's ability to absorb sugar or glucose. The presence of glucose in the circulation can increase if diabetes is not treated progressively and cautiously, providing a health risk for hypertension and arteriosclerosis. Type 1 and Type 2 diabetes are, in fact, the two major kinds. If an individual does not generate enough insulin to fulfill the body's needs, they will acquire type 1. Type 2 diabetes affects the way human body uses insulin (insulin resistance). Medical datasets may be used to apply machine learning to identify and disease prediction in a more robust and appropriate approach. This analysis is based on existing machine learning algorithms on a publicly available two datasets that contains signs and symptoms suggesting if an individual is diabetic or not. The dataset is explored with the outcomes of machine learning models Logistic Regression, KNN, AdaBoost, and Multilayer Perceptron. Finally, Stacking-CVClassifier is used to ensemble these four models. And at last, the study revealed that alone Multilayer perceptron has the best accuracy, with 91 percent and 93 percent for two distinct datasets, respectively.

PID: 153**Accurate Identification of Potholes on The Road using Federated Learning**

Md. Mamunur Rahman, Montaser Abdul Quader, Mozdaher Abdul Quader, Md. Abdur Razzaque

Abstract – In developing countries like Bangladesh maintaining roads properly is a challenging task. Potholes on the road can lead to various accidents putting the lives and property of drivers, passengers, and pedestrians at risk. Due to increasing the number of potholes on the roads, the number of accidents is climbing day by day. Therefore, continuous collection and up-gradation of road condition data with the most recent information are highly necessary. Identification of potholes can abet drivers to select the right path to avoid accidents or vehicle damage as well as assist the concerned Government department to take immediate measures to fill up the potholes for the benefit of the commuters. Concerning this problem, existing solutions in the literature are highly error-prone and time-consuming. On the other hand, no one gives concentration to renew the information on potholes in a little period. In this paper, we develop an immensely proper pothole identification system by using federated learning. The method recognizes potholes and produces a notification for drivers. Whenever a vehicle faces a pothole a response notification is transmitted to the central server, which then aggregates whole data and gets updated road conditions in every phase. The proposed system outclasses the latest works with which it is compared in a matter of accuracy.



Day- 01: 18 Dec 2021, Time: 03:30 PM, Technical Session- 02, Parallel Session- 02

Venue: Online Platform, Session Chairs: Prof. Dr. Hasanul Kabir, Prof. Dr. Forhad Rabbi

PID: 77 | **CNN-based Deep Learning Approach for Micro-crack Detection of Solar Panels**
Md. Raqibur Rahman, Sanzana Tabassum, Ehtashamul Haque, Mirza Muntasir Nishat,
Fahim Faisal, Eklas Hossain

Abstract – With the growing popularity and decreasing cost of solar power, crystalline solar panels have been widely adopted in residential and commercial applications. Increased production and prolonged usage of photovoltaic (PV) modules have facilitated the need for automatic defect detection, such as micro-cracks which significantly degrade the performance of the modules. This study aims to extend the industrial application of image classification by implementing state-of-the-art convolutional neural networks (CNN) architectures and an ensemble of convolutional neural networks (CNN) for identifying PV modules with micro-crack presence from electroluminescence (EL) images. Transfer learning has become increasingly popular for mitigating the prerequisite of large training datasets and for performing satisfactorily on smaller, more practical real-life datasets. In this study, pre-trained models like VGG-16, VGG-19, Inception-v3, Inception-ResNet50-v2, ResNet50-v2, and Xception are individually assessed before aggregating them using the ensemble method. Ensemble learning further increases the accuracy while reducing the risk of relying on a single model. The highest accuracies of 96.97% and 97.06% was achieved through the ensemble method for monocrystalline and polycrystalline solar panels respectively. The individual algorithms also have shown highly accurate performance that is feasible for detecting micro-cracks on PV cells with lower computational cost.

PID: 94 | **Multi-Classification of Brain Tumors via Feature Level Ensemble of Convolutional Neural Networks**
Nahid Ferdous Aurna, Mohammad Abu Yousuf, Kazi Abu Taher

Abstract – The brain tumor is considered to be one of the deadliest diseases that can lead to cancer. Early and appropriate diagnosis can prevent its heinous consequences which are not often possible by solely depending on the manual detection process. A substantial result can be achieved using Convolutional Neural Network (CNN) in automating the process of detecting and classifying different types of brain tumors. In this paper, a new ensemble architecture that consists of 3 individual efficient CNN models is proposed. The proposed feature level ensemble of 3 CNN models increases the model robustness and efficacy to a great extent. Further, Analysis of Principal Component (PCA) is done for feature or dimensionality reduction which also improves the performance of the model considering execution time and accuracy. The Magnetic Resonance Imaging (MRI) dataset that is used contains total 3064 brain images. It includes images of brain tumors and they are categorized as- meningioma, glioma, and pituitary. Our proposed model shows a prominent performance that outperforms other existing models along with the pre-trained models obtaining an average validation accuracy of 98.37%.



**PID: 100****Investigating the Robustness of Deep Neural Network Based COVID-19 Detection Models Against Universal Adversarial Attacks**

Mohammad Akidul Hoque, Samiul Haque, Subhendu Kumar Debnath, and Md. Ahiduz-zaman

Abstract – Corona viruses are a type of virus with a large family which can cause several terrible and devastating infectious diseases like middle east respiratory syndrome and severe acute respiratory syndrome. The first task of the authority is to screen as many people as possible to detect COVID-19 patients which arises the challenge of rapid screening. Although polymerase chain reaction(PCR) tests are primarily used for the COVID19 test but because of it's high false negative results and need of experts leading to an alternative diagnostic system based on radiological images like chest X-ray. Moreover, computer aided diagnosis systems from radiography images has significantly been advanced during the last decade with promising efficiency which can overcome the need of both time and experts. In this case, machine learning(ML) and deep learning(DL) based screening techniques can provide automated, fast and reliable results. Therefore, many researchers have proposed several deep neural network(DNN) models for rapid screening of COVID-19 using chest X-ray images. Nevertheless, the vulnerability issue DNN models are overlooked or poorly evaluated in the COVID-19 screening. DNN models are remarkably vulnerable to perturbation which is addressed universal adversarial perturbation (UAP). UAP can falsely influence a DNN model and can eventually lead to going wrong in most of the classification problems. Here, we experimented and evaluated the performance of several DNN based automated COVID-19 diagnostic models, and investigated the robustness of these models against two types of adversarial attack: non targeted and targeted. We showed that DNN based COVID-19 detection models are highly vulnerable to adversarial attack and it is substantially important to be aware of the risk factors of DNN models before deploying for real life applications.

PID: 139**Cascaded 3-Stage Nuclei Segmentation using U-net, Faster-RCNN and SegNet for Higher Precision**

ASM Shihavuddin, Mohammad Kamrozzaman Kiron, Md. Imamul Islam, Md. Hasan Maruf, Ratil H. Ashique and Shahriar Mahmud Kabir

Abstract – Though there had been much new deep learning based nuclei segmentation architectures available for various applications made by researchers in the last decade, most of them are specific for particular nuclei types of imaging modalities. In this work, we are proposing a step-wise pipeline for nuclei segmentation comprising Unet based difference image extraction, Faster-RCNN for nuclei detection on difference image, and SegNet for Nuclei segmentation from the detected nuclei inside bounding boxes. Our proposed algorithm provides significant improvement when it comes to Mean Average Precision vs MaskRCNN and provides a general framework where advantages of transfer learning could be deployed easily. Due to the use of cascaded approach, each stage has a single cost function to minimize which helps to reach the global optimum with a limited number of training images and could be separately modified as necessary.



PID: 158**Automated Detection of Lung Cancer Using MRI Images**

Md. Mokhlesur Rahman, T M Shahriar Sazzad, Farhan Sedeed Ferdaus

Abstract – Lung cancer is considered as the second leading cause of death for both men and women and this type of cancer is the commonest among all types. Detection of lung cancer at the very early stage will assist histopathology experts' to provide proper medications to the patients to limit the cancer. A number of existing screening options such as CT, X-ray, MRI and numerous computerized approaches are available to detect lung cancer at the very early stage but due to cell structure it is still a challenging task. Additionally, interpretation is still difficult and time consuming for histopathology experts'. The aid of automated computerized based approach can assist to make this process easy. This study delineates an automated approach for lung cancer detection using MRI images. This study approach tends to provide an accuracy rate of 96.28% using conventional image processing approach and 96.55% using CNN based classification approach which possesses an acceptable accuracy rate in the histopathology laboratory.

Day- 01: 18 Dec 2021, Time: 03:30 PM, Technical Session- 02, Parallel Session- 03

Venue: Online Platform, Session Chairs: Prof. Dr. M. Shamim Kaiser, Dr. Muhammad Golam Kibria

PID: 61**DocBook: Online Interactive Health-Care System**

Md. Shihab Hossain, Iftekhar Hyder, Ishmam Ahmed Alvi, Asma Binte Abu Bokor, Tanzim Ahmed, Montasir Billah, and Md. Motaharul Islam

Abstract – In recent times there is a scarcity of smart softwarebased platforms for medical blogs where doctors and patients can transact medical related issues and discuss health conditions and gain knowledge. Through these blog posts, doctors will be able to magnify their medical practices and patients will be able to reach doctors seeking help. In the proposed system, a smart attestation using the medical information knowledge extraction (IKE) of the solutions provided by health-care service providers is implemented. In the suggested model can assist patients in obtaining numerous views while saving time by avoiding the need to go from one medical institution to another. As a consequence, patients will be able to locate reputable treatment providers all on one platform. Through using this system, a patient's follow-up treatment from a doctor will be eased, since the records will be saved. Additionally, our system can connect to the hospital to ensure that doctors are present and that the clinical records of these patients can be sent straight to the hospital from where patients can conveniently pass the examinations, without having to wait long hours. The diagnosis results or reports will be sent back to the DocBook database for the doctor to study and give feedback to the patient.

PID: 72**A Hybrid Approach to Detect Injection Attacks on Server-side Applications using Data Mining Techniques**

Abu Syeed Sajid Ahmed, Mehjabeen Shachi, Afsana Afrin Brishty, Nurnaby Siddiqui, Nazmus Sakib

Abstract – Cyber attacks are one of the most serious concerns facing individuals at all levels, particularly in enterprises, as they can maliciously destroy systems and steal data. Cyberattacks are normally carried out by a hacker group to attack a single computer or networks. An attacker launches a serverside attack directly at a listening service. Server-side attacks aim to compromise and infringe on a server's data and applications. Attackers are mostly interested in email services, media players, web browsers, office suites, and other similar apps. Attackers can more easily target server-side applications due to malicious requests. In our work, a hybrid approach is implemented inside our proposed two-layer security firewall that includes both machine learning and non-machine learning approaches to detect malicious codes. In the machine learning-based approach, Adaboost and Random Forest are evaluated as the best classifiers with the accuracy 97.9% for detecting SQL injection attacks. On the other hand, SVM performed better than other classifiers with an accuracy of 91.5% for detecting NoSQL injection attacks.

**PID: 121** | **STRIDE-based Cyber Security Threat Modeling for IoT-enabled Precision Agriculture Systems**

Md. Rashid Al Asif, Khondokar Fida Hasan, Zahidul Islam and Rahamatullah Khondoker

Abstract – The concept of traditional farming is changing rapidly with the introduction of smart technologies like the Internet of Things (IoT). Under the concept of smart agriculture, precision agriculture is gaining popularity to enable Decision Support System (DSS)-based farming management that utilizes widespread IoT sensors and wireless connectivity to enable automated detection and optimization of resources. Undoubtedly the success of the system would be impacted on crop productivity, where failure would impact severely. Like many other cyberphysical systems, one of the growing challenges to avoid system adversity is to ensure the system's security, privacy, and trust. But what are the vulnerabilities, threats, and security issues we should consider while deploying precision agriculture? This paper has conducted a holistic threat modeling on component levels of precision agriculture's standard infrastructure using popular threat intelligence tools STRIDE to identify common security issues. Our modeling identifies a noticing of fifty-eight potential security threats to consider. This presentation systematically presented them and advised general mitigation suggestions to support cyber security in precision agriculture.

PID: 142 | **A Behavioral Trust Model for Internet of Healthcare Things using an Improved FP-Growth Algorithm and Naïve Bayes Classifier**

Saiful Azad, Amin Salem Saleh, Mufti Mahmud, M. Shamim Kaiser, Md. Saefullah Miah

Abstract – Healthcare 4.0 has revolutionized the delivery of healthcare services during the last years. Facilitated by it, many hospitals have migrated to the paradigm of being smart. Smartization of hospitals has reduced healthcare costs while providing improved and reliable healthcare services. Thanks to the Internet of Healthcare Things (IoHT) based healthcare delivery frameworks, integration of many heterogeneous devices with varying computational capabilities has been possible. However, this introduced a number of security concerns as many secure communication protocols for traditional networks can not be verbatim employed on these frameworks. To ensure security, the threats can largely be tackled by employing a Trust Management Model (TMM) which will critically evaluate the behavior or activity pattern of the nodes and block the untrusted ones. Towards securing these frameworks through an intelligent TMM, this work proposes a machine learning based Behavioral Trust Model (BTM), where an improved Frequent Pattern Growth (iFPGrowth) algorithm is proposed and applied to extract behavioral signatures of various trust classes. Later, these behavioral signatures are utilized in classifying incoming communication requests to either trustworthy and untrustworthy (trust) class using the Naïve Bayes classifier. The proposed model is tested on a benchmark dataset along with other similar existing models, where the proposed BMT outperforms the existing TMMs.

PID: 160 | **IoT Based Multidimensional Mushroom Waste Management System in Urban Area**

Zeseya Sharmin, Rafidah Md. Noor, Tey Kok Soon, Ismail Ahmedy, Nor Aishah Abdullah and Yap Soon Poh

Abstract – Mushroom production became a lucrative agribusiness. Because of the heterogeneous benefits, mushroom consumption proliferates in the last few decades. However, the mushroom industries face issues with a huge waste of substances. Managing the garbage in mushroom businesses is challenging. Moreover, proper utilization of compost is necessary. To address these issues, the proposed model will create an IoT based complete and intelligent mushroom waste management system. To fulfill the demand of a comprehensive and smart mushroom waste management system, the proposed model is segregated in main three objectives, such as- smart bin creation, supply chain management tools and cloud server. By the use of the proposed model, mushroom industries can improve their productivity as well as recycle the unused substances. Moreover, the benefit of the model includes a green environment, time efficiency, and cost-effectiveness.

Day- 02: 19 Dec 2021, Time: 10:45 PM, Technical Session- 03, Parallel Session- 01

Venue: Online Platform, Session Chairs: Prof. Dr. Md. Obaidur Rahman, Dr. Md. Golam Rabiul Alam

PID: 76 | **Enhancing Quality of Experience of 5G Users Exploiting Deep Q-Learning**
Rusmita Halim Chaity, Palash Roy, Md. Abdur Razzaque, Md Sadiquzzaman

Abstract – The Fifth Generation (5G) network aims to redesign the network service architecture so that it can offer an excellent Quality-of-Experience (QoE) to the users. However, the exponentially increasing user demands and large volume of required media services often make the 5G networks congested. Existing works in the literature are limited by focusing either on reducing congestion of the network or maintaining Quality of Service (QoS) expected by the users. However, in this paper, we emphasized on increasing the Quality of Experience (QoE) of the users by selecting an optimal network topology using Deep Q-Learning method, namely, OT-DQL system. The proposed OTDQL system exploits Reinforcement Learning (RL) technique to learn the existing organization of the network connectivity as well as the offered service quality to the users. Thereafter, it predicts the optimal topology for the network that can excel user service experiences and provision the resources accordingly. The performance analysis has been carried out in mininet environment and the experimental results depict significant performance improvement in terms of enhancing the users Quality of Experience (QoE) while reducing the percentage of Service Level Agreement (SLA) violation.

PID: 155 | **Prediction of Energy Harvesting in Solar Powered Small Cells Networks**
Sabikun Nahar Tanha, Sowpna Akter Mim, Palash Roy, Md. Abdur Razzaque

Abstract – Utilization of solar energy in Small Cell Network (SCN) has shown its urgency in the recent era for providing higher Quality-of-Service to the user. Reliance on solar power reduces the dependency on the fixed energy sources. Though the solar power cannot provide a fixed amount of energy needed by the users, the proper utilization of solar power is important to provide sustainable services. In this paper, a solar energy harvesting prediction technique by exploiting Deep-QLearning approach in the small cell networks, namely, DQL-SP is devised to predict energy harvesting levels of SCN in the future time slots. The performance analysis results demonstrate that proposed DQL-SP based system reduces the energy harvesting prediction error ratio significantly compared to the state-of-the-art approaches.

PID: 159 | **A Triple T-topped Planar Antenna for 5G/WiMAX Applications**
Liton Chandra Paul, Md. Hossain Ali, Rezaul Azim, Tushar Kanti Roy

Abstract – A low-profile triple T-topped planar antenna having a partial ground plane is observed and discussed in this article. The designed antenna can be used for the latest wireless technology 5G communication as well as WiMAX applications. The T-topped antenna is designed by using CST-MWS suite on Rogers RT5880 (2.2, 0.0009) substrate and Copper (annealed) material is used for metallic layers. The height of the dielectric material and metallic layers are 0.79 mm and 0.035 mm respectively. The volume of the triple T-topped antenna is 34 mm × 24 mm × 0.79 mm. The operating frequency range of it is 3.22 GHz-4.25 GHz. The gain and directivity at the resonant frequency of 3.60 GHz are 2.199 dB and 2.720 dBi. It provides a very good reflection coefficient (-56.839 dB at 3.60 GHz), a stable and average efficiency about 89% as well as covers frequency range of 5G communication and WiMAX rel 2 (3.4 GHz-3.6 GHz). Thus the triple T-topped antenna can be a good design for 5G communication and WiMAX applications.



**PID: 164****Starfish Routing Backbone on the Optimal Elliptical Ring-canal in Sensor Networks**

Md. Ahsan Habib, Sajeeb Saha, Md. Abdur Razzaque, Md. Mamun-Or-Rashid

Abstract – Data routing via sensor networks has become increasingly important because of the rise of the internet of things and 5G/6G network services. Therefore, routing protocols are being developed to transmit real-time data to mobile sinks more efficiently. Since real-time applications must meet the quality of services (QoS), forming a routing backbone becomes a top priority. In the state-of-the-art works, the Starfish routing (SFR) backbone is constructed with a ring canal and several radial canals that guarantee single-hop access to backbone nodes from any source node. In these works, network lifetime and realtime QoS performances are highly dependent on the appropriate size of the ring canal. However, regardless of the network size, whether square or rectangular, existing Starfish routing backbones form a circular ring canal. As a consequence, network performances significantly hampers. Therefore, in this paper, we develop an optimum elliptical ring canal on the Starfish routing backbone. The optimal size of the elliptical ring canal, in terms of minor and major radii, is determined based on the sensor's transmission range and network area. Later, we conducted simulation studies to assess end-to-end delay and network lifetime. The results demonstrate a 20% reduction in end-to-end delay and a 10% increase in network lifetime.

Day- 02: 19 Dec 2021, Time: 10:45 PM, Technical Session- 03, Parallel Session- 02

Venue: Online Platform, Session Chairs: Prof. Dr. Rezwon Khan, Prof. Dr. Md. Farhad Hossain

PID: 44**Design and Comparative Performance Analysis of a Circular Microstrip Patch Antenna with Different Modifications**

Mousume Samad and Mostafizur Rahman

Abstract – In this paper, a circular microstrip patch antenna is designed at implantable medical devices (IMDs) bands. The antenna is modified with different techniques to reduce the dimension and enhance the performance. This paper focuses the comparative performance analysis of the circular patch, the circular planer inverted F-antenna (PIFA), the circular PIFA with meandered line, the circular PIFA with meandering and defected ground structure (DGS), the multiple substrates layer circular PIFA with meandering, and finally the multiple substrates layer circular PIFA with meandering and DGS. These approaches provide the size reduction, gain enhancement, bandwidth broadening, and efficiency increment. Although this circular patch antenna offers large bandwidth, gain, and radiation efficiency; however the dimension of the antenna is quite high. The dimension of an antenna can be minimized by using circular patch PIFA. To reduce the overall size of this antenna, a circular meandering PIFA has been utilized. The circular meandering PIFA with DGS further increases the current conduction path and controls the input impedance. The increased current flow path contributes to the radiation efficiency. Moreover, the multiple substrates layer circular meandering PIFA helps to enhance the bandwidth, radiation efficiency, and frequency. The radiation efficiency can be increased more by inserting a DGS in the multiple substrates layer circular meandering PIFA.



PID: 56**Effects of Tumor Radius, Metabolic Heat Rate and Heat Transfer Coefficient on the Temperature Distribution of Tumor Affected Breast**

Wasifa Rahman Rashmi, Rafe Md. Abu Zayed, Anika Rahman Riya and Ariful Islam Nahid

Abstract – Tumor is a frequent abnormality of the human breast that can transform into an incurable condition if left untreated at earlier stage. Thus, early detection of tumors is crucial for successful treatment of tumor anomalies. Due to the distinct thermal characteristics of tumor affected tissues namely heat transfer coefficient and metabolic heat generation; bio heat transfer equations can be a viable option to model the temperature profile of the affected breast in order to pinpoint the faulty tissues. This study develops a two-dimensional model of a tumor-affected breast and investigates the temperature profile of it with varied realistic values of metabolic heat generation of the tumor affected area and the heat transfer coefficient at the affected boundary along with the variation of tumors size. A finite element scheme using Pennes' bio heat transfer equation is formulated and implemented for solving the model. Firstly, the dimensional effect of tumor is observed by varying tumor radius from 0.25cm to 0.75cm within a breast section of 9cm radius. It is found that the presence of tumor of any size increases the local temperature. Secondly, it is observed that an increase in the metabolic heat generation of the tumor increases the temperature of the respective region. Furthermore, it is found that an increase in the coefficient of heat transfer at the exposed breast surface decreases the temperature at that region. The findings of this study are significant to assess patients' condition and develop thermography application scheme for the early detection of tumor.

PID: 81**Tumor Detection by Rectangular Microstrip Patch Antenna**

Anis Ahmed, Mohammad Nurunnabi Mollah, ASM Shihavuddin

Abstract – This paper presents an inset feed microstrip patch antenna for biomedical application. The performance of the antenna is enhanced by optimizing the feed line width and length of the radiating patch. The operating frequency of the antenna in the Industrial, Scientific, and Medical (ISM) band at 2.43 GHz. The antenna has a dimension of 58.78x51x1.67 mm³. Antenna performance is based on return loss (dB), Voltage Standing Wave ratio (VSWR), Specific Absorption Rate (SAR), gain, directivity, and radiation pattern. The antenna showed outstanding return loss around -62.2 dB at 2.43 GHz frequency. A three-layer human phantom is integrated with the antenna. The location and size of the tumor are obtained by observing the return loss variation of the antenna. The reflection parameter without tumor is -26.18 dB whereas with tumor is -20.9 dB that indicates power loss occurs between the range of 0.25% to 0.81%. The Specific Absorption Rate (SAR) of this antenna is 0.438 W/Kg which is safe for the human body. Computer Simulation Technology (CST) was used to depict and simulate the antenna.




Day- 02: 19 Dec 2021, Time: 10:45 PM, Technical Session- 03, Parallel Session- 03

Venue: Online Platform, Session Chairs: Prof. Dr. A H M Abdur Rahim, Dr. Tawhidul Alam

PID: 35
Modelling and Viability Study of a Biomass PowerPlant Fired with Pteris vittata in Bangladesh

Rafe Md. Abu Zayed, Bashirunnisa Ananya, Ariful Islam Nahid

Abstract – Pteris vittata shows great potential as a source of biomass energy because of its comparatively higher heating value, easy availability and higher productivity. Proper analysis is required to assess the scope of pteris vittata as biofuel in power sectors. This study investigates the thermodynamic and financial viability of using pteris vittata as bio feedstock in biomass power plants in Bangladesh. A pteris vittata fired power plant model is built and studied to assess the performance of both belowground and aboveground parts of pteris as feedstock. Key thermodynamic performance parameters of the plant namely power generation by the system, gross and net heat rate, and thermal efficiency are studied for ambient temperature data of Bangladesh over one year period. Besides, the financial analysis of the cycle and pollution control measures are also discussed. From this study, it is found that a pteris vittata fired power plant can generate up to 8.5 GWh annual energy with annual capacity factor of about 68.13% and a net heat rate of about 14.84 (MMBtu/MWh) for an annual biomass feed rate of about 9000 ton. Besides, the cycle can be operated in an environment friendly way for a levelized electricity cost of 0.126 \$/kWh, which can be a sustainable energy technology to meet the demand of industry 4.0.

PID: 36
Impact of wind power plant in Bangladesh power system stability

Pollen Barua, M.G Rabbani, Muhammad Quamruzzaman

Abstract – Government of Bangladesh has recently approved the maiden private wind power project of 55 MW in Bagerhat region. In this case the stability of Bangladesh Power System (BPS) is of prime concern as the behavior of renewable energy sources are different from non-renewable sources. Wind power based non-conventional source of energy integration may change the stability. Hence, this paper investigates the steady state, small signal and transient state stability replacing the conventional sources of generation with equivalent size in step by step for different penetration levels. Eigenvalue analysis technique is used to find out the oscillatory modes basically the critical modes and Hopf Bifurcation (HB) point. Doubly Fed Induction Generator (DFIG) is considered to model the Wind Turbine Generator (WTG) in Bagerhat. NEPLAN software is used to carry out all the simulations.

PID: 39
A Robust Double Integral Sliding Mode Controller Design Based on an Adaptive Power Reaching Law for Mitigating SSR Problems

Farjana Faria, Tushar Kanti Roy, Tabassum Haque, Tanmoy Sarkar, Most. Mahmuda Khatun and Anik Kumar Hore

Abstract – In this paper, an adaptive power reaching law-based robust double integral sliding mode controller is proposed to extrude the sub-synchronous resonance (SSR) problem in wind farms. The rotor-side-converter (RSC) dynamic is considered to design the proposed controller as it has the noteworthy influence of eliminating the SSR problem relative to the grid-side-converter (GSC). In the proposed control framework, the sliding mode scheme is built-based on an adaptive power reaching law which ensures the elimination of SSR problems while enhancing the transient stability and steady-state tracking error performance in a quicker manner. Since the proposed nonlinear controller has robustness property against uncertainties, exterior disturbance is also taken into consideration within the RSC dynamical model. The control signal is generated in a way that it meets the criteria for overall stability and the Lyapunov theorem is applied to demonstrate the aggregate stability. Finally, in the MATLAB/SIMULINK platform a simulation study is conducted to demonstrate its performance and compared with an existing single integral SMC scheme.

PID: 41 | **Design of a Robust Integral Sliding Mode Controller Based on an Enhanced Reaching Law for DC Microgrids**

Tabassum Haque, Tushar Kanti Roy, Farjana Faria, Tanmoy Sarkar, Most. Mahmuda Khatun and Anik Kumar Hore

Abstract – In this paper, for improving the power-sharing in DC microgrids, an enhanced reaching law-integral sliding mode controller (ERL-ISMC) is proposed. The foremost purpose is to sustain the power balance in the system. The main indicator for sustaining a power balance (PB) is to uphold a stable voltage at the DC-bus. Therefore, another objective of this paper is to keep a constant DC-bus voltage. The proposed DC microgrid comprises with a solar photovoltaic (PV) system, a battery, and DC loads. The output of each unit is controlled using the proposed ERLISM scheme. The Lyapunov theory is used to check the system's stability. Finally, simulation results are presented to explain the proposed controller's performance on the proposed microgrid. In addition, to show its usefulness, the performance is also correlated with a designed conventional reaching law-ISMC (CRL-ISMC).

Day- 02: 19 Dec 2021, Time: 10:45 PM, Technical Session- 03, Parallel Session- 04

Venue: Online Platform, Session Chairs: Prof. Dr. Md. Ashraful Hoque, Dr. Ashik Ahmed

PID: 31 | **Gate Driving Complexity Reduction of an H-Bridge Connected Silicon Controlled Rectifier**
Md. Shihab Uddin, Shuvra Prokash Biswas, Md. Kamal Hosain, Safa Haq, Rizwan Amir Fahim

Abstract – One of the key challenges in power converter design is to reduce the gate driving components (opto-coupler) as well as the driving complexity of the switches used in the implementation without disrupting advantageous features of the converter. To demonstrate an alternative way, a modified gate driving technique is proposed in this paper for AC-DC and AC-AC converter when silicon controlled rectifier (SCR) is used as a switch in bridge connected topology. The proposed driving technique facilitates number of gate driving components count reduction of the existing bridge connected SCR topology. The proposed driving technique also reduces the driving complexity as well as the complexity of the pulse generation algorithm for microcontroller or microprocessor.

The proposed driving technique is simulated in MATLAB/Simulink environment. A voltage down laboratory prototype is also built to analyse the experimental validation and test the feasibility of the proposed technique.

PID: 84 | **An Efficient Protection Scheme for VSC-HVDC System with Modified Bridge Limiter Controller**

M. Shafiul Alam, M. Azharul Islam, Md. Ahsanul Alam, Aasim Ullah, Md. Ismail Hossain, Sk. Md. Golam Mostafa, Fahad Saleh Al-Ismael

Abstract – Voltage source converter-high voltage direct current (VSC-HVDC) system is susceptible to disturbances. This is because of the antiparallel diodes of VSC which allow current flow as well as discharge of DC capacitors. The DC protective devices are also not mature enough till date to protect such a system. In order to protect the VSC-HVDC system, this work proposes an efficient approach based on a modified bridge limiter controller. The proposed technique applies appropriate limiting resistance during contingencies only whereas almost zero impact is observed during normal conditions as the controller bypasses the limiting resistance. Real-time digital simulator (RTDS) has been adopted to simulate the system and its controller. The implemented results show that the proposed method is capable to tackle voltage fluctuation, real power oscillation, and line fault current during contingencies. The numerical results show that 60% voltage fluctuation reduction and 71.4% power oscillation damping are obtained with the proposed approach. A comparative study with the existing method in the literature further guarantees the suitability of this protection scheme.



PID: 148 | **Performance Projection of GaN HEMT: Bias and Temperature Dependent Study of 3rd-Order Intermodulation Distortion**

Mohammad A. Alim, I. Jahan, Mayahsa M. Ali, and Christophe Gaquiere

Abstract – The third-order intermodulation distortion in AlGaIn/GaN high electron mobility transistors fabricated on SiC substrate for power amplifier applications is reported in this study as a function of bias and temperature. The nonlinearity of active devices in terms of frequency and input power was demonstrated using two-tone intermodulation distortion measurements with a wide bias and temperature range. It is shown that the second derivatives of RF transconductance (G_{m3}) determined from two-tone measurements are directly related to the third-order intermodulation distortion (IMD) components. Furthermore, the third-order intermodulation distortion power was found to be minimum at the value of G_{m3} is zero. An empirical analytical model for the nonlinearity of this device based on two-tone technique has been developed to highlight the influence of RF transconductance. The modelled data are shown to be consistent with measurement results giving a useful tool for studying these devices.

PID: 149 | **Design and Modelling of Grid Connected Multilevel Inverter for Microgrid Applications**

Md. Tariqul Islam, Hady H. Fayek, Md. Fayzur Rahman, Md. Mizanur Rahman, Md. Hasan Maruf and Rukhshana Parvin

Abstract – Inverters are the main actuator in the control of AC microgrid because of their managing capability of power flows of both generators and energy storage devices. This paper introduces a high frequency magnetic linked three-phase sevenlevel asymmetric inverter for microgrid applications. This proposed topology uses relatively low switching devices and voltage sources for generating the required voltage level. From the simulation results and the comparative study, the proposed topology has demonstrated significantly lower Total Blocking Voltage. The total number of components in the proposed method compared to Cascade H-Bridge inverter is around 40% less which is the least component requirement among the recently published topologies. Moreover, the proposed inverter topology diminishes almost 37.05 % of TBV/level, and 75.47% of G-coefficient than conventional cascaded H-bridge topology as well as recently published multilevel inverter topologies. So, in the future, the proposed topology will be the optimal choice for sustainable microgrid applications.



Day- 02: 19 Dec 2021, Time: 12:00 PM, Technical Session- 04, Parallel Session- 01

Venue: Online Platform, Session Chairs: Prof. Dr. Lafifa Jamal, Prof. Dr. Md. Motaharul Islam

PID: 53**Head Gesture and Voice based Learning App for Children with Autism of Nepal**

Sachin Shrestha, Amit Shah, Pawan Dhakal, and Niraj Dhakal

Abstract – This paper is focused on the development of a learning platform for children with autism of Nepal in the form of a desktop application. Autism spectrum disorder is marked by core features including impaired social communication, and restrictive and repetitive behaviors and interest (Diagnostic and Statistical Manual of Mental Disorders 5th Edition: DSM 5). The main objective of this paper is to develop a desktop-based application that will aid children with autism in learning new words and in recognizing the various objects with the help of pictures and audio in games. The front end of the application has three main sections. Two of them were based on voice and pictures; one is speech training and the other is speech game. The third section is a game that consists of a game character which makes movements as per the head and facial gestures such as left and right, and jump. The performance parameters like accuracy of the character movements and voice recognition were calculated and were obtained as 97.09% and 85% respectively. The application was tested among neuro-typical as well as people with autism, with the age ranging from 4 to 22. The tests showed the positive attitude toward the application for the learning by both groups however in differing ranges. Their involvement was measured against different parameters like their learning time, scores in the game etc. Thus, it can be concluded that this kind of learning platform can help the children with autism to grow their skills in different fields. Also, with the implementation of AI analytics and cloud computing into the data collected through this application, in future, this could be an initiating step toward the industry 4.0 approach for the children with autism.

PID: 62**Forecasting the COVID-19 pandemic in Bangladesh using ARIMA model**

Julshan Alam Ratu, Md. Abdul Masud, Md. Munim Hossain, Md. Samsuzzaman

Abstract – The effects of the coronavirus disease in 2019 are visible in every corner of the globe. The public health system is mostly affected, and the economic and social crises are also increasing day by day. Due to the widespread nature and the unavailability of drugs or vaccines for this pandemic, it is urgent to predict the COVID-19 infected cases to handle the situation more efficiently. Time series prediction is a crucial technique of the machine learning domain to deal with the issue. This research aims to predict the number of daily confirmed COVID-19 cases for a successful time. To forecast COVID-19 instances in Bangladesh, we use the Autoregressive Integrated Moving Average (ARIMA) model. The experimental results show that the estimated best models are: ARIMA(3,1,0) with drift, ARIMA(3,1,2) with drift, ARIMA(5,1,0) perform significant predictions on three different kinds of COVID-19 datasets.

PID: 113**An Intelligent Application for Preventing the Counterfeit Medicines through a Distributed Blockchain**

Md. Abdullah Al Noman, Md. Jobaer Hossain, Md. Musa Kalimulla, Shamim Azad, and Md. Anwar Hussien Wadud

Abstract – Recently, one of the most challenging problems has been considered about the purity of drug or drug safety. This issue has a significant impact in various fields related to medicine, especially in the pharmaceutical industry's commercial area. It takes thousands of lives per year for fake drugs to be delivered and consumed. There are no successful approaches to handling the network of the phony medicine syndicate globally, and the stakeholders in the drug industry have to act under authentication among them. This paper focuses on explaining an approach to resolve the issue of counterfeit drugs by using Blockchain technology. Further, Blockchain is a distributed system where each node holds the same data and aligns with other nodes without worrying about losing data. The suggested approach is based on storing the drug distribution criteria from medicine manufacturing to the consumer on the Blockchain network. The effect of a medicine on a patient will be recorded in a database for future statistics. For keeping transaction records, an approved Blockchain will be applied, and only trusted people will be able to access the system and push data to the Blockchain.



PID: 132 | **An Online Reversed Bangla Sign Language Learning System**

Muhammad Aminur Rahaman, Md. Imran Hossain, Shamima Nasrin, Mahmuda Rahman, and Syed Ahsanul Kabir

Abstract – Hearing and speech impaired people around the world express their thoughts through sign language, which is incomprehensible to most people. As a result, interacting with them is quite challenging. Specially in Bangladesh, where people are unable to learn the Bangla sign language (BdSL) due to a lack of resources. We have proposed and implemented an online reversed Bangla sign language learning system using unsupervised rulebased method, which can be utilized to interpret Bangla natural language (speech and/or text) into BdSL. The system takes input of Bangla speech via a Bangla voice recognition module and then convert it into Bangla text. The system can also take Bangla text directly from the text editor module of the system. The system parse Bangla text using a designed set of rules from Bangla semantic analysis. After semantic analysis the system is trained based on unsupervised learning using the parsed Bangla text for each corresponding BdSL. We have used an efficient animation algorithm instead of video clips to display the BdSL for corresponding Bangla speech or text. We have considered only starting and ending frame of each gesture to make the animation. As a result, by using limited number of postures, the system can dynamically make any gestures based on the proposed animation algorithm. The system can animate sentences of various lengths and numerals ranging from 0 to 9 in BdSL. It can generate many phrases with a small quantity of data and has been trained and tested with over 500 examples with lower computation cost rather than existing systems. The proposed system achieves 99.60% accuracy for speech/voice inputs and 100% accuracy for text inputs where as the average accuracy is 99.8% with the mean computational cost of 120 milliseconds per gesture animation.

Day- 02: 19 Dec 2021, Time: 12:00 PM, Technical Session- 04, Parallel Session- 02

Venue: Online Platform, Session Chairs: Prof. Dr. Md. Al Mamun, Prof. Dr. Md. Shariful Islam

PID: 17 | **IoT Based Biometric Home Security Management and Alert System**

Md.Eftekhari Alam, Mohammed Abdul Kader, Murshida Akter, Syeda Maftuha Alam, Zinnia Sultana, Sumaiya Deen Muhammad

Abstract – IoT services bring a technological revolution in all sectors. Security issues in any residential building, bank, institute, factory, etc can be overcome through IoT. In this project, we aim at the fingerprint sensor to overcome the security problem for a house. Since some of the related studies have been already done but in our work, we added some new characteristics. Fingerprint module, Bluetooth, Node MCU, door lock all the components are connected with each other through IoT. Firstly, the fingerprint of all the people of the house will be collected and stored in the EEPROM by the authority. When a user wants to enter the house he has to keep his finger to the fingerprint module. After giving the user's fingerprint it will match the fingerprint from the stored data. The main authority can get a notification and also the name of the user who enters his house will get notification on his or her smartphone through the Blynk app. His family will know who has come from the LCD display. It ensures the security of the house.



PID: 19**IoT Based Smart and Secured Mobile Charging Station in Public Place**Md. Eftekhar Alam, Mohammed Abdul Kader, Momtaz Hossain, Fareha Noushin,
Mohammed Shamsul Alam, Sahrin Farid

Abstract – In this era of technological advancements, mobile phones became a part of people’s daily activities. Many countries have charging port facilities in public places, but they are at high risk of security. Many developing countries don’t have a sufficient charging port in public places. A smart and secured mobile phone charging station is proposed in this paper. The system can be easily installed anywhere and designed so that this system can charge any mobile phone. Arduino is the core component of this system. A coin recognition module is used to recognize a valid coin that has been entered; then, the system proceeds further action. According to the amount of coin, the system set the particular time of charging the mobile phone. To ensure the system’s security, we have used a solenoid door locker protected by RFID cards; only by using this, the user will be able to open the door and access the device. There is also some feature that helps the system provider to collect the coin from the system before it is overloaded. All the features have been tested properly by building a prototype.

PID: 103**Reputation Aware Fair Worker Selection in Collaborative Software Crowdsourcing**

S. M. Tanvir Rahman, Afsana Kabir Sinthia, Syeda Nabila Akter, Palash Roy, Md. Abdur Razzaque

Abstract – Soaring demand of software products without degrading the performance and meeting the expectation of maximum cost-profit satisfaction have made collaborative software crowdsourcing an immense essence of technological employment. The geographical, technological, and psychological variations among the crowdsourcing workers can delude the team selection procedure at a high rate, which ends up being a most challenging problem to select the best worker and form an efficient group. However, existing works in the literature suffer from the limitation of not having an efficient mechanism to select workers in a collaborative software crowdsourcing platform by maintaining a fair worker selection procedure. In this paper, we have developed an algorithm where the buyer has the facilities to select workers by prioritizing the worker’s reputations. The performance analysis results, carried out in MATLAB, show that compared to other state-of-the-art works, the proposed Crowdsourcing Online Group (COG) system can achieve significant performance improvement in terms of user satisfaction by selecting workers with a high reputation and the system has stronger practicability.

PID: 108**QoE Aware Optimal Deployment of Virtual Network Functions in 5G Hybrid Cloud**

Mohammad Shahjalal, Nusrat Farhana, Palash Roy, Md. Abdur Razzaque

Abstract – Virtual Network Functions (VNFs) in the collaboration of edge and cloud servers, i.e., hybrid cloud infrastructure of the 5G Internet are accountable for running codes offloaded from mobile users. Due to the mobility of the users, optimal placement of VNFs in the hybrid cloud infrastructure is a critical issue for getting services in real-time. The two primary design objectives of VNF deployment in hybrid cloud architecture are to minimize service latency (i.e., maximize the quality of experience) and the deployment cost. In this paper, we have formulated the problem as a Multi-objective Integer Linear Programming (MILP) problem that brings a trade-off among these two parameters. The results of performance analysis demonstrate a notable improvement concerning deployment cost and users QoE compared to the state-of-the-art works.



**Day- 02: 19 Dec 2021, Time: 12:00 PM, Technical Session- 04, Parallel Session- 03**

Venue: Online Platform, Session Chairs: Prof. Dr. Abdul Hasib Chowdhury, Dr. Nahid-Al-Masood

PID: 43**Reducing levelized cost of energy using gas generator in off-grid wind-PV hybrid system**
Md. Touhidul Imam, Md. Hasan Maruf, Ahmed Al Mansur, and ASM Shihavuddin

Abstract – The environmental influence and perpetual dwindling of fuel has become a great concern in the current situation. Renewable energy can be a solution to this concern because of its earth-abundant quality and less pollution to the environment. In this paper, the main focus is to develop an optimized hybrid renewable energy system in a remote area of Bangladesh (Dacope, Khulna). The proposed hybrid system consists of an off-grid PV-Wind-Gas Generator. Normally, an off-grid system has high the levelized cost of energy (LCOE). In this research, we demonstrated a novel procedure for reduction of the LCOE by tracing additional load and Homer PRO simulation. In our primary simulation (without gas generator) the LCOE was 0.33 \$/kWh. After adding the gas generator, the LCOE fell down to 0.103 \$/kWh. The proposed method minimizes the LCOE significantly which is very promising compare to the other state of the results. We can use this method for grid connected system and smart grid system. The work uses HOMER PRO software for optimization and simulation. This paper can be a reference for achieving sustainability in the power sector of Bangladesh.

PID: 60**Application of Predictive Maintenance in Industry 4.0: A Use-Case Study for Datacenters**
Kazi Pushpa Ahmed , Adnin Mourin, and Kazi Main Uddin Ahmed

Abstract – In the context of the upcoming 4th generation industrial revolution (industry 4.0), mechanical failures in the cyber-physical systems have huge financial impacts. The IT industry like Google, Facebook, Microsoft, etc. mostly depends on the Datacenters (DCs) to assure the quality of services. The equipment of the DC including the power supply system and the computational resources are sensitive to supplied power quality, thus predictive maintenance is needed to prevent failures and limit financial losses. The predictive maintenance assures operational security based on the monitored data that can characterize the failures of the physical machines, and also ensures the maximum return of the capital investment by prolonging the useful life of the equipment. The size of the monitored data typically occupies large memory space that can compare with “big-data” nowadays. Thus, the big-data-sized monitored data analysis is an additional computational challenge to characterize the failures of physical machines, hence, schedule the predictive maintenance. However, characterizing the failure and repair time of the major components based on the measured data is still a challenge that is the goal of this paper. Meanwhile, the revenue of the business also largely depends on the accuracy of predictive maintenance in general. In this paper, a predictive maintenance approach is presented based on the stochastic failure time of the major components of the DC. Additionally, the business challenges for predictive maintenance considering industry 4.0 are also analyzed in this paper.



PID: 144 | **Threads Scheduling and Load Balancing with Loop Iteration in Multicore Processors: A Case Study with OpenMP**

Md. Sirajul Islam, Mohammad Abdur Rouf

Abstract – In multi-core processor architecture, all the cores run instructions on different cores at the same time. As a result, overall speed for programs that support multithreading is increased. A CPU in multithreaded environment is capable to handle multiple threads concurrently. The threads share the resources among different cores. Optimal thread allocation to cores with proper load balancing is very challenging. This paper presents a way to allocate threads to multiple cores that minimize thread switching overhead. As a result, overall work load is balanced. For parallel computation, OpenMP (Open Multi-Processing)- an Application Programming Interface (API) is used here in this paper, to supports multi-platform shared-memory for allocating threads in multiple cores with proper load balancing.

PID: 165 | **Critical Analysis and Performance Evaluation of Solar PV-System Implementing Non-Isolated DC-DC Converters**

Khan Mohammad, Abdul Ahad, M Saad bin Arif, and Ratil Hasnat Ashique

Abstract – In a solar PV system, the use of dc-dc converters to regulate the dc output of the panels is inevitable. Therefore, selecting an appropriate converter is a crucial design concern for the optimal operation of the system. Non-isolated dc-dc converters are compact in design and have better efficiency. This work presents a comprehensive and concise analysis of the PV system implementing selected conventional and advanced non-isolated dc-dc converters. Mathematical and simulation modelling of the components has been carried out. The sizes of passive elements of the converters are obtained mathematically. Modelling and system analysis is done using Matlab/Simulink software. Performance of the system is evaluated on the parameters such as passive elements used, ripple factors, output power and efficiency.

Day- 02: 19 Dec 2021, Time: 12:00 PM, Technical Session- 04, Parallel Session- 04

Venue: Online Platform, Session Chairs: Prof. Dr. Lal Mohan Boral, Prof. Dr. Ummul Khair Fatema

PID: 02 | **Characterization of Heat Insulating Ceramic Fiber Raw Material for Industrial Furnace Insulation**

T. M. S. A. Hossain, Mst Alpona Akter, M. A. Matin, M. A. Hakim and M. F. Islam

Abstract – Clay is an essential mineral which often needs improvement for particular applications. Due to huge demand in ceramic industry, nanostructure clay materials can be improved to use as advanced materials such as porous filtration, heat resistance insulators and other applications. The excellent alternating layered crystal sheet structure of clay minerals allows to comprehensively modifying its properties. Local clay was chosen as potential material and its properties are broadly investigated. Chemical composition analysis by X-ray fluorescence revealed that the clay contains Al₂O₃ (26.67 %) and SiO₂ (66.32 %) as major oxides and impurity oxides include mainly Fe₂O₃ (2.01%) and TiO₂ (2.47 %) with acceptable amount. Mineralogical study employing X-ray diffraction (XRD) exhibited mainly kaolinite and quartz phases with minor contents of illite and rutile phases. Field Emission Scanning Electron Microscopy (FE-SEM) displayed the morphological features of clay mineral structural. Particle size of kaolinite platelets varied from < 2 μm. In addition, particle shape of clay structure was also discerned with size spans from 50–500 nm. EDX analysis also gives the elemental analysis of nanostructure sheef. The local sedimentary clay resembled white clay type characteristics though XRD contradicts with well-crystalline structure of kaolinite. Differential thermal analysis (DSC-TG) confirmed phase transition occurs with increasing temperature. The obtained results from various characterization techniques provide an in-depth understanding of its fundamental characteristics to suit it for applications.

PID: 37 | **Advantages of using CAD/CAM system over Manual System in Apparel Production**
Avijeeet Datta, Md. Mutasim Uddin, Md. Mahbubur Rahman, and Md. Mazharul Helal

Abstract – Clothing industries are the backbone of national economy in Bangladesh. One of the important initial steps of an apparel industry is to design and develop garments patterns according to specification of the intended apparel and finally to plan the marker and cut the fabric as per pattern pieces. These can be done by both manually as well as by using Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM). Computer Aided Designing (CAD) and Computer Aided Manufacturing (CAM) has revolutionized the apparel industry and has become a cornerstone of many new manufacturing strategies. As much of the cost of apparel production is associated with the fabric cost, it is necessary to properly utilize the fabric and cut down the fabric wastage percentage (%). Additionally reducing the production time will further cut down the lead time. Though using CAD/CAM is costly but it provides lot of economic and technical advantages over manual system. The study examined the relative advantages of using CAD/CAM in apparel manufacturing other than manual manufacturing processes and from there a comparison between CAD/CAM based and manual based apparel manufacturing is obtained. Factors that were considered are time taken for pattern designing, manpower reduction, cost reduction, productivity. The results were as expected and there was significant improvement in productivity, desired quality, time savings as a result of using CAD/CAM system in apparel manufacturing process.

PID: 92 | **Analyzing the Effect of Neutral Enzyme on JuteCotton Blended Denim Fabric**
Md. Mazharul Helal, Md. Mahbubur Rahman, Md Mutasim Uddin, Md. Shariful Alam,
Dilshat Rubia Dola

Abstract – The processing that is incorporated in the later stage of apparel manufacturing to modify the aesthetic, appearance, fashion and comfortability of a garment is termed as garments washing. Nowadays most of the garments undergo several washing process prior to become a retail unit. However, washing is particularly important for denim fabric as denim is one of the most versatile fabrics available today and the aesthetics can be reimagined in innumerable ways. At present jute is not used as a mainstream fiber for garments manufacturing because of its rough and stiff nature. Jute and cotton can be blended together to produce a sustainable solution for jute fiber to manufacture garments. Furthermore, enzyme is an environmentally friendly substance. While using as a washing chemical, enzyme acts as a catalyst to hydrolyze fiber, soften the fiber surface and reduce pilling. The blended fabric that was used for the investigation is 70% cotton & 30% jute with twill 2/1 weave construction. This paper aims to determine the effects of industrial enzyme wash on jute-cotton blended denim fabric by treating it with neutral enzyme. Finally, the physical properties i.e. EPI, PPI, GSM, warp strength, weft strength will be compared between the raw sample and the washed sample. This study may pave the way for the enzymatic treatment of jute cotton blended denim fabric.



ABSTRACTS | Interactive Poster Session

Day- 02: 19 Dec 2021, Time: 02:00 PM, D2IPS

Venue: Online Platform, Session Chairs: Prof. Dr. Md. Mamun-Or-Rashid, Prof. Dr. Ashik Ahmed, Dr. Md. Abu Layek, Dr. Maheen Islam, Dr. Md. Selina Sharnin, Dr. Tushar Kanti Saha, Dr. Taskin Jamal, Dr. Kafiul Islam, Dr. Saad Bin Arif, Dr. Md. Samiullah, Dr. Abdullah Al Hadi, Dr. Md. Mazharul Haque

PID: 29

Analyzing the Effect of Linear Density (Ne) on the Characteristics of CVC (90:10) Melange Yarn

Md. Monir Hossan, Md. Touhidul Islam, Md. Mahbubur Rahman, Md. Fahim Bin Alam

Abstract – The physical properties of CVC Mélange yarn on ring spinning system have been studied. Cotton fibers are available in Bangladesh having good length, strength, uniformity, fineness, and excellent moisture absorption. So, the blending is performed with cotton & Polyester at feeding stage of miniature carding machine and blending ratio of cotton & polyester were 90:10. Manufacturing of CVC Mélange yarn on ring spinning have done successfully and physical properties such as bundle strength, TPI, unevenness, imperfections, strength and hairiness are observed and showed significant result among different linear density of mélange yarn.

PID: 38

Trend Analysis of Garments Printed Products among European and North American Consumers

Jannat Jahan Joya, Md Mutasim Uddin, Md. Mahbubur Rahman, Md. Mazharul Helal

Abstract – The main objective of this study is to analyze the recent trends of buying behavior of special printed garments among the European and North American consumers. Print related order data of 22 different over-sea buyers are collected from Thanbee Printing World and DBL Group Limited which consists of around 3 million pieces order. The tech packs and cost sheets are systematically analyzed to conclude which types of special printed garments are most frequently ordered by these renowned buyers. Costing data of various special garment printing processes are also analyzed. Result shows among seven different types of special garment printing, rubber printed fabrics are most frequently ordered, about 2.15 million pieces out of 3 million pieces which accounts for 70% of total ordering quantity. The second most frequently ordered style is pigment printing which accounts for 11.57% of total ordering quantity. Discharge, CMYK, flock, high density, puff accounts for 1.81%, 1.33%, 1.22%, 0.48%, 0.33% respectively of total o.

PID: 47

Smart Ceiling Fan: An Application of Ambient Intelligence

Md. Mariful Islam, Tasnim Niger, Md. Solaiman Mia

Abstract – Nowadays, energy is a scarce resource in our world. Scientists across the globe are developing different alternative sources of energy or developing tools and devices which ensure lower consumption of energy. In the hot and humid countries, people use ceiling fan as a tool to get relief from this hot weather. Due to affordability issue, ceiling fan is widely used unlike air conditioner. Particularly in public places we see huge number of ceiling fans are placed to cover wide area, to give comfort to the mass people. The ceiling fan runs the whole day despite there is no presence of people in public places. This paper intends to build a ceiling fan applying concept of ambient intelligence which will ensure efficient power consumption. The room temperature is detected by a sensor which in a way control the speed of the fan to preserve more energy. An experiment has been performed to prove the concept duly shared in this paper. The outcome of this experiment has saved 17% of electricity in a night and no electricity has been consumed in the absence of people.

**PID: 64** | **A More Effective Approach to Student's Academic Performance Prediction Using Data Mining Techniques**

Mocarram Hossain, Sarika Mahboob, Amit Mandal

Abstract – Enhancement of the education system is perhaps the most escalated concern nowadays. Thus, educational data mining (EDM) is emerging as a fundamental area of research to engage the academic area with various statistical methods. One significant study of the EDM is to analyze student's academic performance, which can assist in early decision making to enhance the educational process. Analytics on student performance is crucial in today's increasingly online-assisted learning systems. This paper aims to propose an improved performance prediction model that offers increased prediction accuracy than existing works while trying to increase the interpretability of our approach. We have approached feature selection procedures to achieve a concise feature set that produces higher prediction performance. Accordingly, our proposed model offers a reliable prediction on student's data which can assist in developing efficient academic structures.

PID: 70 | **SMART: An Improved Wireless Body Area Network**

Rajan Karmaker, Sabah Musfiah, Tanjir Ahmed Dip, Margia Binte Nasir, Md. Adnan Quaium

Abstract – Wireless Body Area Network (WBAN) has added a new dimension to modern technology. Research works related to WBAN has gained much popularity. This paper focuses on implementing a new WBAN model based on M-attempt and SIMPLE. Our proposed model is reliable, energy-efficient with higher throughput which improves the routing protocol for WBAN. This model deploys more sensors and positions them in a suitable place to perform better than the previous models. Our protocol shows a decrement in path loss and an increment in residual energy, which in turn improves the network lifetime. As a result, the number of data packets sending to the sink increases. Therefore, SMART shows better performance than M-attempt and SIMPLE. Body sensors that can easily be placed on the surface of the body or clothes are used in this protocol and the simulation is done in MATLAB. The unavailability and cost of the sensors are the limitations of this model. But this model will be a user-friendly system for distant health caring services. The proposed scheme would allow the system to use an effective cost function to select an appropriate route to sink.

PID: 116 | **A Survey on the Inclusion of IoT in Agriculture for Soil monitoring**

Nazma Tara, Md. Mahtab Uddin, Khandokar Shahid Hyder, Selina Sharmin

Abstract – Recently, the Internet of Things (IoT) has become one of the most dominant technologies in the world. It is a technology of interconnected things capable of sensing, actuating, and communicating among themselves and with the environment. It is the core technology behind the concept of smart home, smart vehicle, smart agriculture, etc. In conventional farming, a farmer has to depend only on human skills and experiences for production as there is no specific and organized data obtained from the farming environment. In fact, it is a manual process that does not ensure higher productivity and efficiency. The entire farming system needs to be modernized using smart devices to increase the efficiency and productivity of our agricultural system. IoT helps to decide for cultivating the appropriate crop by analyzing the nature of the soil, which is changing dynamically with a time reduction of manual monitoring. It provides on/realtime irrigation, real-time pesticides. Though the practice of soil monitoring and smart farming is at its inception, the world is rapidly moving towards the perfect implementation of smart farming. In this study, 23 papers are reviewed from 2017 to 2021, where IoT in agriculture soil monitoring is the main concern. Our objective is to abstract and accumulate the works regarding soil monitoring using IoT devices. Based on the review, the issues regarding soil monitoring, sensors, related technologies, wireless communication protocols, IoT platforms, and cloud computing will be analyzed to get a clear view and understand its future scope.

PID: 127**Distribution of Rice Through Valid Fingerprints**

Md. Mehedi Hasan, Umme Habiba, Shamima Akter, Shammi Afroj Mim

Abstract – The public distribution of ration supplies in Bangladesh is difficult due to the country's large population. This system is overseen by Bangladesh's Ministry of Food. Many families receive a ration card, which is an authorized document provided by the government. Having a ration card one can easily collect rations. Ration distribution is a manual process. Due to this process many problems arise mainly corruption. Our proposed system will help us a lot, especially to prevent corruption. This system allows the only one whose fingerprint will match. As a result, we developed a web application and hardware device project. This project will save us a lot of valuable time as we will be able to distribute it evenly. With proper process and time, our projects are much more accessible than at present. Where we will have every information of the customers and all the information will be delivered to them before the specified time as

PID: 128**Texture Recognition for Color Image Using Enhanced Adjacent Local Directional Ternary Pattern**

Md. Anwarul Islam

Abstract – LBP-like variants are used for texture recognition from an image. Several algorithms have been published throughout the years to improve the texture. In this paper, an extended version of the Local Directional Ternary Pattern (ELDTP) is proposed where the LDP and LTP descriptors are combined and extended to achieve using enhanced adjacent neighbor for better and more accurate textures. Moreover, we maintain color information, therefore, the proposed EALDTP works for color images rather than traditional LBP variants. To testify the performance, we have done several experiments on two different texture datasets KTH-TIPs and KTH-TIPS-2b.

PID: 135**GreenBot: A Human-Robot Interaction System For Exploring Information Using Face Image and Voice Recognition for Green University of Bangladesh Perspective**

Md. Rasel Mahmud, Shakir Hossain

Abstract – Many students who come to the Green University of Bangladesh (GUB) seeking admission and other academic information. They sometimes face difficulties in obtaining that information since they do not know where to go for it. GreenBot is a humanoid robot that's been created to provide an overview of the GUB to prospective students or newcomers to the campus who wish to learn about the various resources available to them at GUB. GreenBot can assist current students by giving information such as advisors, program coordinator contact information, and further information about the departments. GreenBot can recognize both voices and faces simultaneously while interacting with humans. To accomplish the voice recognition, human speech is required to meet a dataset that was previously trained. TensorFlow DNN has been used to build CNN layers with SOFTMAX activation for both the voice and face recognition. The NLTK was used to distinguish words from speech. A human to be in front of it, the GreenBot can recognize him if the face of him is learned to the system previously, otherwise the GreenBot is learned with the unknown human face automatically for future recognition. Haar Cascade Classifiers are used for face detection. The detected face is recognized using recognizer() function of OpenCV. Similarly for the question answering, the unanswered questions are recorded automatically and for further learning the GreenBot. The GreenBot is trained using 3600 face images and 1500 voice records (questions) from 120 humans. The system is tested using another 3150 face images and 1500 voice records (questions) from another 105 humans. GreenBot can work with an average of 98.85% accuracy in terms of voice recognition along with an average of 92.4% accuracy on face recognition with very minimal delay.



PID: 154**A High Performance Handover Cell Selection Mechanism in 5G Ultra-Dense Networks**

Nayeema Islam, Md. Abdur Razzaque, Mustafizur Rahman

Abstract – 5G networks have been regarded as a new direction in the research of future cellular networks and they provide high quality wireless services for mobile nodes. In recent years, heterogeneous ultra-dense network has emerged as a notable aspiration to the challenges of fifth generation gratification. Ultra-dense deployment of small cell has been effective in improving the cellular mobile network performance in phrases of capacity enhancement and coverage extension. However, this deployment consequence in heavy interference and severe handover problems, such as ping-pong handover, handover failure and frequent handovers, eventually results in degradation of quality of service. This research proposes a cell selection strategy for ultra-dense mobile networks that takes into account the direction of traffic as well as the speed of a group of mobile nodes thereby filtering the unwanted base stations. Among the remaining candidate cells, the target cell is chosen based on conventional base station selection scheme. The results of performance evaluation show that the proposed handover mechanism outperforms the state of the art works.



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Md Atiqur Rahman Ahad

Senior Member, IEEE
Osaka University, Japan

Workshop on Healthcare Challenges based IoT Sensors & Video

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Biography

Md Atiqur Rahman Ahad, SMIEEE, SMOPTICA, is a Professor, University of Dhaka (DU); Specially Appointed Associate Professor, Osaka University. He studied at the University of Dhaka, University of New South Wales, and Kyushu Institute of Technology. He authored/edited 10+ books in Springer, e.g., “IoT-sensor based Activity Recognition”; “Motion History Images for Action Recognition and Understanding”; “Computer Vision and Action Recognition”. He published 200+ journals, conference papers, book chapters, 130+ keynote/invited talks, 40+ Awards/Recognitions. He is an Editorial Board Member of Scientific Reports, Nature; Assoc. Editor of Frontiers in Computer Science; Editor of Int. Journal of Affective Engineering; Editor-in-Chief: IJCVSP <http://cennser.org/IJCVSP>; Guest-Editor: PRL, Elsevier; JMUI, Springer; JHE; IJICIC; Member: ACM, IAPR. More: <http://AhadVisionLab.com>





STI Expo 2021 is a flagship event of the 3rd International Conference on Sustainable Technologies for Industry 4.0 (STI 2021). For the first time, STI expo 2021 will create a common platform for researchers and industry practitioners to plan, discuss and achieve the goals of industry 4.0. STI expo 2021 is going to be organized with the purpose of amelioration of business relations, demonstration of industrial technologies and collaboration with industry for research projects. The event will also facilitate the exhibition of both new and upcoming technological products, presentation of the technological innovation targets for industrial revolution and an environment for the cooperation and development of new partnerships.

The Organizing Committee of STI Expo 2021 invites Software and App development companies, Telecommunication vendors, Aggregators, Power distribution & Transmission companies, Heavy Machinery industries, Manufacturing Industries, Sales and Service companies, Engineering Consultant & management agencies, Textile industries, Government bodies, and Technical Associations engaged and interested in Computer & Software engineering, Electrical power engineering, Renewable energy or Energy systems to sponsor the conference or, arrange an industrial trade exhibition booth.

In the global competitive market where businesses are continuously looking for new opportunities to grow, we believe, STI Expo 2021 will make a difference to transform the society for socio economic solvency through research, innovation and community service.

Industrial Panel Discussion

Title: Required Technological Transition to Achieve Sustainable Development for Emerging Economy



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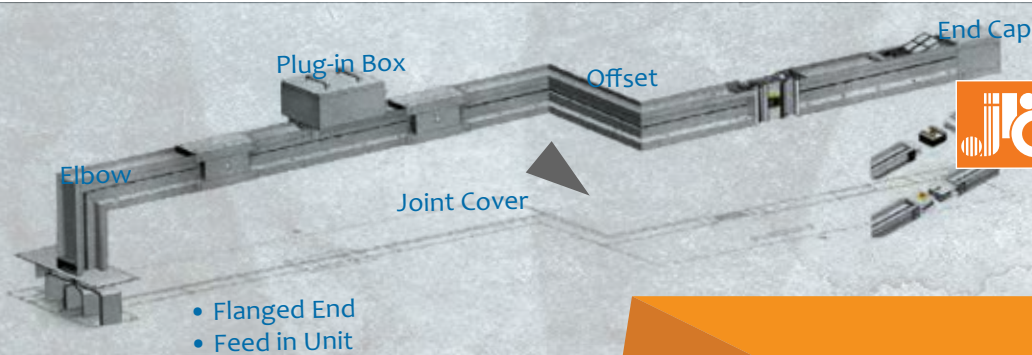


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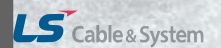


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2022 4th International Conference on Sustainable Technologies for Industry 4.0 (STI)

Green University of Bangladesh, Permanent Campus, Purbachal American City, Rupgonj, Dhaka, Bangladesh

Date: 17-18 December 2022 [✉ sti@green.edu.bd](mailto:sti@green.edu.bd) [🌐 fse.green.edu.bd/sti-2022](http://fse.green.edu.bd/sti-2022)

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- With each subsequent edition, involvement of international participants is increasing, e.g., 2019: 20 countries, 2020: 22 countries, and 2021: 35 countries
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STI conference provides a platform for facilitating and promoting innovative research on Industry 4.0 (or Industrial Revolution 4.0) by encompassing research areas related to smart industries, smart grids, intelligent transportation, real-time healthcare, and others that are bolstered by automation and cyber-physical systems. In addition, detailed studies and research are required to design and develop sustainable solutions for Industry 4.0 since they depend on the complex relations among humans, systems and objects, which is also covered in this conference.

STI 2022 welcomes researchers, industry professionals, and practitioners to display their scientific achievements and sustainable solutions for industrial developments in the fields of computer science & engineering, electrical & electronic engineering, textile engineering, robotics and cyber-physical systems related to Industry 4.0. It will be hosted at the permanent campus of Green University of Bangladesh, Purbachal American City, Dhaka, Bangladesh during 17-18 December 2022.

We are seeking original high-quality innovative research for submissions. All submissions to STI 2022 will go through a double-blind peer reviewing process. Accepted and presented papers will be submitted to the IEEE Xplore digital library. Papers presenting original research are being sought within following tracks, but not limited to:

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Submission of Special Session, Tutorial and/or	
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