American International University-Bangladesh (AIUB)

SDG Activity Report 2023

SDG 7: Affordable and Clean Energy

Ensure access to affordable, reliable, sustainable and modern energy for all

American International University-Bangladesh (AIUB) actively supports Sustainable Development Goal 7 by promoting affordable and clean energy through education, research, and campus initiatives. The university regularly hosts workshops and webinars such as “Hybrid Power System Simulation” and “Offshore Wind Energy: From Wind Turbines to Wind Farms”, offering insights into renewable energy systems and their practical applications.

AIUB is committed to reducing energy consumption on campus. The university has adopted energy-efficient building standards and is actively upgrading its infrastructure for better energy efficiency.

Through collaborations with institutions like SREDA, AIUB has organized events such as “Net Metered Rooftop Solar in Bangladesh”, promoting solar energy use. Research projects like “Design of Off-Grid Solar-Wind-Bio Hybrid Power Systems” further demonstrate AIUB’s commitment to clean energy innovations.

The university provides community outreach programs to educate the public on energy efficiency and renewable energy technologies. AIUB also supports local industries by offering energy efficiency assessments and workshops. These initiatives reflect AIUB’s dedication to fostering sustainable energy practices on and beyond its campus, contributing significantly to SDG-7.

#AIUB #SDG7 #CleanEnergy #RenewableEnergy #Sustainability

Contents

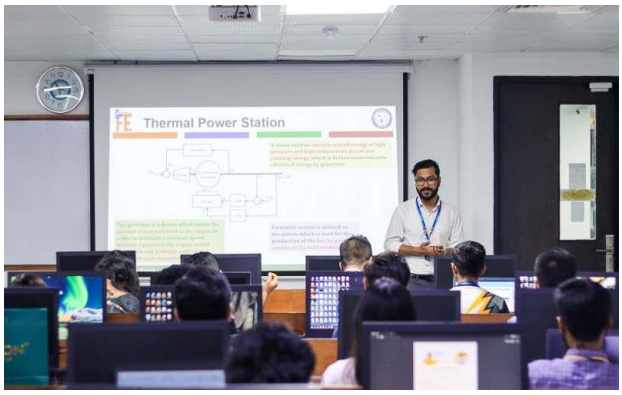
University Activities towards SDG 7

Workshop on "Hybrid Power System Simulation including Renewable Energy Source using PSCAD Software"

The AIUB Community of Engineering Students (ACES) organized a workshop titled "Hybrid Power System Simulation Including Renewable Energy Source Using PSCAD Software" at DN0209, Building D, AIUB. The program began at 10 AM with 43 pre-registered participants. This workshop's objectives were to impart knowledge on renewable energy, how to model a hybrid power system, and the use of PSCAD software to simulate and examine the current frequency range in a power system.

In his opening remarks, Dr. Md. Rifat Hazari (Deputy Director, Dr. Anwarul Abedin Institute of Innovation & Senior Assistant Professor, Department of EEE, AIUB) emphasized the importance of recognizing PSCAD software in daily tasks. He demonstrated to the participants how to simulate using this software, and each participant practiced on their own. After a brief intermission, he discussed how participants could use renewable energy sources to modify the spectrum of current frequencies on power grids. At the end of the workshop, a short question and answer session was held, during which the instructor answered queries raised by the participants. All participants received a certificate for attending and gaining knowledge from the workshop. Afterwards, Dr. Md. Saniat Rahman Zishan (Associate Professor, Faculty of Engineering, AIUB) concluded the workshop by thanking and presenting the token of appreciation to the instructor.

https://www.aiub.edu/workshop-on-hybrid-power-system-simulation-including-renewable-energy-source-using-pscad-software



Workshop on "Modeling and Performance Analysis of Hybrid Energy Systems Using PSCAD Software"

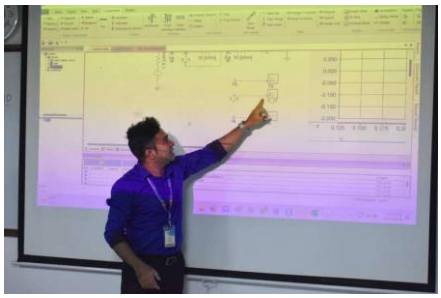
On October 19, 2023, the Engineering Student's Association of Bangladesh (ESAB) AIUB Unit Face organized a workshop on "Modeling and Performance Analysis of Hybrid Energy Systems Using PSCAD Software" at room number DN0209. The workshop started at 11 AM with 30 registered participants. This insightful workshop was conducted by Mr. Mehedi Azad Shawon, Assistant Professor, Department of Electrical and Electronic Engineering (EEE) of AIUB. The event was designed to provide students with a deeper understanding of PSCAD software, practical experience in its use, and its crucial role in electrical engineering and future research opportunities.

In the workshop, Mr. Mehedi Azad Shawon expertly covered the vital aspects of PSCAD software, including its interface, how to use it, and the significant importance it holds in power system analysis. He facilitated an engaging and interactive session that allowed students to explore the software's functionalities and capabilities, making it accessible to all participants, regardless of their prior experience. During the workshop, he provided valuable guidance and support to the students, ensuring they grasped the concepts and techniques involved in modeling and analyzing hybrid energy systems using PSCAD.

Furthermore, Mr. Shawon highlighted the practical outcomes of various research projects that have utilized PSCAD software. He illustrated the software's role in advancing research and development in the field of hybrid energy systems, showcasing its real-world applications and contributions to the industry.

The workshop was successfully concluded by the honorable advisor of ESAB AIUB Unit Face, Dr. Mohammad Abdul Mannan, (Professor and Associate Dean, Faculty of Engineering, AIUB), who expressed his gratitude to the honorable instructor. Dr. Mannan presented a token of appreciation, acknowledging the valuable insights shared during the workshop.

https://www.aiub.edu/workshop-on-modeling-and-performance-analysis-of-hybrid-energy-systems-using-pscad-software



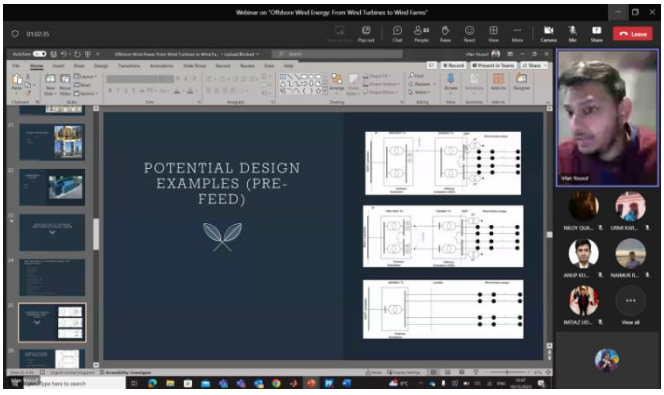
Webinar on “Offshore Wind Energy: From Wind Turbines to Wind Farms”.

On December 10, 2023, AIUB Community of Engineering Students-(ACES) organized a webinar titled "Offshore Wind Energy: From Wind Turbines to Wind Farms". The program started at 4 PM with 91 participants through Microsoft Teams. The purpose of the webinar was to learn about harnessing the wind's energy and converting it into usable electricity, contributing to more sustainable energy while reducing reliance on fossil fuels and decreasing carbon emissions, thus achieving SDG goal 7: Affordable & Clean Energy.

The event started with a warm introduction of the distinguished speaker, Mr. Mohammad Irfan Yousuf (R&D Power Systems Engineer, Offshore Renewable Energy Catapult, Northumberland, UK). He began the session by providing a scenario of offshore wind energy consisting of clusters of wind turbines installed in the water, Turbine Functionality, Switchgears, and their roles to capture the kinetic energy from the wind, rotation of the blade’s spins connected to a generator. Also, he explained the electrical components in an offshore wind farm as well as showed the HVDC linkage of an offshore substation to an onshore substation. Furthermore, he reviewed the techno-economic discussion for the use of high voltages which makes offshore wind energy an increasingly viable and promising renewable energy source.

Then, the Q&A session was held for the participants. Dr. Md. Saniat Rahman Zishan (Associate Professor, Director, Faculty of Engineering, AIUB) concluded the webinar by thanking and presenting a virtual crest and certificate to the honorable speaker.

https://www.aiub.edu/webinar-on-offshore-wind-energy-from-wind-turbines-to-wind-farms



Seminar on “Fundamentals of Materials Science and the Prospect of Research Opportunities in This Field”

On January 26, 2023, the Faculty of Engineering, AIUB organized a seminar titled "Fundamentals of Materials Science and the Prospect of Research Opportunities in This Field." which was supported by the AIUB Community of Engineering Students (ACES). The program started at 3:00 PM with 46 participants at Annex 3 (Room No. 3202), AIUB. The purpose of the seminar was to provide an overview of the fundamentals of materials science and to discuss the prospect of research opportunities in this field.

The event was inaugurated by Prof. Dr. ABM Siddique Hossain (Professor, Dean, Faculty of Engineering, AIUB), where he discussed the importance of material science and provided insights on the current and future conditions of the field in both the local and global contexts. He also highlighted the areas in which our universities have created opportunities for research in materials science. Following that, the honorable speaker, Dr. Rezwan Ahmed (Post-doctoral research fellow, High Energy Accelerator Research Organization, Tsukuba, Japan), was warmly welcomed by the audience. He began his speech by providing a fundamental understanding of his research topic. He explained how the research was carried out and how it will impact the future. Furthermore, he gave a brief overview of the various branches of materials science. Then, a short Q/A session was held for the participants. Prof. Dr. Mohammad Abdul Mannan (Director, Faculty of Engineering, AIUB) concluded the seminar by thanking the speaker and presenting a token of appreciation to the speaker.

https://www.aiub.edu/seminar-on-fundamentals-of-materials-science-and-the-prospect-of-research-opportunities-in-this-field

SREDA Organized a Workshop on “Net Metered Rooftop Solar in Bangladesh” at AIUB

On June 5, 2023, the Sustainable and Renewable Energy Development Authority (SREDA) organized a workshop titled "Net Metered Rooftop Solar in Bangladesh" at American International University-Bangladesh (AIUB). The program started at 10:30 AM with 230 participants at the Auditorium, Building D, AIUB. The purpose of the workshop was to inform the students about the benefits, implementation, and regulatory aspects of net-metered rooftop solar systems in Bangladesh.

Dr. Md. Saniat Rahman Zishan (Director & Associate Professor, Faculty of Engineering, AIUB), provided an introductory overview of net metered rooftop solar in Bangladesh during his opening remarks. Following that, Mr. K. M. Ali Azam (Deputy Director, Renewable Energy (Solar), Sustainable and Renewable Energy Development Authority, SREDA), took the stage to deliver his presentation. He highlighted the importance of solar energy in meeting energy demands, reducing dependence on traditional sources, and emphasized SREDA's role in promoting renewable energy in Bangladesh. After that, the second speaker, Mr. Md. Rashedul Alam (Assistant director, Renewable Energy (Solar), Sustainable and Renewable Energy Development Authority, SREDA) discussed business models for net metered rooftop solar systems, covering capital expenditure (CAPEX) and operational expenditure (OPEX). He explained the energy calculation and settlement process and provided insights into the PV module monitoring structure. Later on, special guest Prof. Dr. A. B. M. Siddique Hossain (Dean, Faculty of Engineering, AIUB) thanked the speakers. He hoped that SREDA will take more initiative to popularize renewable energy to save the future generation. Following that, Special guest Mr. Khandker Md. Abdul Hye, PhD (Member, Joint Secretary (Renewable Energy), SREDA) provided a comprehensive overview of the workshop, summarizing the key points discussed throughout the event. Lastly, chief guest of the workshop Ms. Munira Sultana, ndc (Chairman, SREDA) took the stage. She emphasized the importance of carbon training, highlighted different types of renewable energy, and discussed the positive impact of utilizing renewable energy sources on the environment. Concluding the workshop, Chair of the Session Prof. Dr. Md. Abdur Rahman (Pro Vice-Chancellor, AIUB), delivered the closing speech. In his remarks, he expressed gratitude to SREDA for their remarkable efforts in advancing sustainable energy practices in Bangladesh.

Prof. Dr. Md. Abdur Rahman and Prof. Dr. A. B. M. Siddique Hossain presented token of appreciation to all the guests. The remarkable program came to an end with a group photo.

https://www.aiub.edu/sreda-organized-a-workshop-on-net-metered-rooftop-solar-in-bangladesh-at-aiub

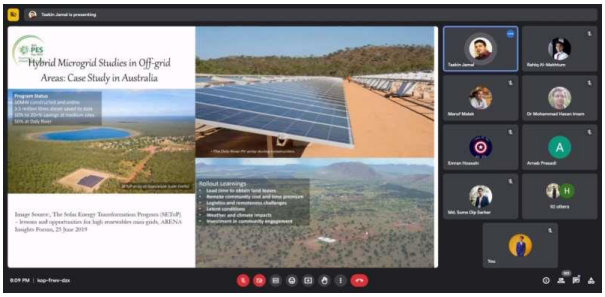
IEEE AIUB Student Branch Celebrated PES Day 2023 with Engaging Webinar

On Sunday, May 21st, 2023, the IEEE AIUB Student Branch successfully organized a webinar session titled “Advancements in Renewable Energy Technologies: Shaping the Future of Power and Energy” in celebration of the 6th IEEE PES Day. The webinar started at 7:10 PM and ended at 8:40 PM. A total of 100+ participants attended the webinar. The webinar aimed to inform students about the latest developments in the power and renewable energy sectors, including advancements in wind, solar, and hydro technologies. It highlighted the potential of renewable energy to meet growing energy demands while addressing the climate crisis, inspiring students in their career choices.

Advisor of IEEE AIUB Student Branch Dr. Md. Saniat Rahman Zishan, Director, Faculty of Engineering, American International University - Bangladesh inaugurated the event by emphasizing the significance of PES Day and its relevance to the participants. He shed light on the power and energy sector, setting the stage for an insightful session. Advisor of IEEE Power and Energy Society AUST Student Branch Chapter Dr. Taskin Jamal, Assistant Professor, Department of EEE, AUST took the floor as the speaker of the session. His session revolved around sustainability and its crucial role in combating the global energy crisis. He delved into topics such as the impact of climate change, the revolution in renewable energy, and the importance of achieving a carbon emission-free environment. The webinar's objective aligned with United Nations Sustainable Development Goals (SDGs) 7 and 13. SDG 7 aims to ensure access to affordable, reliable, sustainable, and modern energy for all, while SDG 13 calls for urgent actions to combat climate change and its impacts. The webinar aimed to inspire participants to contribute to a more sustainable future by addressing these goals. The discussion further explored the volatile energy market, shifting energy forecasts, and the expanding capacity of renewable resources.

Dr. Taskin emphasized China's dominance in renewable energy manufacturing and the potential for wind and solar energy to double within the next five years. He also touched upon alternative fuels, fuel cells, and the increasing adoption of renewable energy in various sectors. Following the completion of the speaker's session, an engaging Q&A session took place, allowing participants to further delve into the topics discussed. Motivator of IEEE AIUB Student Branch Dr. Shameem Ahmad, Assistant Professor, Department of EEE, Faculty of Engineering, AIUB concluded the session by expressing gratitude to the esteemed speaker and presenting a token of appreciation on behalf of the IEEE AIUB Student Branch. Overall, the webinar served as an educational platform, fostering awareness and understanding of sustainable energy solutions while emphasizing the importance of taking action to combat climate change in line with United Nations SDGs 7 and 13.

https://www.aiub.edu/ieee-aiub-student-branch-celebrated-pes-day-2023-with-engaging-webinar



Industrial Tour to the DESCO 132/33 KV Grid substation at Bashundhara R/A

On March 21st and 22nd,2023, Faculty of Engineering Organized an Industrial Tour to the DESCO 132/33 KV Grid substation at Bashundhara R/A which was supported by AIUB Community of Engineering Students (ACES). A group of 107 students from AIUB along with 4 faculty members Mr. Mohammad Khurshed Alam (Assistant Professor, Faculty of Engineering, AIUB), Dr. Shameem Ahmad (Assistant Professor, Faculty of Engineering, AIUB), Mr. Mehedi Hasan (Assistant Professor, Faculty of Engineering, AIUB), Mr. Sadman Shahriar Alam (Lecturer, Faculty of Engineering, AIUB) visited the substation in 4 groups.

The students were guided by the senior engineers of the substation. The engineers provided the students with a first-hand understanding of the switchgear, protection, distribution, and transmission systems utilized in the generation of electric power. The students were taken to the control room, which housed several PLCs used to keep an eye on the system for stepping down from 132KV to 33KV. Later, the senior engineers of DESCO answered various questions asked by the students. The students expressed their warm gratitude towards the authority of the Dhaka Electric Supply Company Limited (DESCO) for their great support and assistance. The visit proved to be an enriching experience, allowing the students to gain invaluable insights into the sophisticated workings of modern power distribution systems. During the closing session, Prof. Dr. Md. Abdul Mannan (Associate Dean, Faculty of Engineering, AIUB) and Dr. Md. Saniat Rahman Zishan (Head, Department of Computer Engineering, AIUB) handed over the token of appreciation to the engineers of DESCO 132/33 KV Grid substation.

https://www.aiub.edu/industrial-tour-to-the-desco-13233-kv-grid-substation-at-bashundhara-ra

Workshop conducted by “Grameen Shakti”

On Tuesday, 26th September 2023, IEEE AIUB Student Branch WIE Affinity Group participated in a workshop organized by the non-profit company Grameen Shakti. The event emphasized the significance of greenhouse gases, as well as the impacts of global warming and climate change.

The workshop was hosted and inaugurated by Mr. Abdul Arif, Manager, Project Development, Grameen Shakti, Engr. Md. Arafath Mostafa, Deputy Manager, Grameen Shakti, and Ms. Rubaya Nasrin, Assistant Manager, Project Development, Grameen Shakti. They addressed the topics of global warming and climate change, delving into the concept of greenhouse gases. Additionally, they explored various forms of renewable energy, particularly focusing on solar energy and the diverse types of solar panels. The discussion revolved around the significance of solar energy, highlighting its associated benefits.

Moreover, they specifically talked about the solar panel installations at AIUB, following which they visited the solar panels installed at AIUB campus. The workshop concluded as Prof. Dr. Mohammad Abdul Mannan, Associate Dean, Faculty of Engineering, American International University – Bangladesh; Advisor, IEEE AIUB Student Branch and Dr. Md. Saniat Rahman Zishan, Director, Faculty of Engineering, AIUB; Advisor, IEEE AIUB Student Branch provided the closing remarks and handed over the tokens of appreciation to the hosts.

The workshop effectively accomplished its objective by raising awareness about the consequences of global warming and climate change among participants. It also highlighted the merits of renewable energy sources and the advantages associated with various solar panel technologies. As this workshop emphasized the significance of providing affordable and sustainable energy access for everyone in the fight against climate change and its effects, it ultimately aligned with SDG-7 (Affordable and Clean Energy) and SDG-13 (Climate Action).

https://www.aiub.edu/workshop-conducted-by-grameen-shakti

International Conference on Robotics, Electrical and Signal Processing Techniques 2023 (3rd ICREST ’23)

The Faculty of Engineering of the American International University Bangladesh (AIUB) organized the 3rd International Conference on Robotics, Electrical and Signal Processing Techniques 2023 (3rd ICREST ’23) on January 7-8, 2023. The two-day conference featured 7 keynote speakers, 12 invited speakers and several other distinguished academic scholars and industry experts. Nearly 16 technical sessions with 69 papers were presented and authored by researchers from 13 different countries on a diverse array of topics such as, Power, Renewable Energy, Microelectronics, Robotics, AI, Big Data and Networking, Nanotechnology, Telemedicine etc.

Dr. Carmen Z. Lamagna (Chief patron of ICREST) inaugurated the conference. Later, Prof. Dr. A B M Siddique Hossain (General Chair of the Conference and Dean, Faculty of Engineering, AIUB), Prof. Dr. Mohammed Moshiul Hoque (Professor, IEEE BDS Chair; TPC Chair, 3rd ICREST’23, CUET) and Prof. Dr. Celia Shahnaz (Special Guest, and TPC Chair ICREST’23, SMIEEE, Professor, EEE Dept., BUET) delivered their speeches in the inauguration ceremony.

Keynote speeches were provided by Prof. Dr. Celia Shahnaz (Special Guest, and TPC Chair ICREST’23, SMIEEE, Professor, EEE Dept., BUET), Prof. Dr. M. Moshiul Hoque (Professor, IEEE BDS Chair; TPC Chair, 3rd ICREST’23; and ECE Department, CUET), Prof. Mohammad S. Alam (Texas A&M University - Kingsville, Texas, USA), Prof. Dr. Erchin Serped (Professor, Texas A&M University, College Station, Texas, USA), Prof. Dr. A B M Siddique Hossain (General Chair of the Conference and Dean, Faculty of Engineering, AIUB), Dr. Nemai Chandra Karmakar (Director, Industry Engagement, Monash University, Australia) and Dr. Shaikh Anowarul Fattah (TPC Chair ICREST’23, SMIEEE, Professor, Department of EEE, BUET) on their recent research topics.

The Closing and Award Distribution Ceremony started with a cultural program by the AIUB Performing Arts Club (APAC). The welcome speech of the closing ceremony was delivered by Prof. Dr. ABM Siddique Hossain. Later, Prof. Dr. Shaikh Anwarul Fattah thanked the organizing committee and suggested numerous future scopes for cooperation. The chief guest of the closing ceremony, Mr. Ishtiaque Abedin (Founder Member and Chairman, Board of Trustees, AIUB) gave an inspiring speech where he congratulated the AIUB team for the success of the program. He also handed over the Dr. Anwarul Abedin and Mrs. Hasna Abedin Scholar Grants. The Scholar Grants were delivered to winners of various categories such as Best Paper, Best Presentation (Male), Best Presentation (Female), Best SDG Posterity. In his concluding remarks, Prof. Dr. Md. Abdur Rahman (Pro Vice-Chancellor, AIUB) shared the future plans the 4th ICREST’25 in January 2025 along with thanking all stakeholders of the conference.

https://www.aiub.edu/icrest-2023

Seminar on “Progress and Stability Enhancement of Hybrid Perovskite Solar Cells: Opportunities and Challenges”

On August 9, 2023, the Department of Electrical & Electronic Engineering (EEE), Faculty of Engineering (FE), AIUB in collaboration with the Engineering Students Association of Bangladesh (ESAB) AIUB Unit Face organized an insightful seminar titled “Progress and Stability Enhancement of Hybrid Perovskite Solar Cells: Opportunities and Challenges”. This seminar, held at the Multipurpose Hall of D – Building, brought together over 150 attendees to learn about the latest advancements and remaining obstacles in developing more efficient and durable perovskite solar cells.

The program started with opening remarks by Dr. Mohammad Mahbub Rabbani, (Associate Professor, Department of Chemistry, Deputy Director, Dr. Anwarul Abedin Institute of Innovation, AIUB) where he provided an overview of the rapid advancements and remaining challenges in developing stable, efficient hybrid perovskite solar cells. After that, Dr. Md. Mahbubur Rahman, (Associate Professor, Department of Applied Chemistry, Konkuk University, South Korea) was invited on stage to share his extraordinary work. He began with an introduction to solar energy and solar cells, providing background information on photovoltaics and the need for continued advancement of solar technologies. This main section of the talk focused on perovskite solar cells. Next, he discussed the principles behind how perovskite PV devices work and their advantages over other solar cell materials. While concluding his speech, he summarized the tremendous promise of perovskite solar cells as an emerging PV technology. Following an engaging Q/A session, the faculty members and the participants got the opportunity to interact with the speakers and gained further clarification on the topics discussed.

The seminar was successfully concluded by Prof. Dr. Abdul Mannan (Associate Dean, Faculty of Engineering, AIUB). Prof. Dr. Abdul Mannan (Associate Dean, Faculty of Engineering, AIUB) and Prof. Dr. S Mosaddeq Ahmed (Head, Department of Chemistry, AIUB) handed over the crests and expressed appreciation toward distinguished speaker for sharing his expertise.

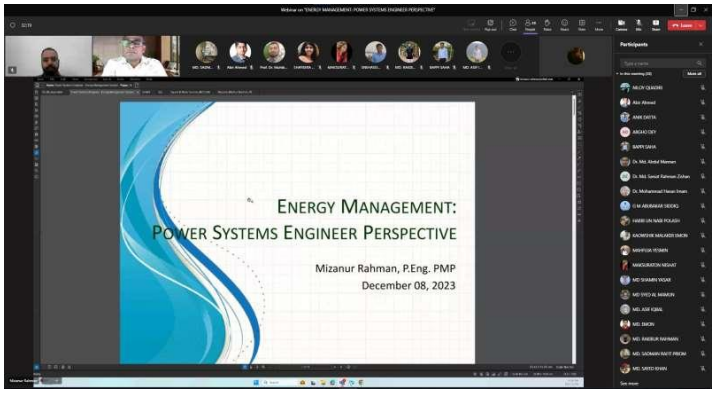
https://www.aiub.edu/seminar-on-progress-and-stability-enhancement-of-hybrid-perovskite-solar-cells-opportunities-and-challenges

Webinar on “Energy Management: Power Systems Engineering Perspective”.

On December 9, 2023, the Department of Electrical & Electronics Engineering (EEE) organized a webinar titled "Energy Management: Power Systems Engineering Perspective" which was supported by the AIUB Community of Engineering Students (ACES). The program started at 10:30 AM with 51 participants including senior students and few faculty members through Microsoft Teams. The purpose of the webinar was to learn from industry experts and seasoned professionals in the field of power systems engineering and energy management to achieve SDG goal 7: Affordable & Clean Energy.

The event was inaugurated by Mr. Nafiz Ahmed Chisty (Associate Professor, Department Head, Department of Electrical & Electronic Engineering, AIUB) where he discussed planning and optimizing the use of energy resources to achieve sustainability. Following that, the keynote speaker, Md. Mizanur Rahman (P.Eng. MBA, PMP, Telecom Design Engineer, CIK Telecom Inc. Toronto, Ontario) was warmly introduced. Then the speaker began the session by providing a scenario of a unity distribution system by its demand response which allocates electricity consumption patterns, and grid operations, enhancing grid stability along with infrastructure upgrades. Also, he explained the potential capacity, and market structure including available programs and incentives with an estimated potential revenue. Furthermore, he reviewed Solar Generation Integration and Prioritize Self -Consumption which are maximizing the use of both batteries and solar panels in energy management. Then, a short Q&A session was held for the participants. Dr. Mohammad Abdul Mannan (Professor, Associate Dean, Faculty of Engineering, AIUB) concluded the webinar by thanking the speaker and presenting a virtual crest and certificate to the honorable speaker.

https://www.aiub.edu/webinar-on-energy-management-power-systems-engineering-perspective



Seminar on 'Space: The New Frontier, South Asian View'

Eminent space scientist and former ISRO Chief, Padma Shri Prof. Kiran Kumar delivered a talk (online) at Dr. Anwarul Abedin Lecture Series of the American International University- Bangladesh (AIUB) on Wednesday, September 27. This signature public lecture series – designed to engage guest speakers of extraordinary academics and professional distinction to broaden and enrich the classroom-based education of the University – celebrates the pioneering role, benevolence, and contribution of AIUB's Founder Chairman in the education sector of Bangladesh.

Prof. Kumar – currently a Member, Space Commission of India and Chairman, Physical Research Laboratory Management Council – delivered his talk on 'Space: The New Frontier (South Asian View).' The hybrid event was moderated by Dr. Mohammad Zahidul Islam Khan (Registrar, AIUB) and participated by around 200 students, faculty and researchers from the AIUB, AIT-Thailand, BSMRAAU, MIST, UIU and the University of Sir Jayewardenepura, Sri Lanka. Aviation and aerospace enthusiasts from the Bangladesh Air Force, Atomic Energy Commission and Supreme Court at registered from the event.

Prof. Kumar, in his talks, outlined the evolution of Indian space industry. He stressed that the states in the global south should pursue a people-centric approach to meet the national objectives in materializing space programs through education, innovation, and research. Progress in the space sector requires a systematic, coherent, and focused approach with long-term commitments – he added. A lively question and answer session followed his talks. Replying to a question by Prof Rahmatullah on the fading hope of Chandrayaan-3 to 'wake up' from its lunar 'nightfall sleep' (14 days on earth) - the former ISRO Chief explained the extreme weather condition endured by the lunar lander after its historic landing near the lunar south pole and completing its primary mission. Applauding AIUB's initiative for arranging event participated by young students, Prof. Kumar hoped to participate in such events in future and facilitate the exchange of knowledge and collaboration between Bangladesh and India in this field.

In his closing remarks, AIUB's Pro VC Prof. Dr. Md. Abdur Rahman reiterated the centrality of a systemic, coherent, and people-centric long-term projects to harness the potential and opportunities of space technology. Thanking the speaker for an enlightening and engaging session, Prof Rahman mentioned some of the projects of Amateur Experimental Rocketry Dhaka (AERD), a hybrid rocket propulsion research organization of AIUB's Dr Anwarul Abedin Institute of Innovation (D2A2I) and expressed hopes for collaboration with ISRO.

https://www.aiub.edu/seminar-on-space-the-new-frontier-south-asian-view

AIUB Environment Club celebrated World Environment Day

The AIUB Environment Club (AEC) of the American International University-Bangladesh (AIUB) celebrated the World Environment Day on June 05, 2023, by organizing different events to create awareness among students of AIUB. Professor Dr. Md. Abdur Rahman, Pro-Vice Chancellor of AIUB inaugurated the event by planting a tree on the campus. Prof. Dr. A. B. M. Siddique Hossain (Dean, Faculty of Engineering, AIUB), Professor Dr. Mohammad Abdul Mannan (Associate Dean, Faculty of Engineering, AIUB), Professor Dr. S. Mosaddeq Ahmed, (Head, Department of Chemistry, AIUB), Dr. Md. Saniat Rahman Zishan (Director & Associate Professor, Faculty of Engineering, AIUB), Dr. Mohammad Mahbub Rabbani (Associate Professor and Deputy Director of the Dr. Anwarul Abedin Institute of Innovation, AIUB), Dr. Md. Rifat Hazari (Senior Assistant Professor , Deputy Director of Dr. Anwaril Abedin Institute of Innovation, AIUB), Ms. Munira Sultana, ndc (Chairman, Sustainable and Renewable Energy Development Authority, SREDA), Dr. Khandker Md. Abdul Hye, (Joint Secretary, SREDA), several other faculty members from different departments, administrative officers, and members of AEC were present at that time.

After the tree plantation, a rally displaying various placards marched across the campus to extend awareness and inspire students to take necessary steps to save our environment. Members of the AIUB Environment Club, general students, faculty members, and administrative officers of AIUB participated in the rally. After the rally, saplings were distributed among students.

Prior to arranging these events, AEC decorated entrance of AIUB and campus with various types of posters containing different messages and instructions to keep our environment sustainable and specially to build awareness of plastic pollution as this year, the theme for World Environment Day 2023 is #BeatPlasticPollution.

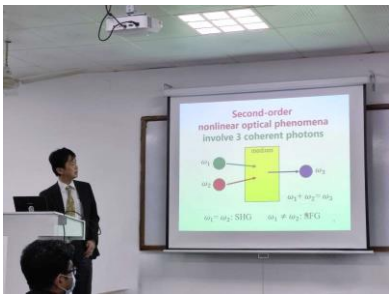
https://www.aiub.edu/aiub-environment-club-celebrated-world-environment-day

Seminar on “Optical sum frequency and second harmonic generation study of hydrogenated silicon surfaces”

On December 28, 2022, Department of Industrial and Production Engineering (IPE), AIUB organized a seminar titled “Optical sum frequency and second harmonic generation study of hydrogenated silicon surfaces” which was supported by AIUB Community of Engineering Students (ACES). The program started at 2:00 PM with 45 pre-registered participants at Room No. 3202, Annex 3, AIUB. The purpose of the seminar was to provide the students with a clear view about the hydrogenated silicon surfaces and its optical sum frequency and second harmonic generation study.

The program started with the inauguration speech by Prof. Dr. ABM Siddique Hossain (Dean, Faculty of Engineering, AIUB) where the important aspects of material science were discussed. Following that the honorable speaker of the seminar Prof. Dr. Goro Mizutani (Professor, Japan Advanced Institute of Science and Technology, Japan) briefly discussed about the overview of hydrogenated silicon surfaces. He highlighted the construction of an ultra-high vacuum SFG & SHG microscopy spectroscopy system. He concluded his remarks by emphasizing the prospects in this industry. After that, a brief Q&A session was held for the participants. Prof. Dr. Mohammad Abdul Mannan (Director, Faculty of Engineering, AIUB) concluded the seminar by thanking the speaker and presenting a token of appreciation to the speaker.

https://www.aiub.edu/seminar-on-optical-sum-frequency-and-second-harmonic-generation-study-of-hydrogenated-silicon-surfaces



Faculty Research and Publication on SDG 7

Porous Hybrid Electrode Materials for High Energy Density Li-Ion and Li-S Batteries.

DR. S. MOSADDEQ AHMED et el.

Hybrid materials play a key role in enhancing the electrochemical properties of electrode materials for lithium-ion and lithium-sulfur batteries. Porous hybrid materials offer high surface area and high conductivity. Moreover, they can store high energy with their large active site. In this chapter, we discussed the highly efficient porous electrode materials (cathode and anode) for the development of the practically used rechargeable lithium-ion and lithium-sulfur batteries. This chapter will open windows for designing next-generation energy storage.

https://doi.org/10.1007/978-3-031-23401-9_7

Porous Hybrid Electrode Materials for High Energy Density Li-Ion and Li-S Batteries

DR. MOHAMMAD TARIQUL ISLAM et el.

Hybrid materials play a key role in enhancing the electrochemical properties of electrode materials for lithium-ion and lithium-sulfur batteries. Porous hybrid materials offer high surface area and high conductivity. Moreover, they can store high energy with their large active site. In this chapter, we discussed the highly efficient porous electrode materials (cathode and anode) for the development of the practically used rechargeable lithium-ion and lithium-sulfur batteries. This chapter will open windows for designing next-generation energy storage.

https://doi.org/10.1007/978-3-031-23401-9

IoT-Based Smart Poultry and Fish Farming System Using Arduino

DR. MUHIBUL HAQUE BHUYAN et el.

This research work aims to reform the conventional farming system, making it smart and automated with the use of Internet of Things (IoT) technology. The work targeted to automate the poultry and fish farming system. As such, the system uses an Arduino Uno microcontroller as a digital controller integrated with an IoT to aid farmers in remote monitoring and controlling the farming system. The farming system consists of a poultry farm at the top and a fishing farm at the bottom of a vertical farming system. The system mainly monitors the critical parameters of the farming environment, such as pH value, temperature, humidity, dissolved oxygen levels, etc. through some sensors. Then it takes appropriate actions based on the sensed parameter values through some actuators, such as servomotor. DC motor, pump, fan, etc. to regulate the farming environment's variables to the values within the acceptable ranges automatically. This would reduce the time and effort to be spent on

farming significantly. Testing and evaluation of the system through Proteus software simulation and hardware implementation show that the target has been achieved.

https://icbbdb.com/workshop-on-icbbdb-wicbbdb-2023/

Isolation Forest Based Anomaly Detection and Fault Localization for Solar PV System

DR. MD. SANIAT RAHMAN ZISHAN et el.

The decrease in fossil fuel reserves has prompted a global move toward distributed energy resources. For this reason, solar PV power generation has recently gained much attention as a feasible renewable energy source. However, large-scale generation is challenging if there are anomalies in individual solar PV panels. This will reduce the efficiency of the PV system and create a potential fire hazard. In this perspective, the anomaly detection technique discloses system anomalies accurately and effectively. Identified anomalies will localize the event for an improved generation. This paper addresses the performance analysis of using the isolation forest technique to identify anomalies in the PV system and the rule-based fault localization technique to identify defective panel events. In the developed model, the isolation forest technique found around 453 anomalies in 45,740 observations, and approximately six panels indicated a fault in the system. The accuracy score is found to be approximately 0.9886. The proposed fault detection method will help detect the faults in solar power systems.

Total Harmonic Distortion Reduction in a Power Grid: A UPQC Based Approach

BISHWAJIT BANIK PATHIK et el.

This study shows a novel design for a unified power quality conditioner (UPQC) to improve the power quality. The designed UPQC has two active power filters (APF) in shunt and series combinations. PWM (pulse width modulation) and hysteresis controls are the two control mechanisms used in this study. To reduce harmonics, a direct-quadrature zero (dq0) conversion is performed. In case 1, for a single-bus system, the total harmonic distortion (THD) of the source current in the system without UPQC was 22.22%. After applying the designed method, THD has been reduced significantly to 2.68%. In case 2, for multi-bus systems, the THD was 20.62% and 5.05% with and without the UPQC, respectively. Here the THD in the grid input voltage was 20.62%, whereas the output voltage was 0.80%. The IEEE 519–2014 standard for voltage and current harmonics distortion criterion for electrical system design is followed in the research.

https://ieeexplore.ieee.org/xpl/conhome/10068861/proceeding

Design Of an Off-Grid Solar-Wind-Bio Hybrid Power Generation For Remote Areas Of Chapainawabgonj District In Bangladesh Using Homer

KAZI FIROZ AHMED et el.

Bangladesh is a highly populated nation in the globe where 76% people live in the remote regions and 24% in metropolitan areas. Peoples living in distant places are encountering problems having no access to energy. In addition, electricity sector of Bangladesh relies on the fossil fuel like natural gas, coal, oil that are limited in supply. Huge potentiality of renewable resources like solar, biogas/biomass, wind, hydro might be an excellent solution for minimizing electricity crises. In this study, hybrid renewable energy like solar, wind and biogas resources are assessed in terms of availability and energy recovery potential. A field study has been done to gather the information regarding population, load demand, biogas and solar resources of the chosen rural regions of Chapai-nawabgonj district. Then a solar PV-wind-biogas based 100 kW hybrid power generating system is constructed utilizing HOMER (Hybrid Optimization Model for Electric Renewable). In comparison to all other combinations, the modeling results demonstrate that the combined Solar-PV-Wind-Diesel system has the lowest COE (cost of electricity) and NPC (net present cost). In Bangladesh's Chapai-Nawabgonj district, electricity produced by the planned hybrid power generating system may be used in some of the area's most distant locations. This technology lowers energy costs per kWh and CO2 emissions, which contributes to the creation of a sustainable environment.

Performance Analysis of Load Frequency Control for Power Plants Using Different Optimization Techniques

ABU HENA MD. SHATIL et el.

In this paper, several optimization techniques including the Particle Swarm Optimization (PSO) technique, the Genetic Algorithm (GA), and the Adaptive Neuro-Fuzzy Inference System (ANFIS) are applied to determine the most efficient output for load frequency control. These optimization techniques analyze the optimal level of system performance. The goal of this paper is to identify the most effective optimization technique for this sophisticated LFC system. In this research, three strategies (PSO, GA, ANFIS) are used in the LFC system to analyze frequency fluctuation and compare the load change rate. The model consists of the transfer function of the governor, turbine, rotating mass, and load. In this analysis, the ideal performance is examined across three separate case scenarios. The MATLAB/SIMULINK software simulates the performance analysis, which offers more realistic data and is generally preferred in this sort of optimization strategy work.

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Feasibility Study of Solar Thermal System Integration for Hot Water Usage in a Hotel Located in Shetland Island, Scotland

MD. SAJID HOSSAIN et el.

This paper aims to present a detailed integration of a solar thermal system in a hotel located in the west of Yell Island, Shetland. This was to assist in the island’s carbon management plan as it attempts to reduce its carbon emissions. The proposed renewable energy system is a solar thermal system to meet the demand for hot water in the hotel. Prior to the selection of a solar thermal system, the feasibility study of other renewable sources was also considered. The solar thermal system is made up of 22 Promatop 1.5 Vertical solar collectors, as this was the maximum number available on the 60 m2 roof space. The gross area of the collector surfaces is 33.55 m2. With the known area of the collectors, Photovoltaic Geographical Information System (PVGIS) data for irradiance at the site was converted to useful energy and transferred to heat in a hot water tank. The efficiency of the collector was calculated from collector specifications and ambient temperature to be approximately 65%. The energy demand of the hotel was calculated using standard values. Based on the analysis it is seen that the proposed system will meet the hot water requirements fully on a summer day and approximately ¾ during an off-peak season of the winter day. Additionally, a 5 KW auxiliary boiler is required to offset the energy deficit in the winter months.

https://ieeexplore.ieee.org/document/10434635

Technical Comparison between Lead-acid and Lithium-ion Batteries Used in Microgrid UPS System

DR. SHAMEEM AHMAD et el.

An uninterruptible power supply (UPS) in microgrid application uses battery to protect important loads against utility-supplied power issues such as spikes, brownouts, fluctuations, and power outages. UPS system typically employs lead-acid batteries instead of lithium-ion (Li-ion), even though Li-ion battery possesses advantages over lead-acid. This paper aims to investigate the performance of the two batteries for UPS system so that a conclusion on which battery is appropriate for UPS application can be drawn. The comparison is conducted based on state of charge (SOC) for both charging and discharging, voltage and current values, and heating effect. Two software namely COMSOL and MATLAB/Simulink have been used to investigate the performance of the two batteries. From the simulation results it has been observed that for microgrid's UPS application, Li-ion batteries overall performance is much better than Lead-acid battery.

Electricity Price Forecasting One Day Ahead by Employing Hybrid Deep Learning Model

DR. SHAMEEM AHMAD et el.

This study proposes hybrid Deep Learning (DL) models for electricity price forecasting (EPF) one day ahead of the Nord Pool spot electricity market. The proposed hybrid DL model employs the Bidirectional Long Short-Term Memory (BiLSTM) and Convolution Neural Network (CNN) to identify short-term local dependence trends among parameters and to discover long-term correlations for time series trends. In addition, a linear bypass (auto-regressive) is included to address the neural network model's scale insensitivity issue. The proposed model (CNN-BiLSTM-AR) is compared with different models like CNN-LSTM, CNN-BiLSTM, and CNN-LSTM-AR, which were evaluated by employing different performance indicators including Mean Absolute Error (MAE), Mean Square Error (MSE), and Root Mean Square Error (RMSE). The findings revealed that the suggested CNN-BiLSTM-AR model achieved the lowest RMSE and MAE with values of 8.67 and 5.43, respectively, followed by CNN-BiLSTM and CNN-LSTM-AR with a value of 9.08, 9.154 and 5.65, 5.645 for RMSE and MAE. Further, the CNN-LSTM model performed badly, attaining the highest RMSE and MAE values of 9.471 and 5.899, respectively.

Short-term Electricity Price Forecasting Using Interpretable Hybrid Machine Learning Models

DR. SHAMEEM AHMAD et el.

In this paper, a combination of single and hybrid Machine learning (ML) models were proposed to forecast the electricity price one day ahead for the Nord Pool spot electricity market. The proposed models were evaluated based on performance metrics, such as Root Mean Square Error (RMSE),

Mean Square Error (MSE), and Mean Absolute Error (MAE). Further, a model interpretation by employing SHapley Additive exPlanations (SHAP) framework to show the impact of each feature in the forecasting output. Based on the SHAP, the lag electricity price EP(t-1) impacts the forecast result most, followed by EP(t-2) and time stamp, respectively. Finally, the results show that hybrid models performed better than single ones, where the LR-CatBoost model surpassed other models and attained 7.94 and 10.49, which are the lowest values of MAE and RMSE respectively. Moreover, the kNN and SVM models performed poorly, achieving the highest RMSE values of 12.88 and 12.39, respectively.

Hardware in The Loop Implementation of The Control Strategies for The AC-Microgrid in OPAL-RT Simulator

DR. SHAMEEM AHMAD et el.

Renewable energy (RE) penetration through the concept of microgrids improves the efficiency and dependability of the electrical system. Power electronic (PE) converters with effective control strategies result in a successful interface between RESs and the electrical grid which enables power sharing among RESs, loads and grid. This paper aims to give a comprehensive analysis of the power sharing and power balancing within AC-microgrid and also investigate the essential control strategies operated during islanded (IS) mode and grid-tied (GT) mode. The impact and function of control levels or controllers associated with a particular control strategy in the power management during IS and GT mode are carried out in MATLAB/Simulink environment and hardware in the loop (HiL) implementation (using RT-LAB and OP5600) considering an AC-microgrid configuration with solar photovoltaic (PV) and energy storage scheme (ESS). The outcomes from the analysis illustrate that the power sharing within AC-microgrid is greatly influenced by the selection of designed parameters and performance of the controllers. Also, suitable operation of the controllers ensures proper power balancing throughout the entire operational time in AC-microgrid. Therefore, utilization of the maximum generated power from RESs and accurate power balancing within AC-microgrid are ensured by the precise operation of the used controllers.

Techno-Economic Feasibility Analysis of Hybrid System in Bangladesh - A Case Study for Higher Learning Institution

DR. SHAMEEM AHMAD et el.

This research describes the application of an imperial strategy using the software program Hybrid Optimization of Multiple Electric Renewables (HOMER) to create an adjustable sketch of a hybrid renewable energy source (HRES). A higher learning institute of Bangladesh located in Dhaka, Bangladesh has been proposed to raise out through techno-economic analysis, operational overall performance analyses, and environmental element reviews pertaining to the above device for each on-grid and off-grid-connected modes. In this work, many combinations of diesel generators, photovoltaic (PV) and storage batteries have been taken into consideration to determine which mixture suits the urban area the fantastic with an affordable cost of electricity and little climate effect. A sensitivity investigation was also

carried out to show how the overall performance of the system would trade if the key parameters, such as power purchase, load demand, sellback, and fuel were changed. The findings indicate a higher tendency towards the use of renewable strength sources, which have the lowest net present cost (NPC) and cost of energy (COE). In comparison to all different eventualities for each off-grid and on-grid connections, the hybrid Diesel /PV/Battery system is found to have the excellent technical performance. It also reviews good economic and environmental performance, which has increased system's sustainability.

Solar Powered Smart Irrigation System Based on Internet of Things (IoT) Using Microcontroller

DR. SHAMEEM AHMAD et el.

In this era of new technology, human life is getting simpler day by day due to the advancement in internet of things (IoT) technology. Similarly, the population is growing rapidly which results in the necessity of huge agricultural goods. Tomeet that need there is a need for making the irrigation process smart using IoT. This paper aims to design and implement an IoT based smart irrigation system, which can reduce manual labor and maximize the productivity of crops. This system is automatically controlled through microcontroller to monitor the moisture level of crops, humidity & temperature and send messages to the farmers about the agricultural field conditions through GSM system for their further perusal. The system is very simple, and it needs less power. Further, a sun tracking system is installed in the irrigative system which helpsthe solar panel to track the sun for powering up the irrigation system. The simulation of the overall system is conducted in Proteus platform and a prototype is developed to validate the performance of the system. From the results it has been observed that the system is able to monitor the agricultural fieldconditions accurately along with informing the farmers about the conditions for further actions.

Performance of Microgrid Systems on Multiple Dynamic Loads Penetration

DR. SHAMEEM AHMAD et el.

Microgrids (MGs) have emerged as a promising solution to enhance the reliability and sustainability of modern power distribution systems. In recent years, there has been a growing interest in interconnecting multiple microgrids to create more resilient and efficient energy networks. However, the performance of interconnected microgrids under various dynamic load scenarios remains a critical research area. In this paper, problems like low-frequency oscillations (LFOs) and the dynamic performance of multiple induction motors (IMs) in microgrids instead of a single motor with the same rating under a wide range of operating conditions are looked at. A single microgrid and an interconnected microgrid are two alternative model configurations designed in Matlab/Simulink that are considered in this study's comparison of non-linear dynamic simulations. The findings show that, compared to a local microgrid system, the performance of an interconnected microgrid system is more susceptible to being impacted by several parallel IM loads. Furthermore, it has been discovered that large IMs have lower LFO damping capabilities than parallel multiple small IMs.

https://ieeexplore.ieee.org/abstract/document/10428691

Efficiency Enhancement of PV System Integrating Thermoelectric Generators and Automatic Cleaning System

DR. SHAMEEM AHMAD et el.

This paper presents a comprehensive design aimed at enhancing the efficiency of photovoltaic (PV) systems through the integration of thermoelectric generators (TEGs), automatic cleaning systems, and PV sun tracking mechanisms. TEGs are employed to capture and convert waste heat from PV panels into additional electricity, thus, increasing the system's output. The automatic cleaning system ensures that panels remain dust-free, mitigating performance degradation caused by dust accumulation. Concurrently, PV sun tracking maximizes energy captured by dynamically aligning panels with the sun's trajectory. The result shows through the proposed system, maximum energy capture of PV is ensured, which is 38.14% by maintaining surface cleaning, sun tracking, and optimizing the wastage of heat. A prototype was built to monitor the increase in efficiency in real life.

https://www.icps23.com/

IoT-Based Real-Time Monitoring And Control System for Distribution Substation

DR. SHAMEEM AHMAD et el.

This paper presents the development and deployment of an IoT-based monitoring and automatic control system for power substations to address equipment failures, energy losses, and safety concerns. This system utilizes a network of sensors to collect voltage, current, and temperature data from various substation components in real-time. The collected data is then sent to a centralized control center and a user-friendly Blynk IoT application that authorized personnel can access. Utilizing sophisticated analytics and algorithms enables proactive maintenance by identifying potential malfunctions and initiating prompt actions. In addition, the system maximizes resource utilization by monitoring voltage levels and balancing loads. Integration with the Blynk application enables remote monitoring, real-time alerts, and remote-control capabilities, thereby improving accessibility and expediting responses to urgent situations. Results show that the proposed system compared to existing ones, improves the substation’s efficiency, minimizes downtime, and increases grid reliability, thereby contributing to more resilient and sustainable power infrastructure.

https://www.icps23.com/

Autonomous Power Management and Control Among Interconnected Standalone Hybrid Microgrids

DR. SHAMEEM AHMAD et el.

Multiple microgrids (MGs) being interconnected permits a high penetration of renewable energy sources while also improving the reliability and generation efficiency of the interconnected MG system. However, an effective power management strategy (PMS) and reliable control structure are required to ensure suitable operation and proper power sharing. Therefore, an effective clustering method of three hybrid MGs with a decentralized control structure is proposed in this paper to ensure sufficient power supply in three MGs depending on their available power generation in islanded mode. The interconnection takes place among the DC buses of each hybrid MG using a bidirectional DC/DC converter, which eliminates the complexity of reactive power management and synchronization and reduces power losses and costs. Moreover, the proposed decentralized PMS is based on the system voltage deviation to achieve proper power sharing without any communication link. Different scenarios for power sharing among interconnected hybrid MGs, including load variations, source failure, and energy storage systems charging or discharging, are analyzed. The performance of the proposed interconnection method and PMS is analyzed and validated using MATLAB/Simulink and a real-time-based OPAL-RT digital simulator. The simulation outcomes show that the proposed method and PMS ensure reliable operation and provide proper power sharing among the three hybrid MGs.

Feasibility Study of Solar Thermal System Integration for Hot Water Usage in a Hotel Located in Shetland Island, Scotland

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This paper aims to present detailed integration of solar thermal system in a hotel located in the west of Yell Island, Shetland. This was to assist in the island's carbon management plan as it attempts to reduce its carbon emissions. The proposed renewable energy system is a solar thermal system to meet the demand for hot water in the hotel. Prior to selection of a solar thermal system, the feasibility study of other renewable sources was also considered. The solar thermal system is made up of 22 Promatop 1.5 Vertical solar collectors, as this was the maximum number available on the 60 m 2 roof space. The gross area of the collector surfaces is 33.55 m 2 . With the known area of the collectors, Photovoltaic Geographical Information System (PVGIS) data for irradiance at the site was converted to useful energy and transferred to heat in a hot water tank. The efficiency of the collector was calculated from collector specifications and ambient temperature to be approximately 65%. The energy demand of the hotel was calculated using standard value. Based on the analysis it is seen that the proposed system will meet the hot water requirements fully on a summer day and approximately ¾ during an off-peak season of the winter day. Additionally, a 5 KW auxiliary boiler is required to offset the energy deficit in winter months.

Current Status and Challenges of Renewable Energy Implementation in Bangladesh

DR. SHAMEEM AHMAD et el.

This paper presents an updated assessment of the progress, challenges, and potential solutions for renewable energy-based power generation in Bangladesh. It emphasizes the growing consideration given to renewable energy sources as a practical substitute for fossil fuels in response to the country's rising energy needs and worries about climate change. The study analyses the policies and incentives in place to encourage the growth of renewable energy and looks at the country's progress to date in meeting its renewable energy goals. It also addresses the obstacles faced in adopting renewable energy, such as financing, technical capacity, and regulatory barriers, and explores potential solutions including appropriate financing mechanisms, effective regulatory frameworks, and grid integration. The final section of the paper discusses the prospects for renewable energy in Bangladesh, highlighting the possible advantages it could have for the country's economy, environment, and energy security.

Smart Interconnection Method for Integrating Two Microgrids

DR. SHAMEEM AHMAD et el.

The resilience and dependability of the power distribution system have been increased by interconnecting several microgrids to create interconnected microgrids. While interconnecting the microgrids, there is ambiguity regarding balanced power sharing across several microgrids. The power mismatch between the generating capacity of distributed energy sources and the load demands of all the microgrids is taken into consideration in this study, a smart interconnection method (SIM) is proposed for tying together two microgrids that are interconnected to the utility grid. The advantage of the suggested technique is the easy, real-time construction of circuitry that is adjustable and simple. To evaluate the effectiveness of the interconnection approach, real-time simulations are carried out using a real-time digital simulator (RTDS). The outcomes of the simulation have confirmed the effectiveness of the proposed smart interconnecting method for connecting two microgrids during grid-connected mode.

Design and Implementation of Solar PV Operated E-Power Tiller

DR. MD. RIFAT HAZARI et el.

The purpose of the paper is to design a Solar PV Operated E-Power tiller for agriculture use. The design of an electrically driven Solar PV Operated E-Power tiller has three primary purposes, the first of which is to reduce the quantity of fuel used; the second of which is to maintain a pollution-free environment, and the third of which is to avoid a price increase. The results of this study will also help in the development of a prototype for a portable charging station, which will be put to use in order to

keep the tractor's battery charged. In order to carry out this project, two brushless DC (BLDC) motors, each of which has 1.34 horsepower, were used. A lithium-ion battery served as the only source of power for the motors. In full running condition, the battery can provide backup for up to 5 hours. The speed of the shaft on the power tiller cultivator is 339.23 rpm. This system is equipped with the necessary brakes, steering controls, and controls for the pace at which the cultivator blades rotate. Both the structural design of this and the simulation of the system were done in MATLAB Simulink. Solidworks was used for the structural design. The system functioned without any issues, and the information that was gathered fell within the parameters of what was considered to be acceptable in relation to the standards that had been established.

Design and Implementation of a Smart Wind Turbine with Yaw Mechanism

DR. MD. RIFAT HAZARI et el.

In this paper, an intelligent low-cost wind turbine is designed which can rotate the rotor hub towards wind direction. The smart wind turbine technology has developed by using six rotor blades, squirrel cage induction generator (SCIG), and yaw mechanism. The yaw mechanism relates to two stepper motors through support tower. Based on the wind direction, the yaw mechanism will control the stepper motors. Finally, this stepper motors will move the wind turbine towards the wind direction. Conventionally, the hub of wind turbine is kept at fixed position. However, this kind of arrangement is not suitable where in some places (e.g. Bangladesh), the wind directions can be changed frequently. Therefore, it is necessary to move the rotor hub continuously towards the wind direction so that it can capture maximum amount of wind power. So, a smart wind turbine with yaw mechanism is designed in this paper.

An Affordable Solution for the Rural Farmers for Irrigation Purpose Including Hybrid Power Source using Solar and Biogas

DR. MD. RIFAT HAZARI et el.

The use of fossil fuels to generate the ever-increasing demand for energy is proving to be a very strong reason behind the global warming issue. The hybrid power system is a combination of different technologies to produce Electricity. In Bangladesh, farmers experience several irrigation-related problems due to a shortage of energy. This paper deals with an economical hybrid power system that uses the grid, solar, and biogas generator that offers a fresh approach to solve this problem. Since it is impossible to always have sunlight, a biogas generator would be used to generate electricity and charge a battery to satisfy the requirements and a grid connection will be a backup for both biogas and sunlight absence. Based on the priority, the user will be able to switch among the three sources for efficient use of power. This hybrid system will contribute to our country's increasing demand for power management by serving the less resourceful farmers from rural areas. In this research, hardware and simulation findings have been examined from Bangladesh's perspective. Since it is

based on renewable energy sources, this initiative presents a novel solution to Bangladesh's emerging power crisis issue.

Design and Implementation of IoT-Based Smart Energy Meter to Augment Residential Energy Consumption

DR. MD. RIFAT HAZARI et el.

There is a constant push for automation, portability, and remote control in the management systems of all organizations. A new IoT -based multifunctional smart energy meter is presented in this paper for automated metering and billing system. Arduino Nano with GSM Short Message Service (SMS) connection provides a meter reading system with predefined automatic functions followed by ESP-8266 WiFi Module to monitor energy parameters. Proteus 8.0 was used to model the project before the hardware implementation was built. With the GSM module and embedded controller, the proposed system can transmit data such as kWh consumption and generated bills over the GSM network, which can then be fed into existing energy management systems at power companies or organizations to provide services to customers without the need for human intervention. As a result, consumer energy analysis is made considerably simpler and more manageable. This device aids in the detection of power theft as well. As a result, this smart meter facilitates wireless connection and home automation utilizing IoT, which is a significant step towards a Digital Bangladesh. Moreover, a prepaid mode is incorporated as part of billing system.

Design and Analysis of IoT-Based Adaptive Microgrid System including Renewable Energy Sources for Decentralized Zones

DR. MD. RIFAT HAZARI et el.

To enhance living conditions and alleviate poverty, emerging nations require energy services that are dependable, accessible, safe, and efficient. This research study proposes an IoT-based smart microgrid system for rural areas with an enhanced control system for an efficient microgrid operation which may, in turn, solves multiple issues in the rural area. The proposed system is a combination of solar and wind power generators, diesel power stations, and backup storage, having the functionality of detecting the instantaneous fault of a branch with the help of the Bewlice lattice diagram and support vector machine algorithm and could be controlled remotely at any moment over the internet. Likewise, a power monitoring system would provide the authorities with technical attributes related to energy that would be utilized to give power to the rural area in an emergency through the Android Application, which can be retrieved and displayed using a cloud platform named ThingSpeak.

Fuzzy Logic-Based Design Optimization and Economic Planning of a Microgrid for a Residential Community in Bangladesh

DR. MD. RIFAT HAZARI et el.

Hybrid renewable energy systems are becoming more predominant because of climate change and the overconsumption of natural fuels. Proper utilization of renewable resources can uplift energy-deprived regions while also contributing to a nation's economic growth. However, effective system planning and resource assessment are essential for effective utilization. In that regard, the study proposes a hybrid microgrid design for a remote island in Bangladesh. The proposed system comprises solar photovoltaics, wind turbines, and lithium-ion battery storage which is coupled to the utility grid. For modeling and simulation of the optimal system design of the residential load in Urir char, Hybrid Optimization Multiple Energy Resources (HOMER) pro was utilized. The load profile for the system was created employing fuzzy logic and random probability, as well as meteorological data for the chosen location. Several instances with reliability factors such as short-term and long-term interruptions are also taken into consideration in the design. Additionally, the paper discussed a comparison between the proposed system and other considered scenarios as well as the utility grid. The proposed system is a viable approach for providing cleaner energy for the selected area in regards to energy cost (0.035$/kWh), a renewable fraction (90 %), emission reduction (78%), and reliability.

Design and Implementation of IoT-Based Load Monitoring and Outage Management System

DR. MD. RIFAT HAZARI et el.

An essential instrument for the operation of a power system is to monitor and analyze the data to find the fault and rectify it before the System collapses completely. This paper intents to utilize the idea to create a control system that will fulfill three objectives, monitoring of vital parameters controlling the power distribution, outage management by fault detection based on the variation of voltage, frequency, and current & protection of the circuit against any significant incidents by isolating the load from utility and flagging the information through feedback to the utility authority. The method used in this project can provide necessary safety from total system outages by adequately monitoring the instant data and historic data, managing the outage system by detecting faults, and cutting loads required to avoid a widespread blackout of a power system. Implementation of the proposed project can solve the problem of system blackout due to overload, under/over voltage, or under/over frequency. This developed system can supply necessary timestamped monitored data that can be accessed remotely and can also archive to create a proper load profile to ultimately help the modeling of Load Forecasting for a smooth and economic grid operation and can be used for developing the Smart Grid network.

Impacts of GA and PSO on Loss Minimization in Distribution Networks with DG Incorporation: A Comparative Study

DR. MD. RIFAT HAZARI et el.

In electrical power systems, efficient power transfer between the high-voltage transmission lines to low-voltage distribution lines is crucial. Nevertheless, the distribution system often suffers significant I2R losses due to high R/X ratios, high current levels, and low voltage. Distribution businesses (DISCOM) are motivated to reduce losses in their networks in order to reap financial rewards. The financial penalties or gains for DISCOM are based on the discrepancy between actual losses and standard losses. As a result, experts have investigated minimizing losses in distribution networks in great detail. Many strategies have been investigated and put into practice in the past to deal with the loss reduction issue. These approaches vary in methodologies, problem formulations, methods used, and solutions produced. The strategies utilized for loss reduction include feeder grading, distributed generation (DG) allocation, network reconfiguration, capacitor allocation, and high voltage distribution system approaches. The primary goal of this work is to employ GA and PSO to identify the best distribution of Photovoltaic (PV) generation based on a multi-objective function with various constraints. MATLAB R2021a assessed the algorithms' efficacy in the IEEE-33 and IEEE-69 bus systems.

Deep Learning and Econometric Analysis of CO2 Emissions in Bangladesh: A Transition Towards Renewable Energy and Sustainable Practice

MD. MORTUZA AHMMED et el.

Environmental sustainability achievement is an increasingly significant issue in current society. Globally, unimpeded greenhouse gas emissions threaten environmental sustainability. As a developing economy, Bangladesh is extremely reliant on energy consumption, which results in greenhouse gas emissions and raises a significant threat to environmental sustainability. In our comprehensive analysis to study the energy consumption patterns of Bangladesh and their environmental implications, we employed a suite of advanced tests, including the auto-regressive distributed lag model. The Augmented-Dicky Fuller test and the Bound test, respectively, confirm the unit root and the co-integration status of the study variables. Later, for identifying the causal relationship, this study adopted the Granger causality test. These methodologies illuminated the intricate relationship between fossil fuel consumption, industrial growth, and the consequent CO2 emissions in the region. Despite the evident challenges posed by non-renewable energy sources, there’s a discernible shift towards renewable energy and sustainable practices, especially in industrial sectors. This transition is further evidenced by the Long Short-Term Memory forecasting model, which projects a promising decline in CO2 emissions over the next six years, plummeting from 70 metric tons to a mere 15 metric tons annually. While these findings highlight the strides Bangladesh is making towards sustainability, they also underscore the importance of continued emphasis on green technology and eco-friendly policies to ensure a sustainable future.

https://isgta-conf.org/

Study of Different Gate Materials on Performance of Si Based MOSFET

DR. MD. KABIRUZZAMAN et el.

In this paper, Silicon-based MOSFET has been investigated with different gate oxides for knowing which oxide shows the best result. Silicon-di oxide (SiO 2), gallium oxide (Ga 2 O 3), and aluminum oxide (Al 2 O 3) have been used as gate materials for observing the sensitivity, threshold voltage, and drain current of the MOSFET in this study. Al 2 O 3 gate material gives the highest terminal current and faster turn-on voltage (0.7 V) of the MOSFET compared to the other two. Al 2 O 3 delivers the best performance; and hence, it could be a promising material for the gate layer. In addition, electron and hole concentrations of those gate oxides and electric potential have been compared. In this paper, COMSOL Multiphysics® software has been used to simulate the obtained results.

Investigation on Multifunctional Properties of Lanthanum Ferrite Nanoparticles for Bismuth Substitution

DR. SHOVAN KUMAR KUNDU et el.

The materials having multifunctional characteristics are considered as the principal base materials in multifunctional and nano-dimensional devices industries. Multiferroics are the combination of more than one ferroic characteristic (ferroelectric, ferromagnetic/ antiferromagnetic and often ferroelastic) in the same phase. There is a coupling between spontaneous polarization and large magnetization. Research interest in multiferroic has increased in recent days because of their potential application in microelectronic and nano-electronic devices like transducers, spintronics, sensors, actuators, etc. Interestingly, it was found that Lanthanum Ferrite (LaFeO3), a member of the centrosymmetric rare earth ortho-ferrite (RFeO3) family (having a distorted orthorhombic perovskite structure), possesses magnetically tunable ferroelectricity due to the exchange striction mechanism.

The structural properties are analyzed by XRD pattern using Rietveld refinement. TEM images confirm that the average particle decreases with Bi doping concentration. The DC and AC charge transport mechanisms are analyzed, and the experimental data is well supported with the theoretical model, i.e. Mott's VRH model, and CBH model. M-H hysteresis loops reveal the antiferromagnetic ordering of the samples. Positive magneto-dielectric coupling is observed in the samples where coupling increases with doping which states that the Bi-doped LaFeO3 can be a good candidate in magneto-electric industries.

https://www.rpconfseries.com/

Design and Modelling of LCL and LC Filters for Symmetric Five-level Inverter

DR. MUHIBUL HAQUE BHUYAN et el.

The design and Modelling of LCL and LC Filters for Symmetric Five-level Inverter were discussed. THDs were reduced.

Foot Step Power Generation: A Comparative Analysis of Multi-Array Piezoelectric Transducer Configurations

NIGAR SULTANA et el.

Energy generation from green energy sources is gaining popularity day by day. Kinetic energy is produced while humans walk or run or jump and this energy can be converted into watt power with the help of piezoelectric transducers. One crucial aspect in this process is the configuration of different numbers of circular disc piezo sensors on the small area of the foot sole. This study aims to do a comparative analysis of the connection configuration of various piezoelectric sensors and determine the best output voltage and power achieved from footsteps. Additionally, the research aims to incorporate IoT to monitor the battery status. Four types of connection configuration of circular disc piezoelectric transducers on sole pads named series, parallel, series-parallel, and parallel-series topology have been designed and tested practically. Piezoelectric sensors of 35 mm dimension with a thickness of 3.36 mm are chosen and there are eight piezo sensors placed on the sole pad in a manner where the exerted pressure is maximum. With a very simple energy harvesting circuit devoid of boost converter and voltage regulator the experiment has been conducted. The investigation revealed that a single step on the sole pad, exerting a pressure of 686.7 N, can generate a maximum of 25 V in both parallel topology and parallel-series topology configurations. Conversely, the series topology exhibits the lowest converted voltage in comparison to all other configurations. But in the case of charging the battery by giving approximately 1000 steps the stable configuration is reported as parallel topology having the maximum dc current and power. The findings will help to select the right configuration for application in low-power-consuming devices like portable health care electronic devices, batteries, and sensors.

Emission and Valve Point Loading Cost Using Superiority of Feasible Solutions-Moth Flame Optimization

MD. SHAORAN SAYEM et el.

The optimal power flow (OPF) the most crucial instrument for power facility design and performance is analysis, load scheduling, and cost-effective dispatch. To determine the evidence of a steady state for a power system network, an optimal power flow analysis is required. This study introduces a novel optimization method called Superiority of Feasible Solutions-Moth Flame Optimization (SH-MFO) to answer the optimal power flow problem. As part of the MATLAB development, SH-MFO is implemented on the IEEE-30 bus standard experiment structure network. When compared to the reliable outcomes produced by other algorithms, the current study employing SH-MFO estimates a Generation and Emission Costs 48.6827/h for minimizing the different fuels, which ultimately proves to be the best value. Analyze the poorest options suggested by the comparison algorithm, it saves money by 0.9873 % per hour. Based on simulation results, the SH-MFO method provides an improved and effective optimization algorithm for optimal power flow problems.

https://ieeexplore.ieee.org/xpl/conhome/10101485/proceeding

Isolation Forest-Based Anomaly Detection and Fault Localization for Solar PV System

ABU SHUFIAN et el.

The decrease in fossil fuel reserves has prompted a global move toward distributed energy resources. For this reason, solar PV power generation has recently gained much attention as a feasible renewable energy source. However, large-scale generation is challenging if there are anomalies in individual solar PV panels. This will reduce the efficiency of the PV system and create a potential fire hazard. In this perspective, the anomaly detection technique discloses system anomalies accurately and effectively. Identified anomalies will localize the event for an improved generation. This paper addresses the performance analysis of using the isolation forest technique to identify anomalies in the PV system and the rule-based fault localization technique to identify defective panel events. In the developed model, the isolation forest technique found around 453 anomalies in 45,740 observations, and approximately six panels indicated a fault in the system. The accuracy score is found to be approximately 0.9886. The proposed fault detection method will help detect the faults in solar power systems.

https://icrest.aiub.edu/

Optimized Energy Management of Grid Connected Solar/Battery-dependent Smart Microgrid

ABU SHUFIAN et el.

To satisfy the escalating energy demand with minimal environmental damage, the world is taking an expeditious shift toward the augmentation of renewable energy sources with the prevailing power sources by using a microgrid, where solar/battery-based grid-connected microgrid systems are gaining immense popularity. However, the intermittent nature of the sun is the most significant impediment to producing a steady flow of energy with solar power, so to resolve

this issue, an optimized microgrid energy management system (EMS) has been proposed in this paper, which provides the requisite functionality to ensure that the consumption, production, and distribution systems supply energy level at minimum operational costs. With the aid of demand-side management, a linear programming optimization technique has been developed for cost-effective microgrid operation, monitoring, and administration. The obtained result from this

proposed model clearly bespeaks the usefulness of the optimized EMS of the microgrid model, which can effectively generate electricity and deliver it to customers at low prices.

https://conf.manit.ac.in/resem2023/index.php

Investigating Clean Energy Generation from Unoccupied Roof-top Space in University Premises

ABU SHUFIAN et el.

Distributed energy sources are becoming popular for producing clean energy, depleting fossil fuels, and meeting growing electricity demand. Solar PV is one of the most commonly used renewable energy sources due to its availability and cost-effective operation. Recently, the roof-top PV system installation on academic premises has been significantly emerging. The unoccupied roof space can be effectively used to generate electricity to substantially meet the university's load demand. This paper investigates the feasibility of a roof-top PV system placed on the EME (Electrical and Mechanical Engineering) academic Building in Chittagong University of Engineering and Technology (CUET). A small test system was developed considering the effective roof-top area and actual load demand. The simulation results demonstrate that the proposed system successfully meets the required load demand of the building. An excess energy supply during peak sun hours can also be shared with the nearby premises.

https://conf.manit.ac.in/resem2023/index.php

Prospects and Economic Feasibility Analysis of Solar PV/Hydrogen Fuel-based Power System for Green City

ABU SHUFIAN et el.

Meeting the energy demands of self-sustaining off-grid systems, especially in regions with extreme solar intermittency and energy consumption patterns like northern climates, requires effective short-term and seasonal energy storage solutions. This research investigates the feasibility and economic viability of a solar PV/hydrogen fuel-based power system for a green city. Employing the Hybrid Optimization of Multiple Energy Resources (HOMER) software, an extensive analysis is conducted to optimize and simulate the proposed system. And a comprehensive assessment is performed to evaluate the technical and economic feasibility of implementing this system in a green city context. Key factors such as potential energy generation capacity, system efficiency, and economic viability are thoroughly analyzed. The findings reveal that the proposed system offers a reliable and sustainable energy source for a green city. By significantly reducing greenhouse gas emissions and providing a cost-effective solution to meet the city's energy requirements, this system showcases its potential in addressing environmental concerns.

https://confncim.com/

Grid-tied Smart Microgrid with Heuristic Optimized Energy Management System (EMS)

ABU SHUFIAN et el.

There is a global shift towards integrating renewable energy sources into existing power systems to address the increasing energy demand while minimizing environmental impact. One popular approach is the utilization of solar/battery-based grid-connected microgrid systems, which have gained significant popularity. However, the intermittent nature of solar power poses a challenge in ensuring a steady energy supply. To overcome this challenge, this research proposes an optimized microgrid EMS that efficiently manages energy consumption, generation, and distribution, aiming to minimize operational costs. A cost-effective solution for microgrid operation, monitoring, and administration has been developed by incorporating demand side management (DSM) techniques and employing a heuristic optimization approach. The results demonstrate a remarkable 33.6% reduction in operational costs compared to systems without an EMS. These findings highlight the effectiveness of the proposed optimized EMS in generating and delivering electricity to consumers at affordable prices. This research contributes to the advancement of microgrid systems and provides valuable insights for policymakers, industry stakeholders, and researchers, supporting the adoption of renewable energy and enhancing microgrid performance.

https://confncim.com/

Enhanced Optimum Design and Performance Evaluation for Grid-Connected Solar PV Rooftop Systems: A Case Study for Bangladesh

ABU SHUFIAN et el.

Load-shedding has been rising because of a vast gas shortage that has led to Bangladesh's significant fall in power generation. Renewable energy sources could help Bangladesh's electricity production overcome these problems. The roof-mounted solar PV system is a desirable alternative energy source. Location, design, appropriate installation, and solar module type all affect the performance and efficiency of a PV system. The PV simulation tool computes how much electricity will be produced by the PV array setup. The energy efficiency of rooftop PV systems is significantly impacted by the design and orientation of roofs. By increasing the energy production of rooftop PV systems through improved roof design, this study seeks to close a knowledge gap. In this study, we used SketchUp and PVsyst to design and simulate a grid-tied rooftop solar photovoltaic system for Bangladeshi educational-type consumer loads. This project also attempts to lower grid outages close to the building, energy costs (COE), grid dependence, and CO2 emissions. The suggested system has been accurately modeled, considering factors such as choosing the most suitable PV panel rating, inverter, tilt angle, sun azimuth, shading calculation, loss calculation, performance, and technical assessment. The electric grid receives extra energy. The suggested system will generate electricity efficiently, minimizing reliance on the grid, as shown by the real-time simulation.

https://csa.ru.ac.bd/icrpset/2022/

GSM-based Automatic Voltage Protection System for Residential Small Appliances

ABU SHUFIAN et el.

A voltage protection system is one of the essential things in most of residential and home appliances. It is a low-cost, easy-to-use system that safeguards electrical and electronic devices and low-power home appliances. The main goal of this research is to create a system that can detect undervoltage and overvoltage conditions and regulate the associated output of different loads. The proposed protection system is developed and analyzed in the Proteus flatform. A voltage divider circuit and a voltage regulator are attached to the Arduino Pro Mini in the protection model, which determines whether the voltage level is accurate. When the GSM module is turned on, the user receives a message that says “System Initializing”. When the voltage reaches a threshold level, it notifies the user that “System is ON”. Otherwise, it notifies the user that “System is OFF”. Several case studies reveal that the system protects small residential and home appliances from undervoltage and overvoltage.

https://www.bracu.ac.bd/academics/departments/electrical-and-electronic-engineering/icepe-2022

Success History Moth Flow Optimization for Multi-Goal Generation Dispatching with Nonlinear Cost Functions

MD. SHAORAN SAYEM et el.

Combined Economic Emission Dispatch (CEED) is resolved by combining Success History Moth Flow Optimization (SHMFO) and valve-point loading of thermal generators. This SHMFO the valve-point loading problem is a multi-objective nonlinear optimization problem including generator capacity limits and power balance. The valve-point loading causes oscillations in the input-output characteristics of generating units, hence rendering the CEED problem an imperfect optimization problem. As a benchmark test system for validating the efficacy of SHMFO, IEEE 30-bus systems are studied. Comparing the SHMFO method to other optimization strategies revealed its superiority and proved its capacity to resolve the CEED issue. The OPF is framed as a single or multiobjective problem with restrictions on generator capability, line capacity, bus voltage, and power flow balance to minimize fuel cost, emission, transmission loss, voltage deviation, etc. The numerical findings indicate that the SHMFO algorithm can provide cost-efficiency, diversity, and convergence in a single run. SHMFO performs better than the other algorithms and is an excellent choice for addressing the OPF problem, as shown by the results. On non-dominated solutions, a method adapted from the Technique for Ordering Preferences by Similarity to Ideal Solution (TOPSIS) is used to establish the Best Compromise Solution (BCS).

https://ieeexplore.ieee.org/xpl/conhome/10068861/proceeding

Transforming Slum Dwellings into Better Livable Units: An Approach through Minimum Intervention

SAIFUL HASAN TARIQ et el.

Dhaka, the capital of Bangladesh and the 9th largest city in terms of population, is like an urban melting pot bubbling over with population and a city which is forever changing and never finished for it's over population. When Cities are out of control of population density problems, informal urban development is perceived as a consequence of uneven urban growth. The crisis of Dhaka city disables the conventional planning faculty and requests the formulation of alternatives that will integrate architecture of informality into the whole urban structure. This paper tried to figure out the poor living conditions at Duaripara slum which is in the north-western part of Mirpur Thana at Dhaka North City Corporation. Through research and hands-on inclusive solutions, the paper proposed options for their better living condition. Analyzing the present condition of light, ventilation and temperature inside the houses, this research shows how quality of life might be improved through nurturing the opening condition and insulation system of the existing house, which is very much affordable for the slum dwellers, but unfortunately, they are unaware of it. The innovative solutions and increase in skills of informal builders can uplift the permanent up-gradation to informal settlements. Literature study and field survey have helped to develop module design for the improved living conditions that can be retrofitted in existing built forms with minimum intervention. As we are now living in the cutting edge of technology, this small but inclusive initiative may open up big opportunities to upgrade the living conditions of the settlement of slums in Bangladesh and elsewhere with similar existing context.

https://ajse.aiub.edu/index.php/ajse/article/view/300

The potentials of boron-doped (nitrogen deficient) and nitrogen-doped (boron deficient) BNNT photocatalysts for decontamination of pollutants from water bodies

DR. MD. HABIB ULLAH et el.

This work investigates the structural, elastic, electronic, and photoabsorption properties of boron- (N-deficient) and nitrogen- (B-deficient) doped single-walled boron nitride nanotube (SWBNNT) for photocatalytic applications for the first time. All calculations of the optimized systems were performed with DFT quantum simulation codes. The results of the structural analysis showed that SWBNNT is stable to both B and N dopants. It was also observed that the photodecomposition activity of the B-doped nanotube improved significantly under the condition of slight compressive stress, while it decreased for the N-doped nanotube. Therefore, N-doped SWBNNT showed poor performance under external pressure. Both B and N-doped systems could narrow the wide band gap of SWBNNT to the photocatalytic region below 3 eV, therefore this material can be used as

photocatalysts in water splitting for hydrogen evolution, dye degradation, wastewater treatment, etc. Analysis of the optical properties revealed that B-doped SWBNNT absorbs more photons in the visible range than the N-doped SWBNNT and can therefore be considered as a more efficient photocatalyst. In addition, it was found that all doped nanotubes are anisotropic since the absorption in one direction of nanotube axes is worse than the other.

https://pubs.rsc.org/en/content/articlelanding/2023/ra/d3ra03838f

IoT-Based Automated Solar Panel Cleaning and Monitoring Technique

DR. MD. KAMRUL HASSAN et el.

Aims: The objective of this research work is to design and develop an IoT-based automated solar panel cleaning and real-time monitoring system using a microcontroller to improve the output and efficiency of a solar module at a low cost. Study Design: Most of the time, dust over solar panels creates a barrier that obstructs the sun's radiation and reduces their performance. As such, it is necessary to keep the solar panel clean to improve output power levels. We integrated the IoT technology along with a range of components, including a microcontroller, a NodeMCU, a servo motor, a DC motor-driven submersible pump, a Light Dependent Resistor (LDR), an LCD with driver IC, etc. to design the system. We developed the assembly language program for the microcontroller. Place and Duration of Study: The work was conducted individually under the supervisor of a faculty member as a part of the final project work of the Master of Engineering degree in Electrical Method Article Methodology: An LDR sensor detects the solar panel's dirtiness and triggers the cleaning process through the microcontroller. The system monitors this continuously and real-time vital data is accessible to have some performance metrics, empowering timely maintenance actions to be triggered by the system and hence ensuring the maximum power output. The automated cleaning mechanism, driven by servo motors and mini submersible DC motor pumps, effectively removes dust and dirt from solar panels. An application was used to get real-time data through the internet to the user's smartphone. Results: The server data is accessed to observe the system performance. The cost analysis shows that this system offers a cost-effective and sustainable solution for maintaining clean solar panels and optimizing power output. Conclusion: Such an automation system can contribute meaningfully to the progression of renewable power generation by significantly improving the efficiency and longevity of solar panels. Thus, we can have sustainable and efficient energy systems in the country by integrating IoT-based automation systems.

https://www.researchgate.net/publication/373628287_IoT-Based_Automated_Solar_Panel_Cleaning_and_Monitoring_Technique

Solar PV- and PEM electrolyzer-based green hydrogen production cost for a selected location in Bangladesh

DR. MD. SANIAT RAHMAN ZISHAN et el.

Hydrogen is considered to be the environmentally safest energy source. Green hydrogen has no carbon footprint as it is produced from renewable energy sources. The barrier is the high production cost of hydrogen for all through usage of it. The use of solar photovoltaic (PV) electricity for polymer electrolytic membrane-based electrolysis may lower the production costs. Estimation of hydrogen production cost is performed using the life cycle cost (LCC) method. The PV electricity cost was calculated using the HOMER Energy Software. Lifetime of the project is 25 years with a 7.48% discount rate. The electricity cost is about Bangladeshi Taka (BDT) 39.91/kWh from solar PV. The system consumes 6,011 kWh of electricity and produces 42.44 kg of hydrogen per year. The LCC result shows that the hydrogen production cost is about BDT 230.90/g. Bangladesh might consider giving emphasis for green hydrogen production and help establish a green hydrogen economy.

Modeling and performance analysis of a transparent multilayer solar cell

DR. M. TANSEER ALI et el.

Transparent solar cells have emerged as a promising frontier in renewable energy research, offering the dual functionality of generating electricity while maintaining transparency. Five layers of InAs/InSb/AlGaAs/GaN/Si are incorporated into the proposed model structure which takes the properties of the source materials into consideration. Simulations of electromagnetic waves are used to evaluate optical and electrical properties. The cell is assumed to function at room temperature in the simulated settings. The I-V curve's fill factor (F.F.) of 0.6531 corresponds to a maximum conversion efficiency of 15.2655%, according to the data. Furthermore, at 530 nm, this combination and device configuration show a very good transparency of up to 60%.

https://ajse.aiub.edu/index.php/ajse/article/view/580

A hybrid machine learning method with explicit time encoding for improved Malaysian photovoltaic power prediction

DR. SHAMEEM AHMAD et el.

Nowadays, with the growing interest in green energy, further improvements in photovoltaic (PV) power systems are needed. In this regard, the main aim is to find an optimal method to predict the output power of PV systems to maintain a sustainable operation. Hence, this work proposes a hybrid Machine Learning (ML) method LASSO-RFR for an hourly PV power output prediction. The model consists of Least Absolute Shrinkage and Selection Operator (LASSO) and Random Forest Regressor

(RFR), where the former model makes a prediction and the latter fine tune it by the addition or subtraction of a relatively small value. The proposed model outperformed other models when tested on real data recorded from 2016 to 2019 for three Malaysian PV systems, namely Thin-Film (TF), Monocrystalline (MC), and Polycrystalline (PC). LASSO-RFR attained the lowest root mean square error (RMSE) of 23.7, 18.2, and 20.8 Wh/m2 for the TF, MC, and PC, respectively. This work also highlights the importance of explicit time encoding in improving PV power prediction. Although it is used to be ignored in the literature when developing ML models, the time feature is the second most influencing factor of PV power prediction after solar irradiance, as shown by the SHAP analysis (shapely additive explanation). For the study implications, the developed prediction model will assist the industry in predicting 1 h ahead of PV power output, demand-side management, and building operations and maintenance.

Multi-Objective-Based Charging and Discharging Coordination of Plug-in Electric Vehicle Integrating Capacitor and OLTC

DR. SHAMEEM AHMAD et el.

The integration of plug-in electric vehicles (PEVs) in residential distribution networks demands a significant amount of electrical load where random and uncoordinated charging affects the quality and performance of the distribution network. Random and uncoordinated charging may increase the peak demand and can increase stress on critical network assets such as line, transformer, and switching devices. Moreover, the charging of PEVs in a low network reduces the voltage of the system below the lower limit. On the other hand, using PEVs as storage in the V2G mode can improve the network condition. Therefore, it is critical to properly manage the charging and discharging operation of PEVs. This paper proposes a multi-objective-based charging and discharging coordination of PEVs with the operation of the capacitor and on-load tap changer (OLTC). With the proposed strategy, the distribution network is operated safely, and charging is ensured for all PEVs connected to the network. The main consideration of this research is to reduce the daily power loss, operational cost, and voltage deviation of the system. The metaheuristic optimization binary firefly algorithm (BFA) has been applied to coordinate PEV charging and discharging as well as capacitor and OLTC operation in the system. A modified IEEE 31 bus 23 kV distribution system is used to implement the proposed strategy. From the obtained results, it is found that the combined PEV charging and discharging coordination with capacitor and OLTC operation reduces the power loss and cost by 34.16% and 12.68%, respectively, with respect to uncoordinated charging and enhances the voltage condition of the network.

Point of Common Coupling Voltage Modulated Direct Power Control of Grid-Tied Photovoltaic Inverter for AC Microgrid Application

DR. SHAMEEM AHMAD et el.

A direct power control (DPC) approach is proposed in this study for a grid-tied photovoltaic (PV) voltage source inverter (VSI) to regulate active and reactive power flow directly in between utility grid

and microgrid (MG) by controlling point of common coupling (PCC) voltage. The proposed PCC voltage modulated (PVM) theory-based DPC method (PVMT-DPC) is composed of nonlinear PVM, nonlinear damping, conventional feedforward, and feedback PI controllers. For grid synchronization rather than employing phase-locked-loop (PLL) technology, in this study, direct power calculation of the PCC voltage and current is adopted. Subsequently, at PCC, the computed real and reactive powers are compared with reference powers in order to generate the VSI's control signals using sinusoidal pulse width modulation (SPWM). Because of the absence of the PLL and DPC method adoption, the suggested controller has a faster convergence rate compared to traditional VSI's power controllers. Additionally, it displays nearly zero steady-state power oscillations, which assure that MG's power quality is improved significantly. To validate the proposed PVMT-DPC method's performance, real-time simulations are conducted via real-time digital simulator (RTDS) for a variety of cases. The obtained results demonstrate that using the proposed PVMT-DPC approach, PV VSI can track the reference power within 0.055 s where the output power has low steady-state oscillations and output current has lower total harmonic distortion (THD) of 1.68%.

Voltage-Oriented Control-Based Three-Phase, Three-Leg Bidirectional AC–DC Converter with Improved Power Quality for Microgrids

DR. SHAMEEM AHMAD et el.

Renewable energy sources (RESs) and energy storage schemes (ESSs) integrated into a microgrid (MG) system have been widely used in power generation and distribution to provide a constant supply of electricity. The power electronics converters, particularly the bidirectional power converters (BPCs), are promising interfaces for MG infrastructure because they control the power management of the whole MG system. The controller of BPCs can be designed using several different control strategies. However, all the existing controllers have system stability, dynamics, and power quality issues. Therefore, this study demonstrates the development of an LCL-filtered grid-connected bidirectional AC–DC converter's (BADC) control strategy based on voltage-oriented control (VOC) to overcome these issues. The proposed VOC-based inner current control loop (ICCL) is implemented in synchronous dq-coordinate with the help of proportional-integral (PI) controllers. An observer-based active damping (AD) is also developed in order to estimate the filter capacitor current from the capacitor voltage instead of directly measuring it. This developed AD system helpsto damp the resonance effect of the LCL filter, improves system stability, and also eliminates the practical challenges of measuring capacitor current. The proposed controller with AD is able to realize bidirectional power transfer (BPT) with reduced power losses due to the elimination of passive damping and improved power quality, system dynamics, and stability. The mathematical modeling of the suggested system was developed, and the structure of the system model was established in the MATLAB/Simulink environment. The performance of the proposed system was validated with real-time software-in-the-loop (RT-SIL) simulation using the OPAL-RT simulator for a 16 kVA converter system. The real-time (RT) simulation results show that the BADC with the proposed control scheme can provide better dynamic performance and operate with tolerable total harmonic distortion (THD) of 2.62% and 2.71% for inverter and rectifier modes of operation, respectively.

Design and Analysis of Iot-Based Remote Load Monitoring and Outage Management System

DR. MD. RIFAT HAZARI et el.

An essential instrument for the operation of a power system is to monitor and analyze the data to find the fault and rectify it before the system collapses completely. This paper intents to utilize the idea to create a control system that will fulfill objectives like monitoring vital parameters controlling the power distribution, outage management by fault detection based on the variation of Voltage, Frequency, and Current & protection of the Circuit against any significant incidents by isolating the load from utility and flagging the information through feedback to the utility authority. The Project implements the high-end technology for IoT applications that will connect with the Microcontroller to receive the data at regular intervals and post the timestamped data in a cloud platform for remote monitoring and archiving. This innovation can reduce human dependency and overcome the whole outage situation by building a two-way communication that means electricity and information are traded between consumers and utilities to capitalize on the efficiency of a grid system. The proposed model offers intelligent monitoring of the timestamped data with remote access & historical data archiving for a better load profile. An outage management system is designed for the proposed system by intellectual fault detection through Voltage, Frequency & current variation, and isolation of the faulty part from the entire system, maintaining an auto circuit recloser application before the permanent isolation for reducing the human interaction & flagging the outage information & supply emergency backup during the shutdown period, and in the process, helping the power grid from total power outage or blackout.

https://ajse.aiub.edu/index.php/ajse/article/view/552

Dynamic Analysis of Grid-connected Hybrid Wind Farm

DR. MD. RIFAT HAZARI et el.

Since the last couple of years, the expansion of grid-connected wind farms (WFs) has increased dramatically. The wind turbine might be a fixed-speed squirrel cage induction generator (FSWT-SCIG) or a variable speed wind turbine with a doubly-fed induction generator (VSWT-DFIG). The main disadvantage of FSWT-SCIG is its lack of ability to adjust power quality. Inversely, the VSWT-DFIG is a competitive wind turbine technology that allows for the effective management of both active and reactive power outputs. Moreover, it has some extraordinary functionaries rather than FSWTSCIG. However, the major downside to this system is that it only has a partial rating AC/DC/AC power converter, which is extremely expensive. Hence, to reduce the overall cost combining the implementation of VSWT-DFIG and FSWT-SCIG in a WF could be a feasible alternative. Therefore, a novel DFIG control technique is proposed in this article, which can keep the connection point voltage

of the hybrid WF stable during dynamic analysis. To evaluate the proposed controller responses PSCAD/EMTDC software has been used.

https://ijpeds.iaescore.com/index.php/IJPEDS/article/view/22281

Design optimization of a grid-tied microgrid for a residential community in southern Bangladesh

DR. MD. RIFAT HAZARI et el.

Growing energy demand, diminishing fossil fuel reserves and geopolitical tensions are serious concerns for any country's energy strategy and security. These factors have a greater impact on developing countries, as many of them rely largely on traditional energy resources. Cleaner energy generation is the viable alternative for mitigating these problems, as well as achieving energy independence and tackling climate change. The article discusses planning and design optimization of a residential community microgrid based on multiple renewable resources. In particular, the design and techno-economic assessment of a grid-tied hybrid microgrid for meeting the electricity demand of an alluvial region, Urir Char, located in southern Bangladesh, was addressed. Hybrid Optimization of Multiple Energy Resources is used for the evaluation and it is supplemented by a fuzzy-logic-based load profile design strategy. In addition to the analysis, a predictive load-shifting-based demand management is also introduced. Several cases were considered for the studies and, after considering several criteria, a grid-tied system comprising a photovoltaic array, wind turbine and energy storage system was found to be the best fit for powering the loads. The suggested system reduces the life-cycle cost by 18.3%, the levelized cost of energy by 61.9% and emissions by 77.2% when compared with the grid-only option. Along with the microgrid design, cooking emissions and energy categorization were also discussed.

https://academic.oup.com/ce/article/7/6/1300/7429454

Modeling and Economic Assessment of an Agricultural Microgrid: A Comparative Analysis

DR. MD. RIFAT HAZARI et el.

he article focuses on sizing and designing microgrids with pvlib-python and the Python programming language. Pvlib-python is a free and open-source program for simulating solar photovoltaic (PV) systems. For the design, an existing case study of an agricultural microgrid comprised of PV arrays, batteries, and a biogas-based generator in an off-grid configuration was explored. The solar resources and PV system were modeled using pvlib-python, while the rest of the microgrid was built and simulated using a custom dispatch algorithm written in Python. The study also discussed an in-depth strategy for modeling PV utilizing various data sources using the included modules and functions. A similarly specified microgrid was also modeled in Homer Pro software and the results

from the designed microgrid in Python were compared. The hourly distribution of data for both tools exhibits a noticeable deviation. The daily and annual distribution of most of the parameters, on the other hand, produce comparable results.

https://ajse.aiub.edu/index.php/ajse/article/view/733

Porous Hybrid Electrode Materials for High Energy Density Li-Ion and Li-S Batteries

DR. FARZANA KHALIL et el.

Hybrid materials play a key role in enhancing the electrochemical properties of electrode materials for lithium-ion and lithium-sulfur batteries. Porous hybrid materials offer high surface area and high conductivity. Moreover, they can store high energy with their large active site. In this chapter, we discussed the highly efficient porous electrode materials (cathode and anode) for the development of the practically used rechargeable lithium-ion and lithium-sulfur batteries. This chapter will open windows for designing next-generation energy storage.

10.1007/978-3-031-23401-9_7

Dynamic Analysis of Grid-connected Hybrid Wind Farm

DR. EFFAT JAHAN et el.

Since the last couple of years, the expansion of grid-connected wind farms (WFs) has increased dramatically. The wind turbine might be a fixed-speed squirrel cage induction generator (FSWT-SCIG) or a variable speed wind turbine with a doubly-fed induction generator (VSWT-DFIG). The main disadvantage of FSWT-SCIG is its lack of ability to adjust power quality. Inversely, the VSWT-DFIG is a competitive wind turbine technology that allows for the effective management of both active and reactive power outputs. Moreover, it has some extraordinary functionaries rather than FSWTSCIG. However, the major downside to this system is that it only has a partial rating AC/DC/AC power converter, which is extremely expensive. Hence, to reduce the overall cost combining the implementation of VSWT-DFIG and FSWT-SCIG in a WF could be a feasible alternative. Therefore, a novel DFIG control technique is proposed in this article, which can keep the connection point voltage of the hybrid WF stable during dynamic analysis. To evaluate the proposed controller responses PSCAD/EMTDC software has been used.

https://ijpeds.iaescore.com/index.php/IJPEDS/article/view/22281

A Novel Stability Model for AC-DC Combined Simultaneous Power Flow

DR. MOHAMMAD TAWHIDUL ALAM et el.

Conversion of existing high voltage long AC transmission line into combined AC-DC system can bring the benefit of stability improvement. Of late, most of the developments in stability analysis are simulation based. Sometimes it is difficult to draw a generalized conclusion through simulation

result. In this case, an analytical model can be a perfect tool to analyze the fault and get concrete decision about the future planning. This paper presents a stability model for the analysis of all types of fault. Primarily, the stability model is established for the fault at the transmission line and then introducing simple logical modification it can be applicable for the development of analytical models of all kinds of faults, such as; Fault at the load terminal, sustained fault at the line, fault very close to the generator bus. To expose the efficacy of the developed stability model two different ways of validation process is followed and optimistic results are found.

https://ajse.aiub.edu/index.php/ajse/article/view/682

Enhancing Photovoltaic Power Generation through a Microcontroller-Driven Single-Axis Solar Tracker

DR. MUHIBUL HAQUE BHUYAN et el.

Aims: The principal aim of this study is to make an automatic single-axis solar panel tracking system according to the sun's movement. The purpose of this effort is to design an efficient microcontroller-based solar panel follower system to follow the trajectory of the sun.

Study Design: This research initiative aims to design, simulate, and implement an automatic single-axis solar panel tracking system using Arduino Uno microcontroller and light sensors and thus to ensure that the environment is clean and safe to combat the climate change effect. This is especially significant in locations where the amount of sunshine varies during the day.

Place and Duration of Study: Department of Electrical and Electronic Engineering, American International University-Bangladesh (AIUB), Dhaka, Bangladesh between January 2023 and July 2023.

Methodology: In this research effort, we used an Arduino Uno microcontroller, servo motor, LDR sensor, LEDs, solar photovoltaic panel, etc. to make the proposed system. Arduino IDE was used for the program development. The microcontroller controls a servo motor to drive the solar panel from east to west to follow the sun’s path in the same direction.

Results: The simulation results and hardware output results confirm its functionality.

Conclusion: This design has the potential to drastically cut energy costs and increase the use of renewable energy sources by augmenting the efficacy of photovoltaic systems through the use of a microcontroller-driven single-axis solar tracker, thus contributing to a more sustainable future. This can be scaled up in the future using more sensors and axis.

https://journaljenrr.com/index.php/JENRR/article/view/319

Design and Implementation of Thermal Sensor Based Temperature Measuring Robot Using Arduino Uno.

TAMIM HOSSAIN et el.

This paper is about the “Thermal sensor based Temperature Measuring Robot” using Arduino Uno circuits. In this technology, Temperature Measuring Robot measured the temperature of the human body and the temperature of any object. The MLX90614 infrared thermometer is a contactless temperature sensor module for Arduino compatible device. An infrared thermometer works to measure the object temperature by the infrared radiation in the form of an electromagnetic wave through the light emitted on the object. MLX90614 is a powerful infrared sensing device with a very low noise amplifier with a 17 bit ADC. It utilizes non-contact temperature sensing to collect the temperature info without touching any surface of the object. The construction is equipped with many sensors. Hardware and software architecture and integration with Robot operating system is described in details. In the last part of the paper we presented the results of implemented measurement technologies and draw conclusions.

Development of Cost-Effective Fuel Briquette with Poultry Manure

DR. GOUR CHAND MAZUMDER et el.

Biomass can be converted into either heat energy or electrical or energy carriers using both thermo-chemical and biochemical conversion. Briquetting is a process where untreated biomass is converted into homogeneous, uniformly sized high density solid blocks. Briquettes are used in boilers, heating plants, thermal power stations and by individual households for heating. Present study focuses on using poultry manure with rice husk and saw dust. Poultry manure mixed with rice husk or saw dust by 60:40 ratio provides comparatively higher bond strength. Calorific value varies significantly with the use of poultry manure and tree leaves as well as its production cost. Pure rice husk contains higher calorific value (HCV) 12.6 MJ/Kg where adding poultry manure reduces its value to 10.3 MJ/Kg and Saw dust shows 10.4 MJ/Kg where pure saw dust has 16.3 MJ/Kg in 60:40 ratios with poultry manure. Addition of 20% tree leaves on weight basis ratio of 40:40:20 with base materials and poultry manure shows 10.5 MJ/Kg and 11.7 MJ/Kg respectively for rice husk and saw dust. Competitive price of briquette for 60:40 ratios with Poultry Manure shows 6 BDT/Kg and 5BDT/Kg when secondary material is added. Moreover, if the machine capacity increases the price is reduced

https://www.banglajol.info/index.php/DUJS/article/view/69091

Solar PV- and PEM electrolyzer-based green hydrogen production cost for a selected location in Bangladesh

DR. GOUR CHAND MAZUMDER et el.

Hydrogen is considered to be the environmentally safest energy source. Green hydrogen has no carbon footprint as it is produced from renewable energy sources. The barrier is the high production cost of hydrogen for all through usage of it. The use of solar photovoltaic (PV) electricity for polymer electrolytic membrane-based electrolysis may lower the production costs. Estimation of hydrogen production cost is performed using the life cycle cost (LCC) method. The PV electricity cost was calculated using the HOMER Energy Software. Lifetime of the project is 25 years with a 7.48% discount rate. The electricity cost is about Bangladeshi Taka (BDT) 39.91/kWh from solar PV. The

system consumes 6,011 kWh of electricity and produces 42.44 kg of hydrogen per year. The LCC result shows that the hydrogen production cost is about BDT 230.90/g. Bangladesh might consider giving emphasis for green hydrogen production and help establish a green hydrogen economy.

https://www.academia.edu/academia-green-energy/1/1/10.20935/AcadEnergy6160

Boosting Perovskite Solar Cell Stability through a Sputtered Mo-Doped Tungsten Oxide (WOx) Electron Transport Layer

DR. SAMIA MAHJABIN et el.

This study focuses on improving the stability of perovskite solar cells (PSCs) by developing a high-quality electron transport material (ETM). The optoelectronic and morphological properties of the ETM play a significant role in PSC performance. To prepare molybdenum-doped tungsten oxide (WOx:Mo) thin films, RF magnetron sputtering, followed by annealing, was used under vacuum conditions. Various sputter deposition times were used to optimize the thin film, and it was characterized for optical, electrical, structural, and morphological properties. Deposited WOx:Mo thin films demonstrated excellent optoelectronic properties and an average transmittance of 60 to 80%, making them suitable for efficient PSCs. The best WOx:Mo thin film was used to fabricate PSCs, resulting in long-term stability (retained >80% of its initial power output after 1440 h of storage at ambient conditions with a humidity range of 40–50%). The complete device optics were studied using the three-dimensional (3D) finite-difference time-domain (FDTD) method. This study demonstrates, for the first time, the use of RF magnetron-sputtered WOx:Mo ETM for PSCs, providing a new pathway for developing next-generation, highly stable PSCs.

An Adaptive Decision Tree Regression Modeling for the Output Power of Large-Scale Solar (LSS) Farm Forecasting

PROF. DR. NOWSHAD AMIN et el.

The installation of large-scale solar (LSS) photovoltaic (PV) power plants continues to rise globally as well as in Malaysia. The data provided by LSS PV consist of five weather stations with seven parameters, a 22-unit inverter, and 1-unit PQM Meter Grid as a big dataset. These big data are rapidly changing every minute, they lack data quality when missing data, and need to be analyzed for a longer duration to leverage their benefits to prevent misleading information. This paper proposed the forecasting power LSS PV using decision tree regression from three types of input data. Case 1 used all 35 parameters from five weather stations. For Case 2, only seven parameters were used by calculating the mean of five weather stations. While Case 3 was chosen from an index correlation of more than 0.8. The analysis of the historical data was carried out from June 2019 until December 2020. Moreover, the mean absolute error (MAE) was also calculated. A reliability test using the Pearson correlation coefficient (r) and coefficient of determination (R2) was done upon comparing with actual historical data. As a result, Case 2 was proposed to be the best input dataset for the forecasting algorithm.

https://www.mdpi.com/2071-1050/15/18/13521

Impact Analysis of Metallization Design and Recombination Losses on Performance of Crystalline Silicon Solar Cells

PROF. DR. NOWSHAD AMIN et el.

Using Griddler software, this study aims to select the optimal metallization design by analyzing the impact of the number and sizes of busbars and fingers on a solar cell's performance. There is interest in the PV industry to reduce the finger size toward 25 m in upcoming years. It is shown that an increase in the number and size of busbars and fingers causes an increase in the fill factor; however, with regards to the cell's efficiency, the shading factor should be considered in addition to the size and number of metal contacts. The results of this study indicate that solar cells' efficiency could be increased by 0.33–0.84% when using five busbars and a finger width of 35 m. Moreover, this increase is achieved by reducing the emitter resistance to less than 60 ohm/sq and considering a recombination rate of about 165 fA/cm2.

https://www.mdpi.com/1996-1073/16/18/6505

Elucidating the Effects of Interconnecting Layer Thickness and Bandgap Variations on the Performance of Monolithic Perovskite/Silicon Tandem Solar Cell by wxAMPS

PROF. DR. NOWSHAD AMIN et el.

In this study, we investigated the pathways for integration of perovskite and silicon solar cells through variation of the properties of the interconnecting layer (ICL). The user-friendly computer simulation software wxAMPS was used to conduct the investigation. The simulation started with numerical inspection of the individual single junction sub-cell, and this was followed by performing an electrical and optical evaluation of monolithic 2T tandem PSC/Si, with variation of the thickness and bandgap of the interconnecting layer. The electrical performance of the monolithic crystalline silicon and CH3NH3PbI3 perovskite tandem configuration was observed to be the best with the insertion of a 50 nm thick (Eg ≥ 2.25 eV) interconnecting layer, which directly contributed to the optimum optical absorption coverage. These design parameters improved the optical absorption and current matching, while also enhancing the electrical performance of the tandem solar cell, which benefited the photovoltaic aspects through lowering the parasitic loss.

https://www.mdpi.com/1996-1944/16/11/4106

Optoelectrical Properties of Treated CdSe Thin Films with Variations in Indium Chloride Concentration

PROF. DR. NOWSHAD AMIN et el.

The effect of a nontoxic chloride treatment on the crystallinity and optoelectrical characteristics of a CdSe thin film was studied. A detailed comparative analysis was conducted utilizing four molarities (0.01 M, 0.10 M, 0.15 M, and 0.20 M) of indium (III) chloride (InCl3), where the results showed a notable improvement in CdSe properties. The crystallite size of treated CdSe samples increased from 31.845 nm to 38.819 nm, and the strain in treated films dropped from 4.9 × 10−3 to 4.0 × 10−3, according to XRD measurements. The highest crystallinity resulted from the 0.10 M InCl3-treated CdSe films. The In contents in the prepared samples were verified by compositional analysis, and FESEM images from treated CdSe thin films demonstrated compact and optimal grain arrangements with passivated grain boundaries, which are required for the development of a robust operational solar cell. The UV-Vis plot, similarly, showed that the samples were darkened after treatment and the band gap of 1.7 eV for the as-grown samples fell to roughly 1.5 eV. Furthermore, the Hall effect results suggested that the carrier concentration increased by one order of magnitude for samples treated with 0.10 M of InCl3, but the resistivity remained in the order of 103 ohm/cm2, suggesting that the indium treatment had no considerable effect on resistivity. Hence, despite the deficit in the optical results, samples treated at 0.10 M InCl3 showed promising characteristics as well as the viability of treatment with 0.10 M InCl3 as an alternative to standard CdCl2 treatment.

https://www.mdpi.com/1996-1944/16/11/4108

Economic Power Dispatch Solutions Incorporating Stochastic Wind Power Generators By Moth Flow Optimizer

MD. SHAORAN SAYEM et el.

Optimization encourages the economical and efficient operation of the electrical system. Most power system problems are nonlinear and nonconvex, and they frequently ask for the optimization of two or more diametrically opposed objectives. The numerical optimization revolution led to the introduction of numerous evolutionary algorithms (EAs). Most of these methods sidestep the problems of early convergence by searching the universe for the ideal. Because the field of EA is evolving, it may be necessary to reevaluate the usage of new algorithms to solve optimization problems involving power systems. The introduction of renewable energy sources into the smart grid of the present enables the emergence of novel optimization problems with an abundance of new variables. This study's primary purpose is to apply state-of-the-art variations of the differential evolution (DE) algorithm for single-objective optimization and selected evolutionary algorithms for multi-objective optimization issues in power systems. In this investigation, we employ the recently created metaheuristic algorithm known as the moth flow optimizer (MFO), which allows us to answer all five of the optimal power flow (OPF) difficulty objective functions: (1) reducing the cost of power generation (including stochastic solar and thermal power generation), (2) diminished power, (3)

voltage variation, (4) emissions, and (5) reducing both the cost of power generating and emissions. Compared to the lowest figures provided by comparable approaches, MFO's cost of power production for IEEE-30 and IEEE-57 bus architectures is $888.7248 per hour and $31121.85 per hour, respectively. This results in hourly cost savings between 1.23% and 1.92%. According to the facts, MFO is superior to the other algorithms and might be utilized to address the OPF problem.

http://dx.doi.org/10.19101/IJATEE.2022.10100161

IoT-Based Automated Solar Panel Cleaning and Monitoring Technique

DR. MUHIBUL HAQUE BHUYAN et el.

Aims: The objective of this research work is to design and develop an IoT-based automated solar panel cleaning and real-time monitoring system using a microcontroller to improve the output and efficiency of a solar module at a low cost.

Study Design: Most of the time, dust over solar panels creates a barrier that obstructs the sun's radiation and reduces their performance. As such, it is necessary to keep the solar panel clean to improve output power levels. We integrated the IoT technology along with a range of components, including a microcontroller, a NodeMCU, a servo motor, a DC motor-driven submersible pump, a Light Dependent Resistor (LDR), an LCD with driver IC, etc. to design the system. We developed the assembly language program for the microcontroller.

Place and Duration of Study: The work was conducted individually under the supervisor of a faculty member as a part of the final project work of the Master of Engineering degree in Electrical and Electronic Engineering at American International University Bangladesh (AIUB), Dhaka, Bangladesh. The student conducted his research work at AIUB for two consecutive semesters from September 2022 to May 2023.

Methodology: An LDR sensor detects the solar panel's dirtiness and triggers the cleaning process through the microcontroller. The system monitors this continuously and real-time vital data is accessible to have some performance metrics, empowering timely maintenance actions to be triggered by the system and hence ensuring the maximum power output. The automated cleaning mechanism, driven by servo motors and mini submersible DC motor pumps, effectively removes dust and dirt from solar panels. An application was used to get real-time data through the internet to the user's smartphone.

Results: The server data is accessed to observe the system performance. The cost analysis shows that this system offers a cost-effective and sustainable solution for maintaining clean solar panels and optimizing power output.

Conclusion: Such an automation system can contribute meaningfully to the progression of renewable power generation by significantly improving the efficiency and longevity of solar panels. Thus, we can have sustainable and efficient energy systems in the country by integrating IoT-based automation systems.

https://journaljerr.com/index.php/JERR/article/view/959

Design and Implementation of Solar Power and an IoT-Based Pisciculture Management System

DR. MUHIBUL HAQUE BHUYAN et el.

Introduction: Pisciculture means fish farming for commercial purposes in a pond or in an artificially created fish tank. Proper care is needed for optimum fish yields.

Aims: The present research aims to design, simulate, implement, and test a low-cost pisciculture monitoring system to get the environmental status of a fishing pond where aquatic plants and fishes reside. The objective of this work is to produce high-quality and high yields of fish in the pond keeping the standard or prescribed states of the pond water.

Study Design: The factors that affect the pond environment are flow rate, pH level, oxygen level, temperature, humidity, etc. To get high yields of fish from a pond, these factors must be within a specified level. If the values of these parameters go below or above the prescribed level thben the water loses its quality and thereby fishes find it very difficult to survive in that pond because each water quality factor affects the health conditions of fish. Therefore, it is necessary to monitor these parameters.

Place and Duration of Study: Department of Electrical and Electronic Engineering, Southeast University (SEU) between June 2021 and April 2022.

Methodology: In this work, we have designed an automated microcontroller, IoT, and solar power-based water quality monitoring system for a fishpond. The automated system restores the values of these factors automatically when any of these factors fail to maintain their level in the pond.

Results: After testing the prototype of the system, we found that the designed system is performing very well and showing different parameter values in the LCD screen as outputs.

Conclusion: The system is in expensive and therefore, may be employed in practice.

https://journaljerr.com/index.php/JERR/article/view/799

Design and Concept of Renewable Energy Driven Auto-Detectable Railway Level Crossing Systems in Bangladesh

SUSMITA GHOSH et el.

Bangladesh’s railway system mostly uses typical manual railway crossing techniques or boom gates through its 2955.53 km rail route all over the country. Accidents frequently happen at railway crossings due to the lack of quickly operating gate systems, and to fewer safety measures at the

railway crossing as well. Currently, there are very few automatic railway crossing systems available (without obstacle detectors). Additionally, all of them are dependent on the national power grid, without a backup plan for any emergency cases. Bangladesh is still running a bit behind in generating enough power for its consumption; hence, it is not possible to have a continuous power supply at all times all over the countryside. We aim to design and develop a smart railway crossing system with an obstacle detector to prevent common types of accidents at railway crossing points. We use two infrared (IR) sensors to operate the railway crossing systems, which are controlled by an Arduino Uno. This newly designed level crossing system is run with the help of sustainable renewable energy, which is cost-effective and eco-friendly, and applied under the national green energy policy towards achieving sustainable development in Bangladesh as a part of the global sustainable goal to face climate change challenges. We have summarized the simulated the results of several renewable energy sources, including a hybrid system, and optimized the Levelized Cost of Energy (LCOE) and the payback periods.

https://www.mdpi.com/2673-7590/3/1/5

Design and Analysis of IoT-Based Battery Management and Monitoring System for Electric Vehicle

DR. MD. RIFAT HAZARI et el.

The growing popularity of electric vehicles on a worldwide scale leads to further research to monitor their performance. The use of Internet of Things (IoT) technology will make it easier to integrate the automated real-time monitoring system with the current electric vehicle technology. The great majority of electric vehicles use rechargeable lithium-ion batteries. Use of lithium-ion batteries creates an overcharging situation in the battery, which significantly decreases battery life. It also increases the possibility of disastrous safety risks due to fire. This paper develops an IoT-based battery management system to minimize hazardous situations. The battery monitoring system (BMS) notifies the user about the condition of the battery in real time.

https://ajse.aiub.edu/index.php/ajse/article/view/731

Characterization and Comparison of DSSCs Fabricated with Black Natural Dyes Extracted from Jamun, Black Plum, and Blackberry

DR. MOHAMMAD MAHBUB RABBANI et el.

In this report, natural dyes extracted from three different, black-colored fruits were used as photosensitizers for the construction of dye-sensitized solar cells (DSSCs). The natural dyes were extracted from the dark-colored peels of jamun (also known as Indian black plum), black plum, and blackberry fruit. These natural dyes contain polyphenolic compounds—most prominently anthocyanins—which interact strongly with titanium dioxide (TiO2) semiconductors and accordingly

enhance the efficiency of DSSCs. The natural dyes extracted from the various fruits were characterized utilizing UV-Vis and fluorescence spectroscopy. The interaction between the dyes and TiO2 was monitored with FTIR and Raman spectroscopy. The fabricated DSSCs were characterized via current–voltage measurements and electrochemical impedance analysis. DSSCs fabricated with jamun produced the highest efficiency of 1.09% with a short-circuit current of 7.84 mA/cm2, an open-circuit voltage of 0.45 V, and a fill factor of 0.31. The efficiencies of the DSSCs from black plum and blackberry were 0.55% and 0.38%, respectively. The flow of charge occurring at the interfaces between the natural dye and the TiO2 layers were investigated using electrochemical impedance spectroscopy (EIS). To the best of our knowledge, this study is the first to directly compare three distinct types of black DSSCs. Computation analysis was also carried out utilizing SCAPS-1D software (version 3.3.07), which revealed how the type of defects in the devices impacts their performance.

https://www.mdpi.com/1996-1073/16/20/7187

An IoT-Enabled Microbial Fuel Cell for Wastewater Treatment and Enhancing Hydroponic Systems: An Eco-Friendly Renewable Energy Development

ABU SHUFIAN et el.

An IoT-Enabled Microbial Fuel Cell for Wastewater Treatment and Enhancing Hydroponic Systems: An Eco-Friendly Renewable Energy Development

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Smart Monitoring and Control of Water Purification System Using UF Membrane Filtration

ABU SHUFIAN et el.

Smart Monitoring and Control of Water Purification System Using UF Membrane Filtration

https://r10htc2023.org/

Design and Simulation of Standalone Solar Agri-PV System in Bangladesh: A case study

ABU SHUFIAN et el.

Design and Simulation of Standalone Solar Agri-PV System in Bangladesh: A case study

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Three Phase Fault Analysis using Thermal-Magnetic Circuit Breaker and Overcurrent Relay

ABU SHUFIAN et el.

Three Phase Fault Analysis using Thermal-Magnetic Circuit Breaker and Overcurrent Relay

http://icict4sd.bup.edu.bd/

Solar PV Panel Automatic Shading Analysis Using Boost Regulator and Inverter System

ABU SHUFIAN et el.

Solar PV Panel Automatic Shading Analysis Using Boost Regulator and Inverter System

http://icict4sd.bup.edu.bd/

Smart Power Systems for Smart Cities: Architectural Development and Economic Performance Assessment

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Smart Power Systems for Smart Cities: Architectural Development and Economic Performance Assessment

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