Control & Applications Research Centre (CARC)

Annual Report 2017

Control & Applications Research Centre

BRAC UNIVERSITY

Inspiring Excellence

Message from the Director of CARC

Being the director of the Control & Applications Research Center (CARC), it has been an honor and a privilege for me to observe the advancements we have had over the years on the various applications of renewable energy in our country. The fact that our efforts have had a significant impact on the improvement of our country's technology is deeply rewarding and humbling. Additionally, the encouragement that we have received from the current government, for such energy-related research, makes us feel like that it is rather a very remarkable initiative which we have taken for the country's development. It is, therefore, a joy for me to thank the many organizations and individuals who have shown their support for this research center. It is because of generous benefactors, such as yourselves, pioneering researchers get the opportunities to pursue visionary ideas to lead technological changes for the better.

CARC research and projects are precisely concentrated on our country's economy and sustainability. For a few decades, our country has been failing in producing the necessary amount of electricity to meet the people's needs. The government has taken several initiatives to solve this energy crisis, and while the situation has improved, it is still not enough. The catastrophe has driven us towards effective projects like Solar Electric Refrigerator, Solar Electric Stove with Double Burner, Torque Sensor-based Solar Powered Electric Wheel-chair with a Dedicated Solar Charger Kit (Version 2) and so on. Simultaneous publications have already proven our international eminence. I am proud to say that, once again, IEEE SIGHT USA has come forward to fund our humanitarian research development. They, along with Rehabilitation of the Paralyzed (CRP), Bangladesh, have helped CARC to develop the Solar Powered Electric- Wheelchair. These triumphs show how innovative thinking, catalyzed by our research, brings hope to possible energy solutions. Researcher‘s contributions sustain the CARC's unique scientific culture—one that fosters ingenuity, risk-taking, and collaboration among universities and industries to produce major technical advances. On behalf of everyone at the CARC, I extend my sincere thanks to you for helping us by investing in our breakthrough research.

Regards,

Dr. A KM Abdul Malek Azad, PhD
Director
Control & Applications Research Centre (CARC)

Contents

About Us

Control & Applications Research Centre

The Control & Applications Research Centre (CARC) has expertise and activities in an area of systems and control engineering. CARC has a strong practical focus to the work, and many of the projects involve close collaboration with industrial organizations. We emphasis upon the application requirements and exercise established theoretical techniques to provide solutions though technological demonstration.

Control & Applications Research Centre

Vision

Serve Bangladesh as a valuable resource for industry and society through excellence in scientific and technical research.

Mission

The mission of CARC is to generate, apply, and disseminate research findings, build capacity in the field by training the next generation of researchers and to create collaboration and synergy programs with different institutes.

Research Areas

CARC specialises in several fields of Electrical and Electronic Engineering. Our research field includes:

- *Renewable Energy*
- *Industrial applications of Control Systems*
- *Algorithm and Architecture for Real-Time Controllers*
- *Supervisory Control And Data Acquisition (SCADA)*
- *Mechatronics (Robotics)*
- *Intelligent Control*
- *Biomedical Engineering (Direct Cardiac Compressor Device)*
- *Modelling and Simulation*

Leadership & Management

Director of CARC

AKM Abdul Malek Azad, PhD

Professor
Dept. of Electrical and Electronic Engineering (EEE)
Director
Control and Applications Research Centre (CARC)
BRAC Universiry
e-mail: a.azad@bracu.ac.bd

CARC Project Engineer

Ataur Rahman

Project Engineer
Control & Applications Research Centre (CARC)
BRAC University
e-mail: ataur.rahman@bracu.ac.bd

CARC Research Assistants

Md Nazrul Islam

Research Assistant
Control & Applications Research Centre (CARC)
BRAC University

Sayem Chowdhury

Research Assistant
Control & Applications Research Centre (CARC)
BRAC University

Mashuk Sarwar

Research Assistant
Control & Applications Research Centre (CARC)
BRAC University

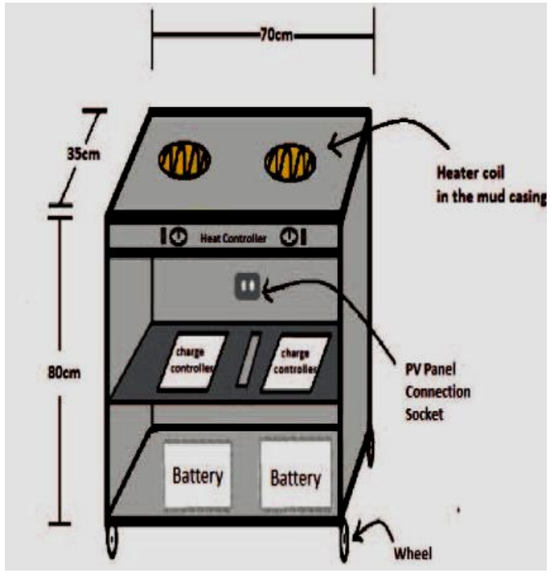
Completed Projects

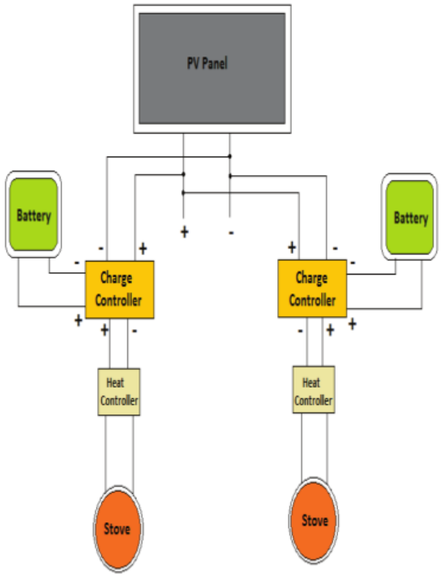
Completed Projects

Solar Electric Stove with Double Burner Project

Bangladesh is facing overwhelming energy challenges that are likely to increase over the next few decades. By acknowledging the potential of renewable energy technologies and associated energy storage, Bangladesh could possibly meet its unprecedented energy demand. Our goal is to design a project which involves the development of a solar-powered electric stove that would use sunlight as a source of power. The electricity and gas shortage in Bangladesh are strong motivators for a solar electric stove to replace the normal stoves. Our system consists of two burners which altogether require solar panels providing power of 1520W. Satisfactory results in terms of the cooking time of various food has rendered us to conclude its effectiveness for the households in distant rural areas of the country.

After the successful and desired performance of the prototype solar stove, CARC planned to start a pilot project in 2017 to spread its usages in both urban and rural areas of the country. But based on the real-life scenario, CARC is currently redesigning the solar electric stove with BRAC University's young researchers for which the burner will be more efficient in heating. Under Synergy program with BRAC, we wish to commercialize this smart stove in a larger scale for both urban and off -grid areas of our country by the mid-2018 via BRAC Social innovation Lab (SIL) which is a genuine platform for researchers for development, generate ideas and insights, design prototypes, and share knowledge about scalable innovations with the global development community.

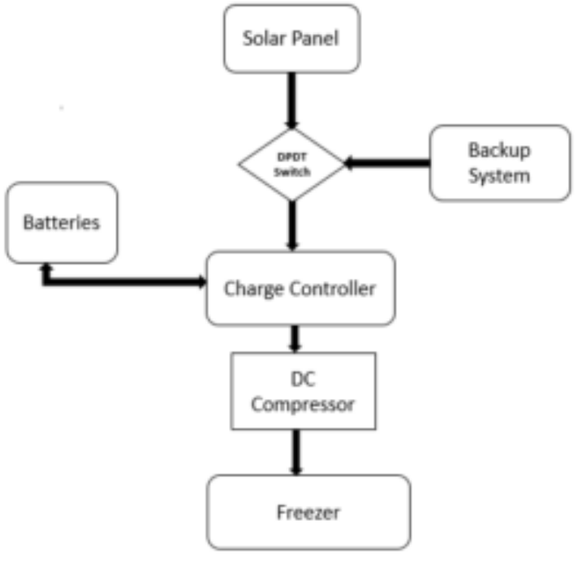




Completed Projects

Solar Electric Refrigerator

Preserving perishable goods as soon as they are harvested is the main concern for the farmers in the rural areas of Bangladesh for lack of cold storage facilities and absence of electricity supply. To supply ample facilities in the rural areas of the country this project is aimed to provide cold storage facilities incorporating renewable energy (Solar energy) and batteries; it will give a total off grid solution to the problem storing perishable goods and ensure food security. The prototype of the cold storage consists of solar Photovoltaic (PV) panels, batteries, charge controller, freezer and a DC compressor. The DC compressor, which is replaced by the AC compressor in the freezer, is the most vital component of the system as it runs the freezer taking DC output from the PV panels. The power supplied from the PV panels simultaneously runs the DC compressor and charges the batteries through the charge controller. The batteries give backup and runs the DC compressor at night in nonappearance of the sun. The system has been developed and implemented at the rooftop of BRAC University building-1 and all the tests have been done there. This project also includes the system's overall performance test, results and analysis of the results. Moreover, the battery backup time in absence of sun for a long time has been analysed. In all, the system has the complete solution for supplying cold storage facilities in off grid areas and give an environment friendly solution of the storage problem.



Completed Projects

Torque Sensor-based Solar Powered Electric Wheel-chair with a Dedicated Solar Charger Kit (Version-2)

Mobility of the physically disabled people is a great concern in our society. Physically disabled people are basically using some assistive devices like, crutches, artificial limbs or legs etc. and manual wheel chairs or three-wheelers for their day-to-day movements. In response to this Control and Research Applications Centre (CARC) of BRAC University has conducted a research on making an electrical wheelchair with a dedicated solar charger kit. It is an IEEE funded project.

At the beginning of 2017, CARC, BRAC University and Centre for the Rehabilitation of the Paralysed (CRP), Bangladesh signed a Memorandum of Understanding (MoU) of Six months for the modified electrical wheelchair. The expectation was to evaluate the real-life assessment of the usefulness and impact of this electric wheelchair on the lives of the physically-challenged people at CRP. Unfortunately, the contract of the project engineer was over in the middle of the time-frame of the MoU, thus couldn't finish the evaluation. Therefore, CARC is planning now to renew the MoU as the project engineer is back.

The aim of CARC for this project in 2018 is to renew the MoU and modify the vehicle if required for the further test which will be also conducted for 6 months at CRP under the close supervision of doctors, engineers, CARC engineers and other CARC staff members. Upon the completion of the deadline of the works being conducted by CARC in collaboration with CRP, CARC will prepare project report for IEEE SIGHT USA (fund provider) of the outcome of these field tests that will give a complete scenario of the usefulness of this wheelchair in our country so that it can be manufactured in large scale for both rural and urban areas of Bangladesh.

It has been later developed as a part of IEEE SIGHT USA Project.

CRP
Centre for the Rehabilitation of the Paralysed

BRAC UNIVERSITY
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Completed Projects

Shouro Shebha (Solar Ambulance)

Rickshaws are an essential method of transportation in Bangladesh. When it was altered to electrically assisted rickshaw in the IDCOL-CARC venture, it attained popularity but was soon is continued due to overconsumption of power. Therefore, Control and Applications Research Centre (CARC), BRAC University had developed a complete off-grid arrangement by utilizing the PV array, torque sensor pedal, and solar battery charging station and implementing it in a solar electric ambulance van as a significant part of individuals who live in the provincial zones, where the likelihood of reaching the hospital on time is very low due to lack of mode of transportation. The torque sensor pedal lessens the over-utilization of battery-bank. The intelligent control framework reduces the human force and diminishes the over-utilization of engine. PV panel is introduced on top of the van to share a part of the power and a solar battery charging station is installed to make the entire framework totally autonomous of national grid. CARC has success to bring the ambulance in the commercial stage and able to sell it in the rural area. As an industrial partner or CARC, BeevaTech delivered two commercial electrical Ambulance vans on a very affordable price to a local clinic in Tongibari, Munshiganj.

Ongoing Projects

Ongoing Projects

An Automated Fire Suppression Mechanism Controlled Using an Arduino

In 2017, the CARC has completed and tested successfully of the initial prototype on automated fire suppression mechanism controlled using an Arduino in BRAC University premises. The project is a real time system that detects the presence of flame of certain wavelength in the air due to fire and suppresses the fire via continuous water running through multiple sprinklers. In 2018, the CARC plans to work with BRAC SIL to commercialize the fire suppression mechanism and disseminate its usages across Bangladesh and also to evaluate the impact of this project on the effectiveness of the people living in rural and urban areas.

The key feature of this system is the ability to remotely send an alert when a fire is detected. Fire is an undesirable event that could cause a great loss of social wealth, human life and confidential amenities. To prevent these losses, various alarm systems have already been developed such as smoke detectors, temperature sensor based systems etc. The room or the area will have dedicated overhead sprinklers connected to the water supply through its dedicated solenoid valve which controls the flow of water in the pipe lines. The triggering devices of this system are the flame sensors, when they detect fire an alarm will go off. The coding set in the Arduino will come into work and provide the optimal voltage to the solenoid valve through a relay and hence water will rush out the sprinklers extinguishing fire in no time. The sensors we will be using are highly sensitive, thus it will detect fire even before it reaches to a point of concern. Water will be evenly spread out through the overhead sprinklers. Unlike other alarm systems, the components we used are readily available and reasonable in price. Our automated fire suppression system can be used both for commercial and residential purposes.

Ongoing Projects

Automatic Luminous measurement of LED lights in cost effective way using cylindrical method

Due to an exceptional geographical location, Bangladesh can produce significant amount of solar energy, which is 1840-1575 kWh/m^2 annually. Because of that solar home system (SHS) is gaining enormous popularity in our country in social as well as business sector in our country. Since verities SHS components manufacturers, overall quality of LED lamps fluctuates from organization to organization, and as a result an increment in unsteady quality with the number of SHS installation occurs, which eventually causes system ineffectiveness. There are two existing lumen testing procedures - integrated sphere and goniophotometer method are quite costly in our country's perspective. So we have to come up with handmade cylindrical box with different dimension and sizes in CARC lab of BRAC University. Researches already included the testing results and also have established equations based on the measurement of total lumen of light sources. In our thesis we will make automatic luminous measuring embedded box based on these equations using a micro-controller, which will show the output of the system on the screen of the embedded box.

Ongoing Projects

IOT Based Real -Time Synchronized Clock

This project brings forward an approach of an IOT based synchronized clock system where data is acquired from an NTP server. The data is then distributed using an optimum system comprising of WiFi and Microcontrollers. Synchronization is achieved through a method of implementing ESP8266 being utilized as its input device. Shift registers along with RTC in incorporated in order to maintain the display synchronous in case of power failure. The program has been developed in Arduino IDE. CARC is planning to disseminate this project throughout all the school, college and university classrooms after the successful prototype implementation in BRAC University premise.

Upcoming Projects

Upcoming Projects

Fatigue driving warning device

According to reports published in several newspapers and electronic medias in Bangladesh, a total number of 3,412 people were killed and 8,572 others injured in 2,998 road accidents in 2016. A large portion of the accidents occur in the highway during night time, where drivers drive buses or trucks in long routes. Many of these accidents occurs because often the drivers fall asleep while driving due to fatigue. This project is to make an electronic device that will allow them to be notified when they are about to fall asleep and this will decrease a large portion of accidents. This project will include a pulse sensor and a blink sensor to detect the drowsiness of the driver. Only if both the sensor is positive, then a buzzer will be activated which will wake the driver up for sure. Moreover, the project will also allow the device to sense rather the driver is having a heart related problem such as arrhythmia by recognizing the heart beat rate which is relatively higher than the normal rate, the buzzer will blow off also in this case to alert the attendants.

Upcoming Projects

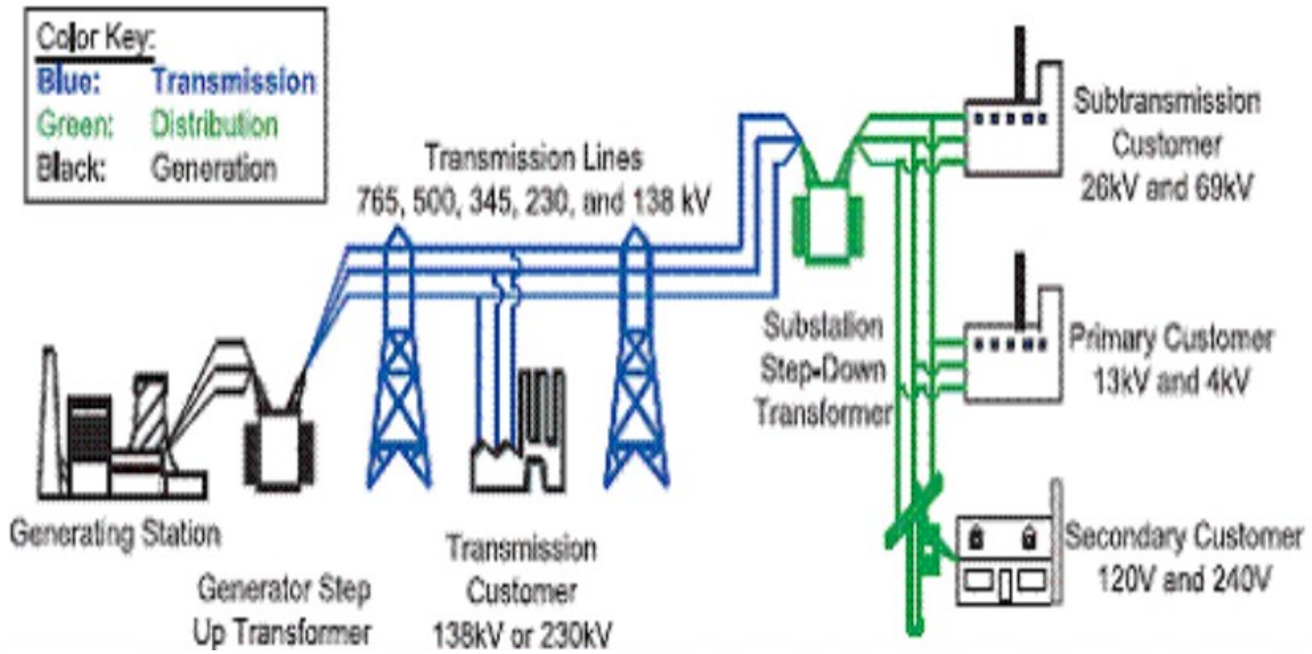
Traffic Predictability and Congestion Evasion using Kalman Filter

Traffic congestion in the city of Dhaka is reaching a new pinnacle every day. Owing to numerous private cars and local buses, the gridlocks in Dhaka city can be termed as one of the worst in the world. In a recent World Bank-sponsored international conference, it was told that around 3.2 million working hours are being lost every day in Dhaka city due to traffic gridlocks. In order to resolve this issue and help manage the gargantuan problem, CARC had decided to tackle this by the implementation of Kalman Filter to predict the level of congestion at a particular road according to time variance of the day. The reason for using Kalman Filter is because its accuracy. Other reasons being that it can be simulated using Matlab and can be constantly updated using the latest data.

Post-Graduate Thesis

Post-Graduate Thesis (Completed)

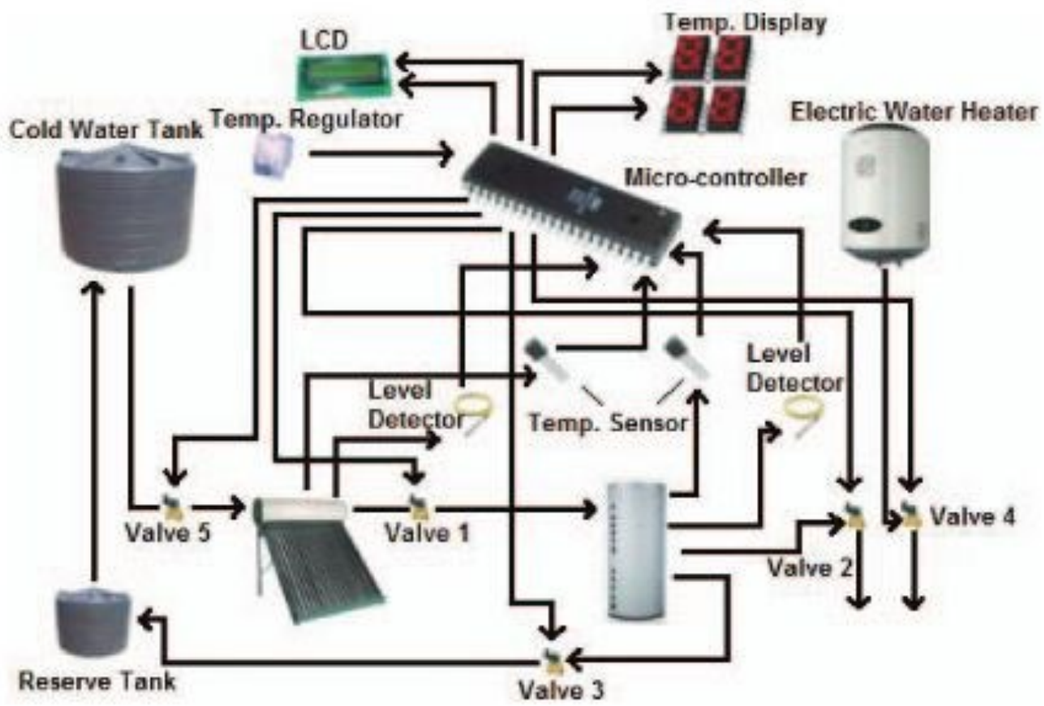
WiMAX Implementation of Smart Grid Wide Area Distributed Generation and Demand Side Load Protection Model in MATLAB/SIMULINK



Smart grid plays a vital role to protect electrical load and utilities among electrical power consumers due to its wide range of advantages which in turn made up its growing demand in current world. Mostly, electrical loads are venerable to fault current in the system results in sudden failure of expensive loads which is needed to be detached for safety reason. Therefore, this paper mainly focuses on designing the circuit in generating a fictitious fault current and its detection through WiMAX communication so as to detach the load from power generation unit using Matlab Simulink. In order for transmission of fault or trip current through wireless communication system, a WiMAX transceiver IEEE STD 802.16d has been designed, implemented and optimized for trip current transmission and receiption to certain distant places circuit breakers located in different HV and LV distribution system. Moreover, an automatic back-up system has been proposed to provide an uninterruptable power to the utilities/ load during when the fault current occurs. Finally, the simulation result shows a successful transmission and detection of fault signal along with its impact in load end is evaluated for overall performance of the designed system.

Post-Graduate Thesis (Ongoing)

Mathematical modeling of solar domestic hot water system (SDHWS) with thermal storage tank



This paper depicts detailed operation of water heating with solar all glass evacuated tube collector has been evaluated experimentally and numerically. A precise model of the system has been advanced to observe the execution of solar powered heating system and the perfection analysis of the evacuated tube collector. The model has been considered by the experimental data on various parameters such as circulation system, changes of temperature in the collector, number of storage tank, flow rate of water and ground reflectance that are responsible to assess. Efficiency of evacuated tube collector and storage tank insulation has been calculated for any changes in size and volume. The model can also be used to obtain numerical solar fraction considering the effects of insulation regarding of changes in temperature and mass flow rate of water. Overall efficiency of solar evacuated tube collector has been obtained by using the produced model for the system and also the result has been conducted for a typical multifamily installation to measure the system performance throughout the year.

Post-Graduate Thesis (Ongoing)

Mathematical modeling of Discrete Linear Quadratic Regular (DLQR) for perfect Tracking Control of Non Minimum Phase System with Six Degrees of Freedom

This paper depicts detailed operation of water heating with solar all glass evacuated tube collector has been evaluated experimentally and numerically. A precise model of the system has been advanced to observe the execution of solar powered heating system and the perfection analysis of the evacuated tube collector. The model has been considered by the experimental data on various parameters such as circulation system, changes of temperature in the collector, number of storage tank, flow rate of water and ground reflectance that are responsible to assess. Efficiency of evacuated tube collector and storage tank insulation has been calculated for any changes in size and volume. The model can also be used to obtain numerical solar fraction considering the effects of insulation regarding of changes in temperature and mass flow rate of water. Overall efficiency of solar evacuated tube collector has been obtained by using the produced model for the system and also the result has been conducted for a typical multifamily installation to measure the system performance throughout the year.

Collaborations

National Collaborations

SYNERGY Between CARC, EEE Dept. BRAC University and SIL,BRAC

Solar Electric Stove with Double Burner

After the successful and desired performance of the prototype solar stove, CARC planned to start a pilot project in 2017 to spread its usages in both urban and rural areas of the country. But based on the real-life scenario, CARC is currently redesigning the solar electric stove with BRAC University's young researchers for which the burner will be more efficient in heating. Under Synergy program with BRAC, we wish to commercialize this smart stove in a larger scale for both urban and off-grid areas of our country by the mid-2018 via BRAC Social innovation Lab (SIL) which is a genuine platform for researchers for development, generate ideas and insights, design prototypes, and share knowledge about scalable innovations with the global development community.

National Collaborations

SYNERGY Between CARC, EEE Dept. BRAC University and SREDA

By the end of 2017, CARC of BRAC University were supposed to receive the remaining fund for the one year long project on Solar Assisted Human Hauler, Solar Assisted Ambulance Van and Solar Assisted Cargo Hauler. Thus CARC received the last disbursement on time after successfully completing the pilot project on solar assisted electric vehicles. As in 2017, CARC's goal was to commercialize the vehicles and disseminate its usages across the rural areas of Bangladesh in order to assess its feasibility and sustainability of these vehicles through real-life usages and also to evaluate the impact of this environment friendly transportation on the lifestyles of the people living in rural area. The step has already been taken by CARC in 2017 by submitting a proposal to Sustainable and Renewable Energy Development Authority (SREDA). The project got a very positive feedback on the Solar Ambulance in a meeting organized in SREDA Head quarter, IEB Bhaban, Dhaka to disseminate solar ambulance through all the community clinics in Bangladesh to pay the best service. CARC is now waiting for the reply of the proposal which is submitted to SREDA in 2017. Alongside, under CARC observation, BeevaTech delivered two commercial electrical Ambulance vans to a local clinic.

National Collaborations

SYNERGY Between CARC, EEE Dept. BRAC University and CRP

Project on Electric Wheelchair for the Disabled People

At the beginning of 2017, CARC, BRAC University and Centre for the Rehabilitation of the Paralysed CRP, Bangladesh signed a Memorandum of Understanding (MoU) of Six months for the modified electrical wheelchair. The expectation was to evaluate the real-life assessment of the usefulness and impact of this electric wheelchair on the lives of the physically-challenged people at CRP. Unfortunately, the contract of the project engineer was over in the middle of the time-frame of the MoU, thus couldn't finish the evaluation. Therefore, CARC is planning now to renew the MoU as the project engineer is back. The aim of CARC for this project in 2018 is to renew the MoU and modify the vehicle if required for the further test which will be also conducted for 6 months at CRP under the close supervision of doctors, engineers, CARC engineers and other CARC staff members. Upon the completion of the deadline of the works being conducted by CARC in collaboration with CRP, CARC will prepare project report for IEEE SIGHT USA (fund provider) of the outcome of these field tests that will give a complete scenario of the usefulness of this wheelchair in our country so that it can be manufactured in large scale for both rural and urban areas of Bangladesh.

National Collaborations

Industrial Partner Beevatech Ltd.

Since the signing of MoU in 2012 between CARC and Beevatech Ltd. Various projects have been involved with various research projects including Solar Battery Charging Station, Solar Powered Electric Vehicles, Solar powered Wheelchair and so on. The two organisations share the common goal of making the electric vehicles more available in the country removing the government ban. Several publications have been made in this regard.

International Collaborations

Professional Affiliation with IEEE SIGHT USA

CARC is recognized in the international community as the CARG SIGHT (Bangladesh), an organisation funded by IEEE SIGHT USA for various research activities based on humanitarian projects. It provided the seed money required for research on the prototypes of the electric vans, human hauler and ambulance van namely, as well as the electric wheelchair. The successful manufacture of the prototypes of the electric vans have rendered CARC to launch pilot project in collaboration with IDCOL. Collaboration with SREDA, Bangladesh is under process for the project on dissemination of the Solar Ambulance through out the country. CARC is looking forward to the same aftermath with all other projects with the goal of a sustainability as well as commercialization to benefit the community.

IEEE USA

carC
Control & Applications Research Centre

Achievement

Achievement

CARG SIGHT (Bangladesh) received fund from IEEE SIGHT USA for developing a re-modified Electrically Assisted Wheelchair

In 2016, IEEE SIGHT USA provided a seed fund of USD 1237.50 to CARG SIGHT (Bangladesh) of BRAC University for producing and developing a modified torque sensor based electric wheelchair for the physically challenged people. It is to mention that the first version of the electric wheelchair has been tested by doctors, patients and engineers at Centre for Rehabilitation of the Paralyzed (CARP), Savar at the beginning of this year. Based on the feedbacks obtained from CRP personnel, the outcome of the field tests have revealed some necessary modifications require to ensure much more comfortable experience for the disabled people and to improve the performance of the electric wheelchair.

Events

Events

CARC Director invited to SREDA, a government body, for commercialization of solar ambulance all over Bangladesh

The director of CARC, BRAC University, Dr. A.K.M. Abdul Malek Azad attended the meeting for presenting their proposal on the commercialization of solar ambulance all over Bangladesh through 13,136 community clinics. The entire session was chaired by the SREDA chairman Mr. Helal Uddin and the meeting took place on the 10th of April, 2017 at the SREDA Conference Room, IEB Bhaban. Many officials from BRTC of BUET, CARC from BRAC University, IDCOL, Dhaka University, United International University, UNDP, along with members of SREDA took part in the meeting to discuss about the future of various innovative renewable projects in Bangladesh. Solar ambulance, solar human hauler, solar cargo hauler and solar stove are some of the examples of the projects CARC has been investing its resources in. This brings new aspects of improvement in transportation system in the country pioneered by CARC, BRAC University.

Events

IEEE SIGHT Community of Practice meeting

Control & Applications Research Group (CARG) Special Interest Group on Humanitarian Technology (SIGHT) Bangladesh Committee held meeting in Mohakhali, Dhaka, Bangladesh. The inauguration of the first IEEE Community of Practice (CoP) Meeting was held and the respected Professor of BUET, Dr. Shahidul Islam Khan (IEEE Bangladesh Section Founder) welcomed everyone with his warm inaugural speech. Reputed professionals and professors from abroad very keenly attended the two day event, along with respected faculty members of the EEE Department of BRAC University. Some very enthusiastic students of the department and IEEE members took this opportunity to learn and make the most of it. Professor of EEE Department, BRAC University and IEEE Branch Counselor, Dr. AKM Abdul Malek Azad led the meeting for two days and gave the attendees a hands on experience on the projects CARC has been working on. Human Cargo Hauler and Solar Ambulance, which recently have received an immense amount of recognition internationally, were the highlights during the practical demo session. To have everyone engaged and energetic, BRAC University showed great hospitality and delicious meals accompanied every session for the two days. After all the sessions, a conclusion was reached where issues were addressed, that are hoped to be solved by working together, to achieve the mission and vision of IEEE SIGHT USA.

Publications

Journal Publications

1. Jannatul Ferdous, Rafiur Rahman Surjo, Raied Hasan and AKM Azad, “Automation, Heat Loss Reduction and Optimum Positioning of Solar Hot Water System with Storage Tank in Perspective of Bangladesh”, Accepted to appear, BRAC University Journal: Science and Engineering, 2017.

2. MD Jaber AL Rashid, Ataur Rahman, Abu Raihan Mohammad Siddique and A. K. M Abdul Malek Azad, “A Novel Approach of Improving Battery Performance and Longevity of the Developed Electrically Assisted TriWheeler Vehicle by Implementing Torque Sensor Technology”, Hindawi Publisher, The International Journal of Vehicular Technology, 2017. (https://www.hindawi.com/journals/ijvt/aip/3757421/)

3. Fahimul Haque, A. Azad "Luminous Measurement of LED Lights in Cost Effective Way Using Cylindrical Method" Elsevier under “ScienceDirect, Measurement Volume 98, Pages 123–130, February 2017.
(Link: http://www.sciencedirect.com/science/article/pii/S0263224116306728)

Conference Publications

1. DEVELOPMENT OF DOUBLE BURNER SMART ELECTRIC STOVE POWERED BY SOLAR PHOTOVOLTAIC ENERGY. Author: S. Siddiqua, S. Firuz, B. M. Nur, R. J. Shaon, S. J. Chowdhury, and A. Azad. Submitted to: GHTC 2016. Submitted on: 5th June, 2016, Published on: 16th February, 2017.

2. ELECTRICALLY FACILITATED SOLAR CARGO HAULER — A KEY TO EASY AND SAFE TRANSPORTATION OF GOODS WITHOUT DEPENDENCY ON THE NATIONAL GRID. Authors: A.E. Purbasha, F.R. Khan, M. Sanjib and A. Azad. Submitted to: GHTC 2016. Published on: 16th February, 2017.

3. SOLAR ELECTRIC AMBULANCE VAN UNFOLDING MEDICAL EMERGENCIES OF RURAL BANGLADESH. Authors: R. Tarek, A. Anjum, M. A. Hoque and A. Azad. Submitted to: GHTC 2016. Published on: 16th February, 2017.

News Media

Bangladeshi News channel– Dipto had covered the Solar Ambulance in their "Deepto News Special Story: রকিশাভ্যান দয়িে সং·লোর অ্যামবউিলন্সে তরৈরি উদ্যং·াগ ব্র্যাকরে"
Available at:
https://www.youtube.com/watch?v=eDEM8TaEPV0

Multinational Mass Media and Information firm- Thomson Reuters Publication: "*Cheap solar ambulances to speed into service in rural Bangladesh*"
Available at:
http://news.trust.org/item/20170214110125-vmv7z/

Newspaper- The Daily Observer publication: "*Solar in Wheelchair*".
Available at:
http://www.observerbd.com/2016/01/16/131230.php

Newspaper Publication- Dhaka Tribune: "*Powered wheelchair developed by BRACU students*",
Available at:
http://archive.dhakatribune.com/arts-culture/2016/jan/05/powered-wheelchair-developed-bracu-students

Newspaper Publication- The Daily Star: "*Improvised, new look 3-wheelers in the making*"
Available at:
http://www.thedailystar.net/frontpage/improvised-new-look-3-wheelers-the-making-1301812

Newspaper publication- Dhaka Tribune: "*Powered by the sun*".
Available at:
https://issuu.com/dhakatribune/docs/160921191907-fb225561349846c09ebc9a8758afa2bb/19?e=6924309/38991726

Newspaper publication- Kaler Kantho: " *বাঁচাবে মায়রে প্রাণ* ".
Available at:
http://www.kalerkantho.com/feature/campus/2016/09/07/402696

Paper Review

Journal Paper Review

The honor of reviewing journal publications has also been given to CARG by a couple of journal publishers. Several papers have already been reviewed by the CARC members and we have already been requested for reviewing further paper in the upcoming transactions. The following are the journals that CARC has been reviewing recently.

Journal of Frugal Innovation

The ***Journal of Frugal Innovation*** **(JFI)** is a peer-reviewed open access journal published under the Springer Open brand. It is aimed to provide a platform facilitating timely dissemination of innovative concepts for emerging markets. JFI is an open access journal catering to the needs of a wider populace. In the Open Access model the articles are free for all once published. (Source: http://www.springer.com/engineering/journal/40669)

JFI welcomes various kinds of articles that will establish the basis for frugal innovation .

Journal Paper Review

Journal of Renewable and Sustainable Energy

JRSE, published by the American Institute of Physics, is an interdisciplinary, peer-reviewed journal covering all areas of renewable and sustainable energy-related fields that apply to the physical science and engineering communities. Content is published online daily, collected into bimonthly issues (6 times a year). As an electronic-only, web-based journal with rapid publication time, JRSE is responsive to the many new developments expected in this field. The interdisciplinary approach of the publication ensures that the editors draw from researchers worldwide in a diverse range of fields. *(jrse.aip.org)*

Topics covered include:

1. Bioenergy – bio-reactions and bioengineering

2. Geothermal energy – geysers, heat pumps, and novel devices

3. Marine and hydroelectric energy – waves, tides, and dams

4. Nuclear energy – fission, fusion, and related materials

5. Solar energy – photovoltaic and solar thermal converters

6. Wind energy – turbines and electrical systems and controls

7. Energy conversion – solid oxide and proton exchange membrane fuel cells and novel devices

8. Energy efficient buildings – photovoltaic, solar thermal converters, and passive solar approaches

9. Energy storage – hydrogen and batteries

10. Power distribution – conventional and superconducting transmission, fluctuating loads, and controls

11. Renewable energy resource assessment

12. Transportation – hydrogen, batteries, fuel cells, bioenergy, and vehicles

Conference Paper Review

CARC has the similar experience of reviewing by doing conference papers review recently as well. The following is one such conference where CARC members reviewed several papers on request.

The Global Humanitarian Technology Conference

GHTC, organized by IEEE, is a voice amplifier and a forum for hot technological, social, and philosophical debates on the world's urgent human necessities. The cross-disciplinary annual conference brings together communities and individuals – engineering, science, technology, industry, academe, government agencies, NGOs, charities, funders – interested in applying technology to develop effective solutions for the challenges facing the world's underserved. The conference aims to foster exchange of information, networking, and cooperation in the humanitarian field and focus attention of businesses on emerging market opportunities and related technology enablers. (www.ieeeghtc.org)

Finance

Finance

CARC
Finance Details 2017

As at 30 June to 31 Dec 2017	In Taka
Assets:	
Fixed Assets against requisition (Approx.)	**10,00,000**
Total	**10,00,000**
Expenses:	
Research Expense by IO	**24,101**
CARC Expense by Requisition (Approx.)	**100,000**
IEEE COP Meeting (Approx.)	**400,000**
Other CARC expense (Approx.)	**300,000**
Total	**824,101**
Income:	
Fund from IEEE (1237.50 USD, taking 1USD=80BDT)	**99,000**
Fund from IDCOL	**490,000**
Fund from IEEE SIGHT USA	**431,000**
Total	**1,020,000**
Net Surplus of Income over expense	**195, 899**

Acknowledgement

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Author: Ataur Rahman

Contact

CARC Research Lab

Room: UB50604

Department of Electrical and Electronic Engineering (EEE)
BRAC University
45 Mohakhali
Dhaka-1212

Tel. 09617445131; 09617445164

E-mail: a.azad@bracu.ac.bd, ataur.rahman@bracu.ac.bd, a.azad@ieee.org

Website: http://carc.bracu.ac.bd

Facebook Official Page: https://www.facebook.com/Control-and-Applications-Research-Centre-CARC-1492141804400191/?ref=aymt_homepage_panel