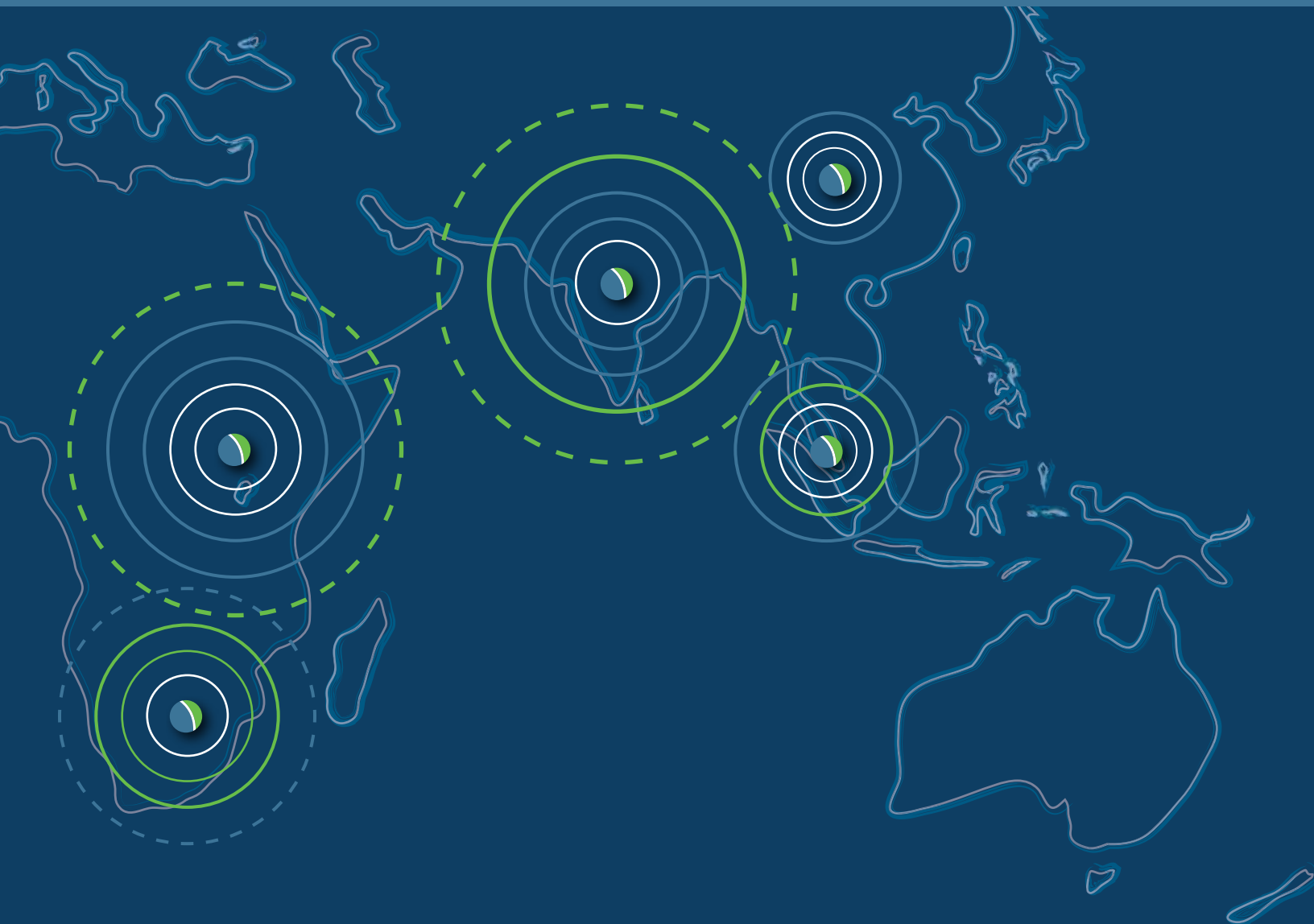


EPICS^{IN}IEEE

Progress Report 2015



Help us Serve the World and Fulfill Global Human Potential through EPICS in IEEE

The pages of this 2015 report demonstrate how EPICS in IEEE is helping to transform lives through the power of technology and education. As a Signature Program of the IEEE Foundation, we are delivering innovative technological solutions while also providing young people with real-world learning experiences.

But we can't do it without your help – volunteers and contributors who are our valued partners. You share our vision to improve lives through technology and to encourage the next generation of innovators.

Your support will be deeply appreciated by those who benefit from EPICS in IEEE projects that enhance technology access, literacy and education. We respectfully ask you to help sustain our efforts by contributing online at www.epicsinieee.org.

Every dollar we raise helps us to approve another project, create another valuable learning experience, and serve another community. Please join us in this effort to change lives through technology.

About IEEE Foundation

As the philanthropic arm of IEEE, the IEEE Foundation inspires the generosity of donors so it may enable IEEE programs that enhance technology access, literacy and education, as well as support the IEEE professional community.

The IEEE Foundation, a tax-exempt 501(c)(3) organization in the United States, fulfills its purpose by soliciting and managing donations, recognizing the generosity of our donors, awarding

grants to IEEE grassroots projects of strategic importance, supporting high impact Signature Programs, serving as a steward of donations that empower bright minds, recognize innovation and preserve the history of technology. With donor support, the IEEE Foundation strives to be a leader in transforming lives through the power of technology and education.

Since its launch in 2009, EPICS in IEEE has become a premier global resource for engineers and engineering students in their efforts to provide important technological support to communities in need. A unique program of the IEEE Educational Activities Department, EPICS in IEEE demonstrates the promise of the IEEE mission: Advancing Technology for Humanity.

In 2015, EPICS in IEEE approved more than US\$60,000 for new projects. They are enabling High School students, University students, NGO partners, and teams of engineers to deliver technology solutions that improve the quality of life in their own environments. For example:

- Biomedical engineering students at the New Jersey Institute of Technology are working with a major non-profit vision provider in the Philadelphia area to provide a less costly, quality 3D video game with the potential to reverse a common vision disability among children. (p. 2)
- In South Africa, a team representing the Engineers Without Borders student chapter of the University of Johannesburg and an associated high school are developing no-cost, solar-powered lights to reduce the number of devastating fires in one of Johannesburg's poorest neighborhoods. (p. 9)

The following pages describe the many other EPICS in IEEE initiatives launched during 2015. All are providing critical solutions created by a strong, vibrant generation of socially responsive engineers and engineering students. After you read about these achievements, we know you will share our pride. It is our hope that you will also want to add your financial support, enabling us to create another valuable learning experience and serve another deserving community.

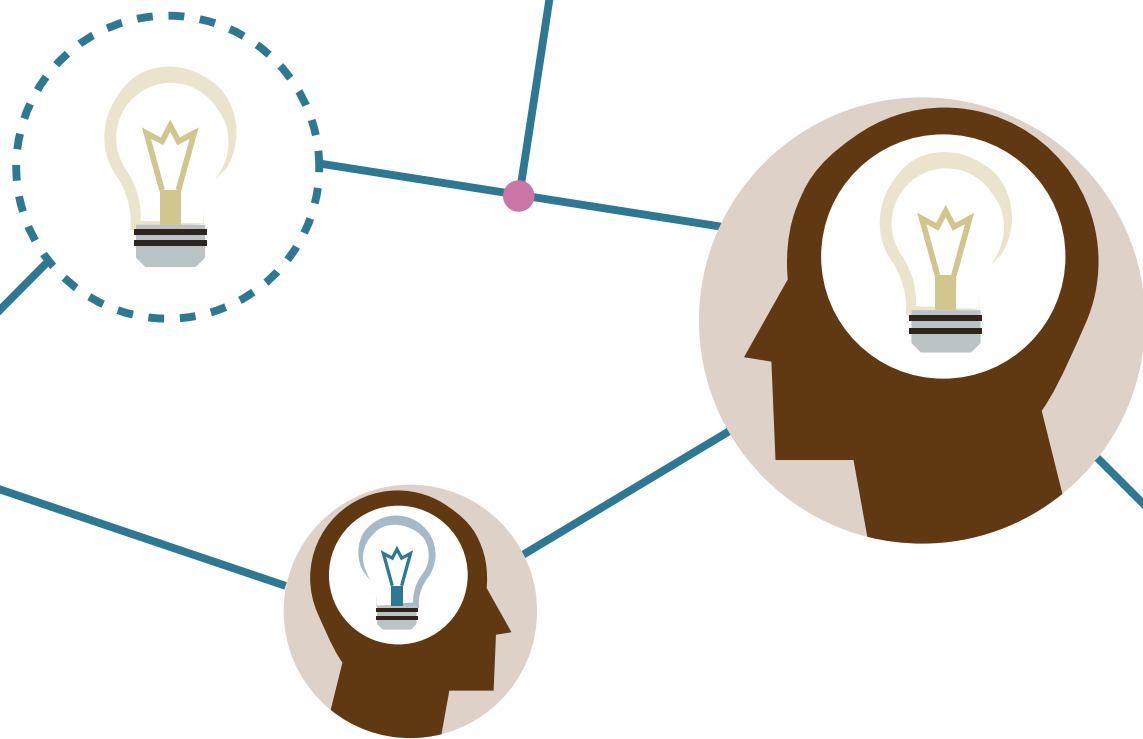
Sincerely,



Kapil Dandekar
2015 EPICS in IEEE Development Chair



Kapil Dandekar
2015 EPICS in IEEE Development Chair



Creating Uganda's First Hub for Innovation

In late 2014, after attending the first-ever Entrepreneurship Workshop for Scientists and Engineers in East Africa in Nairobi, IEEE Member Ezabo Baron of the Uganda subsection found inspiration for an online innovation hub.

He saw that as science and technology continue to influence peoples' lives, Uganda needed a way to identify and encourage the nation's innovators and inventors. Baron envisioned a hub that would help his country's emerging economy become more involved in the global movement toward collaborative research and technology transfer – while also helping to lift people from poverty.

To make this vision a reality, he quickly moved to obtain the support of other Uganda subsection members, an important NGO and several major universities. Then he applied for and obtained an EPICS in IEEE grant of US\$5,670.

IEEE members in Uganda are now partnering with the Humanitarian Innovation Technical Institute (HITI) and students from Makerere University, Kyambogo University, and Entebbe Secondary School to create the Science, Technology and Innovation (STI) Platform. When completed, the software application will help HITI to select and mentor innovative community projects for development. The project aligns with both Uganda's national STI development plans and HITI's goals to encourage and assist emerging inventors and entrepreneurs in commercializing new products and processes to benefit the most vulnerable and underserved.

A five-day technical meeting in September 2015 at the two participating universities launched work on the STI Platform. Underscoring the project's unique nature and popularity, the meeting was broadcast by Uganda's leading television station and covered by two major newspapers. Simultaneously, the project's Facebook page was launched, and received nearly 800 "likes" within a week.

Students building the application are gaining hands-on experience in web development, critical thinking and community action. Development is well underway, and the team is committed to making it operative on both computers and mobile devices while also being accessible for everyone, including people with disabilities.

The EPICS in IEEE grant is helping to fund basic project requirements, including laptops, web hosting, communications services and student participants' local transportation to meetings.

Sustainability is being planned for, in part through a small membership fee for users. Community participation and an advisory committee that includes representatives from government agencies, universities, research institutions and NGOs will also help the STI platform to flourish.

Reducing Fires with Sunlight in a Bottle

How can you reduce the frequency of devastating fires using two-liter glass bottles?

In Kathrada Park, where some of poorest residents of Johannesburg, South Africa, live, the only light currently available at night is from kerosene lamps or candles. As a result, the settlement has suffered ruinous fires that have destroyed many homes.

After visiting Kathrada Park, members of the University of Johannesburg's Engineers without Borders student chapter came up with a solution to improve living conditions and help to eliminate fires caused by tipped-over candles. The idea: to use the Liter of Light Day and Night solution to bring safe lighting into homes.

Liter of Light is a global, open-source movement to bring sustainable solar light into simple dwellings, which generally have thin, tin roofs. Bottles filled with water are inserted into the roofs and act as bright skylights, distributing light throughout the room during the day. With the addition of a small solar cell secured to the top of the bottle, which sticks up from the roof, plus a rechargeable battery and LEDs, there's light both day and night.

With a US\$5,000 grant from EPICS in IEEE, university engineering students are designing the electrical system to charge the batteries using solar energy. They are also conducting workshops to familiarize high school students from UJ Metropolitan Academy with electronic components as well as assembly and soldering techniques. The younger students, with their teacher and the university students will assemble the Liter of Light units. All the students will take part in final testing and installation of the lights.

When they first heard about the Light in a Bottle project, residents of Kathrada Park were distrustful; in the past, other organizations had made promises but they went unfulfilled. Now, after attending workshops and presentations, the residents are excited about the program and want to take part. Community members will be trained to build and maintain the solar lights so the project can be self-sustaining.

Through this project, the Engineers without Borders student chapter is fulfilling its mission to improve the quality of life using human-centered engineering solutions and a community is gaining safe, sustainable lighting. Perhaps best of all, students are learning how engineering can be a career not only about practical solutions, but also about caring.



Growing Food Security with Simple Technology

Drought, and the threat of famine resulting from it, is a fact of life for the people of La Paz Centro, Nicaragua.

The town is one of the epicenters of water scarcity in Central America – the result of El Niño, the periodic weather phenomenon that diminishes rainfall on the Pacific Coast of the region, and which climate change is making worse.

But an innovative project that combines engineering and bio-intensive agriculture is now underway, and it could contribute to greater food supplies in the face of unprecedented lack of rainfall and limited resources.

The collaborative project is bringing together students from Vassar College, the University of Managua's School of Engineering and 20 STEM high school students at Colegio Centro America Paulo XII in La Paz Centro. The high school students are experimenting with simple circuit-board solar kits, a prototype water monitoring system with Arduino controllers, and credit card-sized raspberry pi computers as they work to come up with local solutions to agricultural challenges.

Artists for Soup, a U.S.-based nonprofit working for food security, educational enrichment and environment protection in La Paz Centro, is developing 70 bio-intensive garden beds at the high school. The students know that the need is urgent for innovative approaches

to food growing and irrigation. Thanks to a US\$2,300 EPICS in IEEE grant, they are working with their university mentors in bi-weekly, after-school sessions to develop strategies for water collection and slow-drip irrigation.

With assistance from a University of Managua student who is also an Artists for Soup agricultural technician, the high school students will be able to apply what they've learned to a real-life project. Once the garden system is up and in operation, they will take part in a program to demonstrate what they've learned to other students in the region.

Producing healthy food year-round in water-scarce parts of Nicaragua, as well as elsewhere in Central America, is a growing challenge; according to the U.N. World Food Program, 2.8 million Central Americans suffered from seasonal hunger in 2014–2015.

With just a small amount of money, a little shared knowledge and simple technology, new agricultural methods are now being introduced to secondary students. They will see the results of their efforts as they produce food while also cultivating their knowledge of engineering.

We Take Special Pride

These four EPICS in IEEE projects demonstrate the breadth of IEEE members' creativity and resourcefulness in applying technology to meet the needs of humanity.

Controlling Insect Infestations

While talking with local farmers about insects that were destroying their crops, IEEE Graduate Student Member Patrick Kibambe Mashoko Nkwari had an idea: A method to help farmers detect and track the movements of insects, to help increase the effectiveness of pesticides.

For his project, Nkwari partnered with the University of Johannesburg Metropolitan Academy, a high school. He received US\$5,950 for the project and the team is working with the South African Subtropical Growers Association, which represents farmers who grow avocados, mangos, and litchi and macadamia nuts. With Nkwari's guidance, the students are designing and building a harmonic radar system, which tracks small insects by attaching an RFID tag to a captured bug and releasing it. The radar can determine its location even in a cluttered environment. The tag uses the original radar signal as an energy source, reemitting a harmonic of the transmitting signal. Tuning the receiver to the harmonic frequency distinguishes the tagged target – and the others in its cluster – from background clutter. The students will also analyze signal propagation and harmonic effects. Then, they hope to propose building a system with a longer range.

Protecting Electric Appliances during Floods

The IEEE Malaysia Section and the IEEE Student Branch of Universiti Sains Malaysia are partnering with Mercy Malaysia, a non-profit that provides relief, sustainable development and risk reduction to vulnerable communities. Together, they are building a body of knowledge on electrical safety that high school students will use to educate

the residents of the eastern coastal states of Peninsular Malaysia where flooding regularly occurs.

With a US\$5,000 grant from EPICS in IEEE, the team is developing procedures and related information people can use to safeguard electrical appliances before evacuating their homes – and also how to safely perform appliance repairs after they return. Students at a vocational high school will be taught the preventive and repair techniques, and they will share this information with their families and communities. The knowledge transfer will be sustainable, an ongoing process to be repeated many times over.

Charging Cell Phones and Careers

How do you provide an important community service while also demonstrating to low-income students the transformative power of a career in engineering? The IEEE Colombia Section and the IEEE Student Branch at Universidad Surcolombiana in Neiva, Huila, have launched an EPICS in IEEE project to achieve both.

With the non-profit Fundacion Picachos, which works with low-income Colombian youngsters, the team is teaching 60 high-school students at Educational Institution Técnico Superior basic concepts of electronics and photovoltaic systems. The two objectives: to enable the students to create a prototype solar charger that will power cell phones and other electronics, and to cultivate an interest in green technology and engineering.

With the US\$5,613 grant, the group is modeling a charger prototype; when completed, the high-school students will be responsible for its maintenance.

To build awareness of renewable energy as well as about engineering careers, the IEEE Student Members hope to expand the project to other Colombian high schools.

Enhancing Mobility for the Disabled

Members of the IEEE Madras Section are working with students from the Sri Ramakrishna Matric Higher Secondary School in Coimbatore, Tamilnadu, to design and build a pioneering automated wheelchair. The user activates it using a switch and joystick, and can easily convert the chair to a bed for sleeping. The device offers greater mobility and independence for the person using it and also reduces the need for caregivers to physically transfer the person between wheelchair and bed.

Using a US\$2,210 grant from EPICS in IEEE and in collaboration with the non-profit Amrit Centre for Special Needs, the team is developing the system to power the wheelchair. At its center is an embedded controller powered by a rechargeable battery. The controller governs the various movements of the wheelchair, and a built-in alarm system helps to ensure the user's safety.

The four participating high-school students are gaining insights into a possible engineering career. They're also learning important lessons about mobility issues routinely faced by the physically disabled, as well as society's responsibility to help others. Meanwhile, the project ultimately will empower those with special needs to lead quality, productive lives.