



ENGINEERS WITHOUT BORDERS-USA  
CARNEGIE MELLON UNIVERSITY  
STUDENT CHAPTER

# SEMESTER NEWSLETTER FALL 2016



EWB members organizing and participating in the Grilled Cheese Iron Chef Late Night on October 16th.

## Contents

Zimbabwe	Page 2
PET Thatch	Page 3
Agriculture	Page 3
Drones	Page 4
Events/Fundraising	Page 5
Thank Yous	Page 6

# PROJECT UPDATES



## Zimbabwe

This project works to provide consistent energy to Nyadire, a Methodist Mission complex located three hours northeast of Zimbabwe's capital city. Home to about 3000 people, Nyadire sustains a hospital, orphanage, and teaching college, among several other educational institutions. Though the complex receives some electricity from a state owned distributor, community members experience multiple unscheduled energy black outs each day and night.

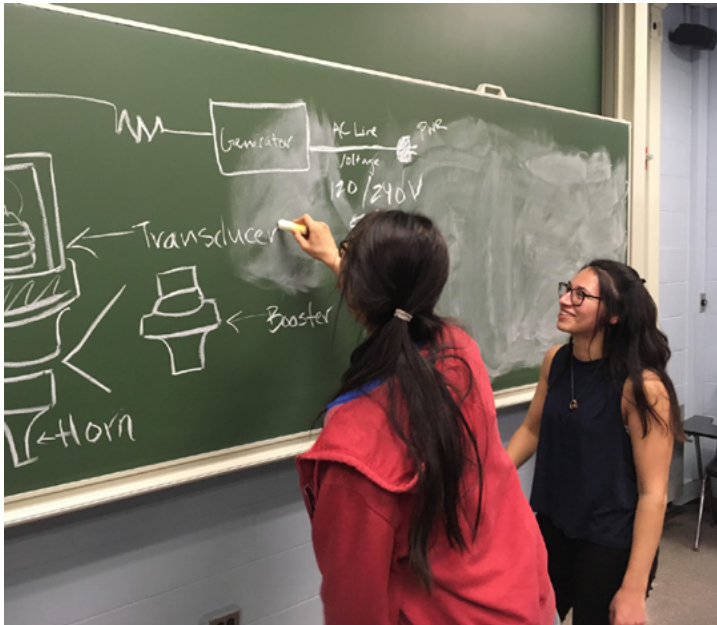
We are committed to collaborating with Nyadire through 2020. Our first project is to design and install a street lighting system of 20 decentralized solar street lights covering high-traffic areas of the community. Our system will make the community safer at night and provide a clean, reliable source of energy. We are using a local contractor to promote in-country development and we will evaluate the success through feedback from the community.

The team carried out an alternatives analysis during the fall of 2015 in order to identify the most cost-effective and sustainable alternative energy source to power the street lights. This research considered decentralized and centralized solar, hydropower, biogas, and grid-charged batteries. After the selection of decentralized solar street lights, we have been planning logistics and raising funds for our implementation trip. We plan to travel to Zimbabwe in August of 2017.

Along with our implementation trip, we also plan to incorporate a simultaneous assessment trip for our next project with the Nyadire community. Although we are helping to solve an important need with our solar street lighting project, there remain a myriad of problems regarding water and energy in both Nyadire and the surrounding rural communities. Thus, we are collaborating with the community to decide and research a potential project to implement in the future.



# PET Thatch



The vision of the PET Thatch Project is to create a reusable economy from waste plastic bottles by re-purposing them as thatched roofing. Over the past few semesters, we have worked with our nonprofit partners REI to develop plans for a set of machines that partly automates this process. Currently there are plans for two machines: the first cuts the bottles into strips of plastic ribbon, fusing them end to end as each bottle is cut. The second removes the contours from the long strips of ribbon, making them suitable material to be used as thatch.

The goal of the previous semester was to begin preparations to bring the plans to life. Our partners, located in Vietnam, have prototyped the designs for proof of concept and by building a set of machines ourselves, we could better evaluate their performance and improve upon the initial designs. Last semester we worked to secure an easily accessible campus workshop space for our group and began the process of selecting and purchasing materials to build. Near the end of the semester, we made our first materials purchase and began building the frame of the machine for cutting the bottles into strips. This spring we plan to continue with the construction of the cutting machine and plan to develop ways to better integrate the process of removing the tops and bottoms of the bottles and fusing the strips together.

# Agriculture



The Agriculture Project is focused on decreasing food deserts within the Pittsburgh community. Work is done at Phipps Conservatory and the Environmental Engineering Laboratory to research indoor agriculture. We utilize aeroponic and hydroponic growing techniques to conserve water and other resources. The project is broken into three main focuses: plants, power, construction. This was the project's premier semester.

During the fall semester, the group constructed and operated an aeroponic system in the back of a greenhouse at Phipps. This endeavor allowed the group to develop its indoor growing skills. Our relationship with Phipps has provided the group with onsite guidance. The Conservatory has been very helpful with meeting our needs. The team will be diverting most of the focus to research on campus during the Spring semester, but Phipps will still serve as a place to test more than one variable at once.

Energy use is the greatest challenge for indoor growth systems. The team looks forward to researching energy efficiency in the lab while working to improve the overall system at Phipps Conservatory during the spring semester.



# Drones

Modern agricultural practices aim to be extremely refined in their methods in an effort to create an optimized, efficient system. This kind of refinement requires massive amounts of data to be collected on the crops and conditions under which they grow. Information on the weather, sunlight exposure, plant ripeness, soil conditions, humidity, nutrients that have been added, encroachment of insects and pests, etc., are all useful in determining what the best practices are for a given farm.

Our goal is to develop a drone-based data collection and analysis system that farms can implement to help with deciding factors to create a more efficient process. Our system will consist of a drone, or fleet of drones, carrying a set of sensors capable of collecting the necessary data, coupled with a data analysis system that can give the user feedback on what the data means for their farm.

Having the farming data in conjunction with data analysis will aid farmers in making important decisions, like when to harvest their crop, when to add certain nutrients, when and how much to irrigate their field, among others. By helping optimize practices, farms will improve yield for their crops and waste fewer resources in their growing. Farms will be less likely to harvest their plants too early or too late, they will only disperse certain nutrients as needed, in the quantity needed, they will time their irrigation system to match up precisely with weather conditions, and so on.

We believe a drone based system is an ideal solution because

of its ability to quickly cover a large area and maintain an aerial view for both visual and physical data collection. Other methods of monitoring growing progress are typically done on foot by hand to take the necessary measurements at select representative locations throughout the field. This is a timely process that does not allow for massive amounts of data collection. Our system is much more agile and can collect a larger set of data throughout the entire field in a shorter amount of time.

The benefit of using a drone, as opposed to another aerial vehicle, is that drones have become common enough that they can be optimized for cost and efficiency, with a wide range of structures, allowing us to develop a drone that works best with our system. Though drone regulation is variable by country, our aim is to work with private farms, where drone use will be subject only to rules governing private property. Using drones will also allow us to make the system modular and split up our sensor distribution as necessary.

We would like to implement this in farms in countries that rely heavily on their agriculture industry as a method of improving yield on important crops. We are working with students from the Rwanda campus to partner with farms in Rwanda, as coffee and tea are the country's main exports.

Specifically, in the spring, we will be researching which sensors are ideal for our application and integrating them into a drone prototype for testing. This will allow us to begin implementing our idea and determine how to integrate the complete system for actual use. Identifying and incorporating the sensors is the first step in creating a tangible solution.



# EVENTS/FUNDRAISING



## Grilled Cheese Iron Chef

On October 16th, we held a Grilled Cheese Iron Chef late night competition to raise awareness for our projects and promote our weekly grilled cheese fundraiser. 6 teams participated under the categories of 'best taste', 'best aesthetic' and 'mom's choice'. The event took place in the Cohon University Center and drew over 150 people from the CMU campus to be taste testers and vote for their favorite team. The team Besto ChEEse won both 'best taste' and 'mom's choice' while the TJ Colonials won 'best aesthetic'. The event was a huge success as it brought many of the EWB members together in friendly competition and helped us promote our organization.

## Annual Gala

On November 12th, we held our Annual Gala in which we invite students, professionals and professors from around the CMU area to join us in a night of fine dining and entertainment. Gala is an opportunity to meet professors and professionals and inform them about our organization's projects so that we can get feedback and advice from people with years of experience in fields related to our projects and raise interest in potential advisors or mentors for our projects. To start off the night our project leads mingled with guests to learn about each of the projects and after dinner was served each of the project leads gave a formal presentation about their projects. We also catered food from Tana Ethiopian Cuisine and had a trio of musicians play during the night. We raised \$500 which will go to funding the Zimbabwe project to purchase materials for our implementation trip this year.



# THANK YOU



## MENTORS

CMU EWB would not have been able to make great progress in our research projects without the support of our mentors. We would like to thank Scott Rhodehamel and Matt Bovee for their continued involvement in the Zimbabwe project. Their valuable experience with installing solar panel systems has helped design an ideal lighting system for the Nyadire community. We would also like to thank CEE lab director Ron Ripper and SURG Account Manager Cornelia Moore for their help in the agriculture project. In addition we would like to thank Rajshekar Prabhakar and Devdatta Narote for their help in starting up the Drones project last semester. We would also like to thank Rebecca Taylor for advising PET Thatch as well as the CEE Lab Managers, Ron Ripper and Marc Peretti.

## CORPORATE SPONSORS

Our projects would not be possible without the gracious donations of our donors. We would like to thank Alcoa for their continued support over the past few years with their generous annual donations. We would also like to thank Xerox, Steinbrenner Institute, CIT, Wabtec and Michael Baker for their funding this year. 100% of our donations go towards research, building material, travel expenses, and member safety. We are extremely appreciative and thankful for our donors support.

## ADVISORS

Finally, we would like to thank our chapter's advisers Professor Kelvin Gregory and Professor Mel Siegel. They generously for their great advice on how to organize and manage our club, using their extensive knowledge and experience with EWB over the last decade.

For more information about our chapter please visit: [cmuewb.org](http://cmuewb.org)

To join the newsletter mailing list or to ask questions about our chapter please email: [cmuewb@gmail.com](mailto:cmuewb@gmail.com)