

April 27, 2016 ECE 2799 - ECE Design

Appreciation

Thank you to Professors Stephen Bitar and Shamsur R. Mazumder for hosting the Robert H. Grant Invention Awards in ECE 2799 D-Term. Thank you also to our veteran judges Bob Waite, '65 of Waitek, Bob Barton of PowerSure Corp and product design expert, David Kmetz, for their many hours of due-diligence and thoughtful questions, comments, and feedback during presentations. Six teams presented in Atwater Kent 233 between 8:00 AM and 10:50 PM.

The Design Challenge

All around us are stray sources of energy. Some are obvious such as solar radiation and wind, while others are more subtle such as sound pressure vibrations and invisible electromagnetic radiation or heat. This term's 2799 design challenge is to conceive of, design and develop a useful product that harvests stray energy from its environment, senses some parameter within that environment and provides some level of safety to the user. For example, if something is too hot to touch, could the heat be used to power a sensor to provide a warning so someone does not get burned? Or could the sound energy next to a vibrating machine be used to indicate a dangerous sound level to prevent hearing loss? Whatever the case, your design should include features that your market research deems necessary for a successful product. Your device may harvest energy from any stray source (solar, RF, heat, motion, etc.). Rechargeable batteries or capacitors may be used for energy storage, but your device should be self-contained and not require battery replacement or an external power supply. Your design should also be cost effective and be priced according to what your market will bear. Your prototype cost should not exceed \$50.

Congratulations!

Congratulations to all of the teams that presented! Honorable Mentions were awarded to two teams, Team 17 - Roof Guardian (Michael Inserra, Y. Batu Sipka, Jacob Mikolajczyk) and Team 16 - Back It Up (Elizabeth Bliss, Stephen Michelini, Nicholas Rowles). Third Place was awarded to Team 12 - Volteg Co Detector (Charlie Sinkler, Erin Ferguson, Chris Connor). Second Place was a tie awarded to both Team 2 - Bark! A Vehicular Heat Sensor for Dog Safety (Jade Pierce, Clara Merino and Kevin Farr) and to Team 9 - Open Window Sensor (Calvin Figuereo-Supraner, Shanshan Xie, Cara Seely). First Place was awarded to Team 7 - ACSafe Distribution Line Fault Detector (Eric Meier, Chris Jackson, Calum Briggs).

Abstracts

Place Prizes

First Place:

Team 7 - ACSafe Distribution Line Fault Detector (Calum Briggs, Chris Jackson, Eric Meier)

Each year, power outages cost the American people billions of dollars in lost revenue and repair costs. Worse still is the cost in lives, when hospitals are forced to rely on backup generators to

power life support equipment, or millions living in a city are left without heat or air conditioning. Our power infrastructure is aging, and with that age comes an increase in both the duration and frequency of these outages. It is the responsibility of utility companies to minimize these losses, and in the event of an outage restore service as quickly as possible. When one minute without power costs the average business over \$8,000, and when Americans rely on electricity for their health and well being, every minute counts. To that end, we introduce the ACSafe Distribution Line Fault Detector. Our product is designed to attach to distribution lines and indicate through a simple interface whether or not a line has power. The indicators are simple, if the green LED is lit, then the line is live. In the event of an outage, the device backup batteries kick in and light a red LED, indicating that there is no current. The purpose of this is twofold. First, the product will aid in faster detection and repair of damaged or downed lines in the event of an outage. At the time of writing, utility companies have to search manually with a flashlight, driving up and down roads looking for the source of a break. With our product installed on distribution lines, this would be as simple as finding the spot where the LED indicators change from green to red. This will save time in locating the source of an outage, leading to a faster repair. Second, in the event that a utility lineman has to work on a line, they can look to this device for a clear indication of whether or not the line is live, preventing accidents and removing a possible unknown from an already dangerous profession. By harvesting power inductively from the line to which it is attached, our product is reliable in all conditions and requires no maintenance. As long as there is current in the line, the device will be receiving power. There is no need for potentially unreliable solar panels, or expensive and wasteful batteries. In the event of an outage, the rechargeable batteries will drive the red LED for up to three days, and once power is restored they will be recharged.

Second Place Tie:

Team 2 Bark! - A Vehicular Heat Sensor for Dog Safety (Kevin Farr, Clara Merino, Jade Pierce)

Our product is a warning system that can be placed into a vehicle and is aimed to save dogs lives. The device detects the interior temperature of the vehicle and if it is outside of the 41-81°F range, it sends an alert to the dog owner. Currently, there are no laws protecting dogs in hot cars within the Rocky Mountains, Southwest and Southeast regions. Research shows that on a seemingly cool day of 80°F, temperatures inside a car can rise up to 99°F within 10 minutes. So imagine the dangerous situation of leaving your dog in the car in the state of Texas. Within just 20 minutes, the temperature would rise from 99°F to 119°F. Our product works with a solar panel powering the control system (microcontroller). It sends and receives data coming from the output system consisting of a: Temperature Sensing Unit, RF Communications Link, and User Hazard Notifications System (buzzer). Our product is designed for dog owners aged 16+ in areas where it is not illegal to have your dog in the car for long periods of time.

Second Place Tie:

Team 9 - Open Window Sensor (Shanshan Xie, Cara Seely, Calvin Leon Figuereo-Supaner)

Each year there are 3.8 million home invasions in the United States alone, meaning that 20% of Americans will be a victim of this crime. On top of that, 38% of reported assaults happen during home invasions. Locks are easy to break, so an alternative reliable option is need. That's where we come in: our solar-powered open window sensor can be placed on a window and the user will

not have to worry about the possibility of the battery running out and the alarm not working. The sensor will deter thefts with a loud siren alarm and alert the user of the break in, keeping the user safe and thieves away!

Third Place:

Team 12 - VOLTEG CO DETECTOR (Chris Connor, Erin Ferguson, Charles Sinkler)

According to the Center for Disease Control and Prevention (CDC), roughly 430 people die each year from unintentional carbon monoxide (CO) poisoning. Many of these deaths are due to operating devices with gasoline-powered engines, such as portable generators and air compressors, in enclosed or poorly ventilated spaces. In order to protect against CO poisoning, both at home and on work sites, there must be a device that is self-powered, reliable and accurate, low-maintenance, durable, and capable of interfacing directly with the gas-powered devices that produce CO. Our product, the VolTeg CO Detector, fills the gap in the market by producing an obvious auditory and visual alarm when there is dangerous CO levels and by costing only \$55, compared to \$120 for other portable CO alarms. It is thermoelectrically powered, reducing the need for batteries and ensuring that the users are protected whenever a device is on and producing CO.

Honorable Mention:

Team 16 - Back It Up (Elizabeth Bliss, Stephen Michelini, Nicholas Rowles)

The product is a driver backup assistance module. The system is a set of wireless modules that contain distance sensors and are mounted to the back of a car. These sensors interface with a driver's cellphone or a separate display module via Bluetooth Low Energy(BLE). The app on the phone will then display the distance to the nearest obstacle behind the car along with providing an audible alert if the car is getting close. The sensors are powered by a solar panel which charges a battery so the system can withstand durations without solar power. This product is intended for drivers who do not own a car with backup assistance. It is designed to be installed easily in a driver's car.

Honorable Mention:

Team 17 - Roof Guardian (Michael Inserra, Jacob Mikolajczyk, Yesugey Batu Sipka)

Say goodbye to cleaning snow off your roof prematurely. With the Roof Guardian, life will be stress free. There is no longer a need to worry about your roof collapsing. A simple alerting system to provide your home with maximum safety throughout the winter. Roof Guardian utilizes a simple yet effective design to track the weight of snow on your roof. The solar powered system is self-sustaining, leaving you with no need for maintenance. Roof Guardian alerts you with a simple e-mail when your roof is in danger.



1st Place: Team 7 - ACSafe Distribution Line Fault Detector (Eric Meier, Chris Jackson, Calum Briggs)



2nd Place Tie: Team 9 - Open Window Sensor (Calvin Figuereo-Supraner, Shanshan Xie, Cara Seely)



2nd Place Tie: Team 2 - Bark! A Vehicular Heat Sensor for Dog Safety (Jade Pierce, Clara Merino and Kevin Farr)



3rd Place: Team 12 - Volteg Co Detector (Charlie Sinkler, Erin Ferguson, Chris Connor)