Abstract

Our team had two goals for Senior Design II. The first goal is to build an application or final product utilizing the Internet of Things Energy Harvesting BoosterPack that we designed and manufactured in Senior Design I. The BoosterPack from Senior Design I is designed to be a power management daughter board for the Texas Instruments LaunchPad line of microcontrollers. Anyone can program a LaunchPad, add extra components to build a system, and then use our BoosterPack to power the system using a battery and solar energy. The BoosterPack also includes two independent motor drivers and a configurable nano-timer for added functionality. To demonstrate the BoosterPack’s capability, an application of the board has been developed called “The Root: A Self Contained Solar Powered Plant Grower”. The Root is an automated hydroponics system that regularly waters plants and keeps them nourished. It is especially useful for growing herbs and vegetables in a small apartment or home. Our second goal is to bring The Root to Kickstarter as a consumer product and run a Kickstarter campaign. The purpose of the Kickstarter campaign is to gain experience in all aspects of the product development process: design, testing, prototyping, technical documenting, and commercialization.

The Root Features

- Automatic plant watering
- Solar power keeps battery charged
- Low water level indicator
- Hardware and software expandable
  - e.g. pH sensor and Bluetooth module

Energy System

- 20 seconds of watering at 17 minute intervals = 2.8 Whr per day
- 3 out of 7 cloudy days a week requires a 2100 mAh battery
- System only operates when sunny or charging = 6 hours per day
- 6 hours of operation a day = 5 Whr/week
- Instantaneous power required during charge time = 206 mW
- Solar panel area is 233 cm² and provides up to 0.5 mW/cm²
- Minimum number of solar panels required = 2.75

Conclusion

- Purpose for the Kickstarter: preparing for and running a campaign can compress several years of corporate learning into a few months.
- This portion of the project required the team to solve problems beyond the mathematical and engineering
- Sacrifices were made to make the system fit a lower power profile (only watering when sunlight is available)

Semester II Objectives

- Test our 30 Booster Packs ordered from the previous semester.
- Design and build a product using the Energy Harvesting BoosterPack
- We chose The Root: Self Contained Solar Powered Plant Grower
- Use the product to demonstrate the features and capability of our Energy Harvesting BoosterPack.
- Launch a Kickstarter campaign to publicize the product
- Collect metrics on the performance of the Kickstarter campaign
- The information is useful to future Texas Instruments SD teams

ETHICS: For the purposes of this project, we utilize software that is either open-source or obtained the appropriate licensing requirements for legal use of said software.

The Root

Uses four solar cells that provide 108 mW each in typical daylight.

The Energy Harvesting BoosterPack automatically manages Li-ion battery charging. Comes with a pair of 5 Amp motor drivers and configurable timer.

The Root interior
Plants are held in watering cups where they stay hydrated and nourished.