

Wake-up Harvester Design for Batteryless IoT System

sdmay21-14 (1/25 – 2/8)

Client & Advisor: Prof. Duwe

Team Members:

Edmund (Eddie) Duan - Powercast Harvester Team, Project Lead

Jacob Bernardi - MCU Team

Douglas (Doug) Zuercher - Transceiver Team

Kwanghum (Ted) Park - MCU Team

Bryce Staver - Powercast Harvester Team

Zacharias (Zack) Komodromos - Transceiver Team

Weekly Summary

Over the past two weeks we have been focusing on testing the different aspects of the project individually. The objective was to make sure the components chosen work as expected and the power consumption we expected is what is observed. Additionally, our goal was to get a definitive answer as to whether our power harvester will be able to support powering the system, to which the answer after testing was positive. On the MCU side of the project, we are going through the process of testing the code written by the team. For the transceiver, nothing can be tested until the MCU is in working order since that is necessary to program it. In the general picture, schematic and PCB layout creation has progressed since the footprints of all our components are now in Altium and ready to be placed and connected.

Past week accomplishments

Because this is the first bi-weekly report of the semester, the updates below include achievements from over the winter break.

MCU Team (Jacob and Ted)

- Researched implementing SPI communication between MCU and transceiver
 - Read through SPI library in SDK for CC1352R (Jacob)
- Began troubleshooting programming of the MCU with code composer studio
 - Went to lab to attempt programming MCU with example code and then took MCU home to attempt programming with another computer (Jacob)

Transceiver Team (Zack and Douglas)

The below achievements were contributed to evenly by Zack and Douglas. Work was done together, at the same time, so contribution is approximately 50/50.

- Collected technical resources (datasheets, manuals, and relevant projects) regarding the transceiver software and hardware.
- Developed a configuration manual for internal use which discusses how the transceiver can be configured and appropriate register values to set. Manual is intended to be used by the MCU team.
- Developed a configuration Excel sheet which generates register values based on desired transceiver configuration. Intended to be used by the MCU team.
 - Software package provided by ON Semiconductor used to verify register values
- Drafted test conditions which will allow us to verify that the transceiver is being configured properly.
- Created transceiver footprint and symbol in Altium Designer in preparation for schematic/PCB work.
- Created a list of Address and Value pairs in specific groupings so the MCU team can reference when making the functions for communication with the transceiver

Harvester Team (Bryce and Eddie)

- Eddie tested on and off times for Powercast harvester with 50 mF capacitor and varying resistor loads.
- Bryce tested the harvester with 1mF capacitor over various loads.

Altium Schematic Work (Bryce, Zack, and Douglas)

Bryce over break got many of the footprints completed and Douglas completed the transceiver. Over the past week Zack and Bryce jointly worked on creating some capacitor and resistor components as well as inserting the MCU footprint.

- Organized Altium schematic to complete the full system, for example we added the boost converter and surrounding components.
- Completed schematic symbol and footprint for all parts used in the device.
- Bryce started a very rough PCB layout using the rooms feature in altium.

Pending issues

- MCU team issue: unable to program MCU with code composer studio

Individual contributions

The below hours include a rough estimate of hours worked over the last two weeks.

<u>NAME</u>	<u>Individual Contributions</u> (Quick list of contributions. This should be short.)	<u>Hours this week</u>	<u>HOURS cumulative</u>
Bryce Staver	Altium Schematic work, Harvester testing	10	10
Douglas Zuercher	Transceiver configuration, Harvester testing	15	15
Edmund Duan	Tested harvester with 50 mF capacitor, recorded results	10	10
Jacob Bernardi	Read through SPI library documentation, began troubleshooting flash issues	9	9
Zack Komodromos	Transceiver configuration	15	15
Kwanghum Park	Research on how to interact with MCU and Transceiver	5	5

Plans for the upcoming week

MCU Testing (Jacob and Ted)

- Solve inability to program MCU with example code
- Write test code to set clock frequency on transceiver and confirm operation
- Get in contact with Graduate student who has experience with our MCU

Harvester Testing (Eddie and Bryce)

Eddie and Bryce plan to be working on these at the same time and will consider this a 50/50 joint effort.

- Test harvester by varying output current and boost converter
- Test power consumption

Altium Schematic (Zack, Douglas, and Bryce)

Transceiver testing is on hold until the MCU is set up. As a result, Douglas and Zack will focus on the schematic and PCB work with help from Bryce.

- Set up supporting components in schematic (resistors/capacitors) for the MCU
- Connect the components together
- Hold a team wide schematic review
- Place and route components on layout view