EE/CPRE/SE 491 WEEKLY REPORT 06

Introduction

Date: 4/5/2019
Group Number: 21
Project Title: Battery-less IoT Devices
Advisor: Dr. Henry Duwe
Clients: Dr. Nathan Neihart, Dr. Daji Qiao

Team Members:

Derek Nash – *Meeting Scribe, Power Systems Engineer, Test Engineer*

Matt Goetzman – *RF Systems Engineer, Test Engineer*

Mohamed Gesalla - *RF Systems Engineer, Test Engineer*

Adithya Basnayake – *Report Manager, Power Systems Engineer, Test Engineer*

Mohammed-Al-Mukhaini – *Meeting Facilitator, Embedded Systems Engineer, Test Engineer*

Bradley Rhein – *Embedded Systems Engineer, Test Engineer*

Weekly Summary

Embedded Systems Team

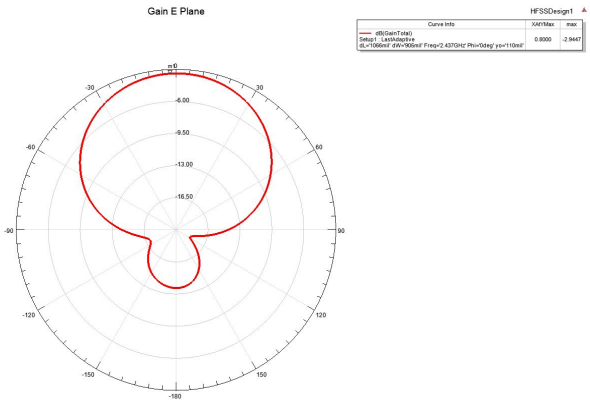
This week we explored low power modes of the MSP430. We read up on how to use EnergyTrace to get detailed energy consumption measurements for the power circuit team. Finally, we ordered a TI Launchpad with FRAM through ETG, since ETG's Launchpads only had flash memory.

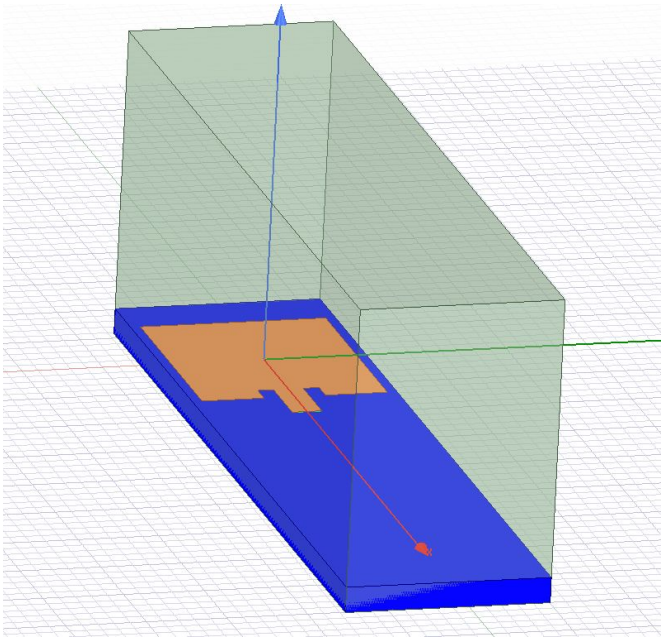
RF and Antenna Team

This week we went forward with making a patch antenna to test with our prototype board. The results from our simulations show that while the antenna will work, it being made on a small board will be an issue. Our simulation takes into account the board size being 1in x 4in. With this size, there will be a significant negative effect on gain. We found that reducing the size from 2in x 4in to 1in x 4in reduces the gain by roughly 4dB. Due to us using FR4, our gain is already limited. Our simulated gain for the antenna is now -3dBi. This shouldn't pose a huge problem for testing purposes but it will most likely reduce the distance we can effectively place the antenna from the source. Adding a copper ground plane doesn't seem to affect the gain, but I'm going to ask a graduate student about that next week. The unintentional benefit of using the relatively thin FR4 boards is that it will allow us a higher bandwidth for gathering across the WiFi spectrum.

This will most likely negate the effect of the board size on our antenna. As long as the antenna is roughly 3.5cm away from anything else on the board, we should be able to share it with the rectifying circuitry.

Gain: -3dB





Power Circuit Team

The group designed one of the proposed rectifier circuits using Eagle PCB.

Pending issues

Some of the team needs to learn Advanced Design System in order to simulate the proposed circuit.

RF Team needs to design array versions of patch and PIFA antenna. Also look into either importing antenna to ADS or recreating it in ADS.

Individual Contributions

Team Member	Contribution	Weekly Hours

Derek Nash	Learned Eagle PCB. Designed rectifier circuit. Wrote paper on the importance of standards.	16
Matt Goetzman	Designed patch antenna for prototype board.	6
Mohamed Gesalla	Designed and simulated patch antenna on HFSS	2
Adithya Basnayake	Researched on super capacitors and ways to reduce leakage current	2
Mohammed Al-Mukhaini	Researched EnergyTrace for optimal power consumption usage. While further learning on launchpad low power options.	6
Bradley Rhein	Researched EnergyTrace and ordered new launchpad.	6

Plans for the upcoming week

Derek, Matt, Adi, and Mohamad G. plan to learn Advanced Design System in order to test the proposed rectifier circuit.

RF Team will look into PIFA feed methods to see if an array is feasible. Transfer prototype antenna to ADS.

Bradley and Mohammed A. plan to work more on the temperature sensing code and incorporate moving into low-power modes.

Summary of Weekly Advisor Meeting

Main topics covered in meeting with Dr. Duwe:

- Dr. Duwe emphasized the importance of recording alternative ideas and the reasons why those weren't chosen
- We discussed the upcoming process of learning ADS and testing a circuit parallel to the one designed in Eagle PCB, which we would edit and ultimately order
- Discussed EnergyTrace with Dr. Duwe, and choose a launchpad best for our needs to order