

EE/CprE/SE/CYBE 492 BIWEEKLY REPORT 03

9/28/2022 - 10/11/2022

Group: 07

Project: Wireless Energy Harvesting

Client: Dr. Jiming Song

Team: Benjamin Brown, Christopher Marting, Greg Schmitt, Jacob Walczak, Sam Runkel, Tanner Garity

Biweekly Summary:

In the past two weeks we have gotten feedback from Dr. Song about our original antenna and got some tips on how to improve it. We built our second iteration and still found some problems with it that will be resolved in the third iteration. We also found that we can use a phone hotspot as a pretty reliable signal source for testing purposes.

Bi-Weekly Accomplishments:

Benjamin Brown - During this week I met with the team to reconstruct our yagi antenna with our new modifications. Additionally, last week I met with the team and the advisor to discuss our first yagi construction and ways to improve it. We also came up with the idea to use a LTE mobile hotspot as a signal source for our project instead of using a generator or the campus routers.

Christopher Marting - Met with the team to build and test the second beta version of our antenna. We came up with a couple ways to improve our testing which we will bring up to Dr. Song at our next meeting. I also went ahead and double checked the Yagi-Uda simulation to ensure that the way I built the antenna gave us the most possible gain from our design. After our test with the second beta version of our antenna I did a little research on cell phone wireless bands and found out that a mobile hotspot with LTE has a frequency of 2.5 GHz on AT&T and Sprint carrier networks which is the frequency we want to harvest for this project. So if we get the okay from Dr. Song to be able to use a hotspot for testing over a traditional router we will be able to have more favorable results and testing conditions.

Sam Runkel - Met with the team to construct our second antenna. The housing design still had some minor problems so I had to design and print a third housing. We had an advisor meeting and got some tips on how to change our housing to better work with our situation. I also researched FCC regulations to determine what values Wi-Fi routers are allowed to use and found that the maximum power allowed to go into a unidirectional antenna is 1 watt and a unidirectional antenna is 4 watts. I did some research though and found that most routers cap out around 100 mWatts however. I also did some theoretical calculations using those numbers and found that we will likely need to be a few inches away from our signal source in order to turn an LED light on which is not ideal.

Jacob Walczak - Met with the team to construct the second iteration of the antenna. We came up with more housing improvements to be made. We also had an advisor meeting to discuss the prototype of the yagi-uda antenna. We also came up with the idea of using a mobile hotspot rather than a router for both more consistent readings and ease of testing.

Tanner Garity- Created a digital schematic of the signal oscillator while also generating the layout on KiCad.

Greg Schmitt - Looked into oscillator circuit components within our 2.5-5 GHz range. However, the only market available operational amplifiers within this tolerance were integrated circuit chips, a total package size similar to a grain of rice. This would limit our testing phase to printing custom boards, as opposed to prototyping on a breadboard for changing components quickly. This informed our decision to use a cellular hotspot as a more controlled real-world source for our testing instead of university wifi routers.

Op Amp integrated circuit (Digikey):

<https://www.digikey.com/en/products/detail/texas-instruments/THS4302RGTR/522601>

Plans for upcoming week:

- Construct 3rd antenna and begin testing using phone hotspot
- Construct Helical antenna
- Have advisor meeting

Individual contributions:

Name	Individual Contributions	Hours this week	Hours cumulative
Benjamin	<ul style="list-style-type: none"> ● Team meeting and antenna construction - 2 hrs ● Mobile hotspot and LTE wifi research - 1 hr ● Advisor meeting - 0.5 hr 	3.5	34.5
Jacob Walczak	<ul style="list-style-type: none"> ● Team meeting and antenna construction - 2 hrs ● Advisor meeting - 0.5 hrs ● Mobile hotspot research - 0.5 hrs 	3	33.5
Greg Schmitt	<ul style="list-style-type: none"> ● Advisor meeting - 0.5 hrs ● Circuit datasheet research - 2 hrs 	2.5	32.5

Name	Individual Contributions	Hours this week	Hours cumulative
Christopher Marting	<ul style="list-style-type: none"> ● Team meeting and antenna construction - 2 hrs ● Advisor meeting - 0.5 hr ● Double checking antenna simulation values - 2 hrs ● Hotspot wireless band research - 0.5 hrs 	5	48
Sam Runkel	<ul style="list-style-type: none"> ● Theoretical antenna simulation and FCC regulation research - 2.5 hrs ● Antenna redesign and print twice - 3 hrs ● Team meeting and antenna construction - 2 hrs ● Advisor meeting - 0.5 hrs 	8	49.5
Tanner Garity	<ul style="list-style-type: none"> ● Oscillator Digital Schematic - 2 hrs ● Oscillator PCB Layout - 7 hrs 	9	45