EE/CprE/SE 491 WEEKLY REPORT 07

10/16/17 – 10/20/17

Group number: 11

Project title: RFRD Phase II

Client &/Advisor: Dr. Daji Qiao and Dr. Nathan Neihart

Team Members/Role:

Bailey Akers - Facilitator/RFRD Tag Design/Fabrication Engineer
Colin Sunderman - RFRD Tag Design/Fabrication Engineer
Lyle Bishop - Principal Antenna Engineer
Pengyu Qu – Antenna/Power Harvesting Engineer
Nathan Mulbrook - RFRD Wireless Communications Engineer

o Past week accomplishments
Team Member 1: Bailey Akers
Researched and presented on STMicroelectronics very low power op amps.

Team Member 2: Colin Sunderman
Researched and presented on STMicroelectronics very low power op amps.

Team Member 3: Pengyu Qu

Team Member 4: Lyle Bishop
Antenna research.

Team Member 5: Nathan Mulbrook
Microcontroller research and presentation.

o Weekly Summary

10/17 - Colin Sunderman and Bailey Akers met to perform three tasks for our project. The tests were as follows: simulating the washer as a capacitor, RC measurements using LCR meter, and SPICE model of relaxation oscillator using recommended op amps from last week. Those op amps were the TSU 104 for the oscillator side and the TS 881 for the comparator circuits.

We simulated the washers as capacitors by charging 4.5V across the capacitor. Using a multimeter, we measured the voltage as it drained from the washers when we isolated it from the power supply. We found that the washers drained very quickly to 0 Volts.
We took various measurements using the LCR meter to determine the quality factor and best model for the washers as a capacitor measured at the 200 Hz, 10 kHz, and 300 kHz. We looked at both the series and parallel model for the washers as a capacitor. We generated a spreadsheet with all of our measurements.
We attempted to generate a SPICE model of the relaxation oscillator. We were able to attach the block diagram for the STMicroelectronics op amps using the .lib file from the

STMicroelectronics website. However, we were not able to simulate the circuit due to an error with the .lib attachment. We decided to pursue the SPICE model for the next week.
10/20 - Met with advisors Dr. Daji Qiao and Dr. Nathan Neihart.

- Bailey Akers and Colin Sunderman presented on the three tests they performed earlier in the week.
    - For the capacitance test, we decided instead of using a multimeter we needed to look at the capacitor using an oscilloscope.
    - For the LCR tests, we decided that they showed that the washer has the best quality factor around 10 kHz. They may be the frequency we tune our relaxation oscillator to.
    - For the SPICE tests we decided to pursue the simulation for the next week. Dr. Neihart offered to help with the .lib attachment error.
- Pengyu Qu presented on calculating the received power using Friis Equation.
    - We decided that Pengyu and Lyle needed to focus on papers that have measured applications with received power using 900 MHz frequencies.
    - This will determine how much power we can harvest to power the relaxation oscillator circuit.
    - Great progress made by the antenna group and the advisors were happy.
- Nathan Mulbrook presented on using a software controller radio wave transmitter for testing our wireless communications.
    - Gives us a cheap option for testing our design.
    - Advisors were happy with the idea and decided we may pursue this with our testing.

This Week:

NAME	Individual Contributions Summary	Hours This Week	Hours Cumulative
Bailey Akers	Developed three tests to better understand using the washers as capacitors. Generated weekly report.	5	43
Colin Sunderman	Developed three tests to better understand using the washers as capacitors.	4	38
Pengyu Qu	Antenna calculations using Friis Equation. Presented on material.	5	32
Lyle Bishop	Antenna calculations using Friis equation.	5	32

Nathan Mulbrook	Research and presentation of using an software controller radio transmitter for testing of our design.	5	32

*Details of weekly contributions are noted in above Weekly Summary section.

o Plan for coming week

Goals for next week's advisor meeting (10/6): Details also listed in Weekly Summary section.

Capacitive Sensing Circuit Design: Colin Sunderman and Bailey Akers
- Develop SPICE model for relaxation oscillator circuitry.

Antenna Design: Pengyu Qu and Lyle Bishop
- Research and present on papers with applications of receiving power at 900 MHz ranges.

Communications, Tx/Rx Module: Nathan Mulbrook
- Further research into implementation of microcontroller design.

o Team Difficulties

The main difficulties were with the SPICE design. The .lib file attachment we added using OrCAD Capture wasn't registering during the simulation. We will try to fix this for the next week.

Grading criteria

Each weekly report is worth 10 points. Scores will be awarded as follows:

• 8 – 10: Progress for your project seems to be suitable. Documentation and hours reported by team members are adequate.

• 6 – 8: There is scope of improvement both in your report and your project progress. Can consult with instructor/TA after class for further inputs.

• < 6: Please talk to instructors/TA after class hours about any difficulties that you/your team is facing.