EE/CprE/SE 491 WEEKLY REPORT 05

10/02/17 – 10/06/17

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
Developed capacitance measuring relaxation oscillator op amp calculation spreadsheet.

Team Member 2: Colin Sunderman
Developed capacitance measuring relaxation oscillator op amp calculation spreadsheet.

Team Member 3: Pengyu Qu

Team Member 4: Lyle Bishop
Antenna research.

Team Member 5: Nathan Mulbrook
Microcontroller and WISP research.

o Weekly Summary

10/4 and 10/6 - Colin Sunderman and Bailey Akers met to revisit gain-bandwidth equation from the spreadsheet. We did some reverse analysis of the equation and determined that the error isn't a unit or factor-of-ten error.
We then decided to look at how the effect of percent error from theoretical changes with changes in gain-bandwidth product, time response delay, and input capacitance of the op amp we use. Using a spreadsheet, we were able to prove and successfully rank the op amp characteristics for our design. Our rankings were as follows:
1) Operation power required of op amp
2) Gain-bandwidth product of op amp
3) Input capacitance of op amp
4) Slew rate of op amp
We decided to present on 10/06 with these results.

We researched using microcontrollers for measuring capacitance. We found a low power microcontroller (86 uA/MHz) that has 24 sensitivity adjusting capacitive sensing I/O.
We soldered the washer design we will use in our application. In order to solder the steel washer, we had to use a torch. We measured the washer design.
We measuring capacitance values as follows:
Resting washer – 20 pF
Washers not touching – 2 pF
~40 lbs of pressure on washers – 36 pF
We decided to present our our results on 10/06. These capacitance results show that our range of measurement for our relaxation oscillator will be from 20 pF – ~50 pF.

10/5 - Lyle Bishop and Pengyu Qu researched antenna equations for near field approximation. They read some academic papers.

10/5 - Nathan Mulbrook researched using very low power microcontrollers to implement the wireless communications between reader and tag. He looked at specific microcontrollers.

10/5 - We met as a team to ensure progress for the advisor meeting.

10/6 - Met with advisors Dr. Daji Qiao and Dr. Nathan Neihart.

- Nathan Mulbrook wasn't able to present due to the meeting running out of time.
    - He will present next week 10/13.
- Lyle Bishop presented on antenna progress.
    - Determined that this topic needed to be revisited for 10/13.
- Colin Sunderman and Bailey Akers presented on the spreadsheet they developed to determine if op amps will fit design criteria for relaxation oscillator. They also presented on the op amp criteria rankings and spreadsheet they developed to prove these results.
    - The advisors were happy with these results. They determined that we are comfortable enough to choose a few op amps and present on these for 10/13.
- They presented on using very low power microcontrollers to measure capacitance and specific options to do so.
- They presented on soldering and capacitance measurements from the sensing washer design.
    - The advisors were pleased with these results. These results show that our capacitance measuring circuit will measure from 20 pF to ~50 pF. This allows for less percent error to occur since our measurements are above 10 pF (proved in the IEEE paper).

This Week:

NAME	Individual Contributions Summary	Hours This Week	Hours Cumulative

Bailey Akers	Revisited relaxation oscillator spreadsheet. Designed op amp criteria ranking spreadsheet. Soldered capacitor. Researched microcontrollers. Presented on results.	10	33
Colin Sunderman	Revisited relaxation oscillator spreadsheet. Designed op amp criteria ranking spreadsheet. Researched microcontrollers. Presented on results.	9	30
Pengyu Qu	Antenna Research.	6	22
Lyle Bishop	Antenna research.	5	22
Nathan Mulbrook	Microcontroller research. Planned on presenting.	5	22

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

o Comments and extended discussion

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

- Research and find op amps to use in relaxation oscillator circuit.

Antenna Design: Pengyu Qu and Lyle Bishop

- Dr. Neihart suggested for Lyle and Pengyu to research alternate methods to calculate max power transmitted/received wirelessly from an antenna. He suggests that we revisit this topic and present on 10/13.

Communications, Tx/Rx Module: Nathan Mulbrook

- Dr. Neihart suggested Nathan look further into using low power microcontrollers for this design. He asked to present on specific chips that we can use and what the rated power is for each chip. Nathan will present on what his findings were on 10/13.

o Team Difficulties

The main difficulties were with Nathan not being able to present due to time constraints. The antenna group also needs to revisit their research for near-field analysis.

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.