Dwight Look College of
ENGINEERING
TEXAS A&M UNIVERSITY

Team 14: RF Triangulation
Bi-Weekly Update 5

Josh Broyles, Brandon Stokes,
Jack Parkinson, Kathleen Hutchinson

Sponsor: Max Lesser
TA: Souryendu Das

Project Summary

Biologists have struggled being able to collect data on wildlife's location, habitat use, and breeding patterns without getting directly involved with the animal they're tracking.

Radio Frequency Triangulation allows a user to track a **known frequency** (such as a previously tagged animal) within the **triangulated area of three antennas** by using a motor to successfully **pinpoint the strongest signal.**

Helpful to study both invasive and threatened wildlife, our RF Triangulation system will focus on being able to accurately **track a transmitter within a 150 meter radius with >10% error.**

Integrated System Diagram

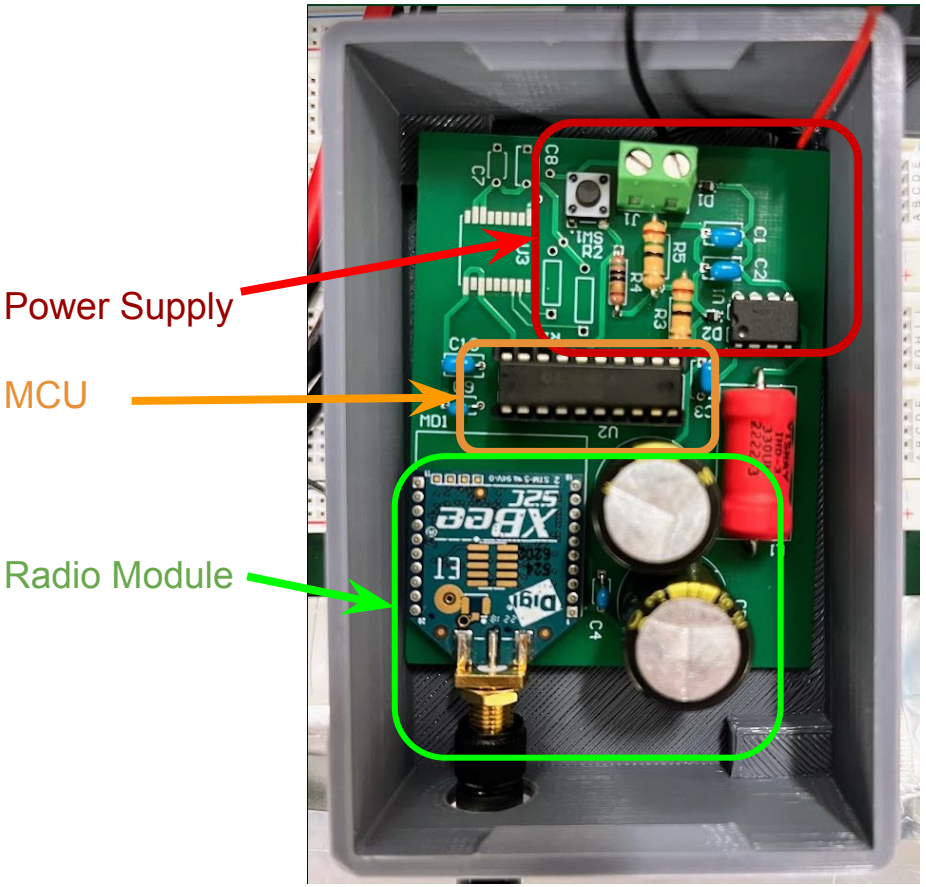
Ideally, our system will have one transmitter and three receivers.

The figure to the right shows a **completed transmitter**.

In the future, three receivers of *relatively the same form* will be created to connect to the transmitter.

The only differences between will be *three added modules* that are essential to the *stepper motor* and data transmission through *LTE*.

Due to power supply failure, the receiver is still in progress to be finished.



Project Timeline

The team will finalize and order parts/PCB

Finalize realistic goals with sponsor

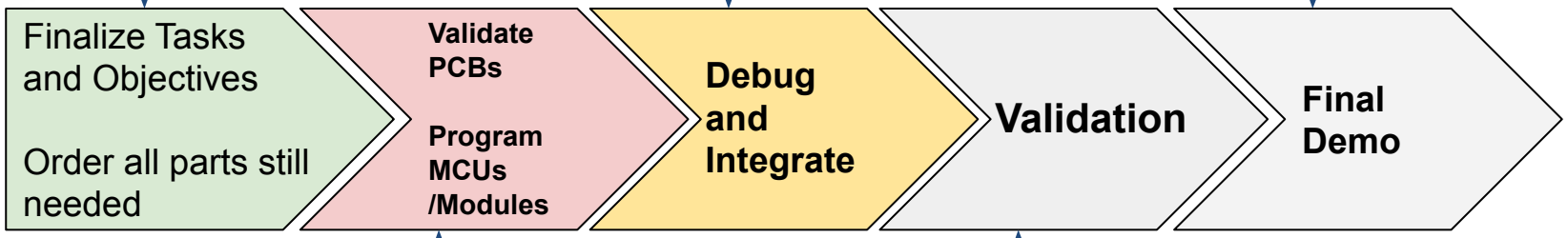
[Complete before February]

The team will debug any problems with code, power, etc. and begin integration

[March]

Once validation is complete with a working project, the team will complete a final demonstration

[Late April]



The team will finalize individual subsystems

[February]

Once fully integrated with all parts working, the team will begin validation testing.

[Late March through Mid April]

Completed

In Progress

Not Started

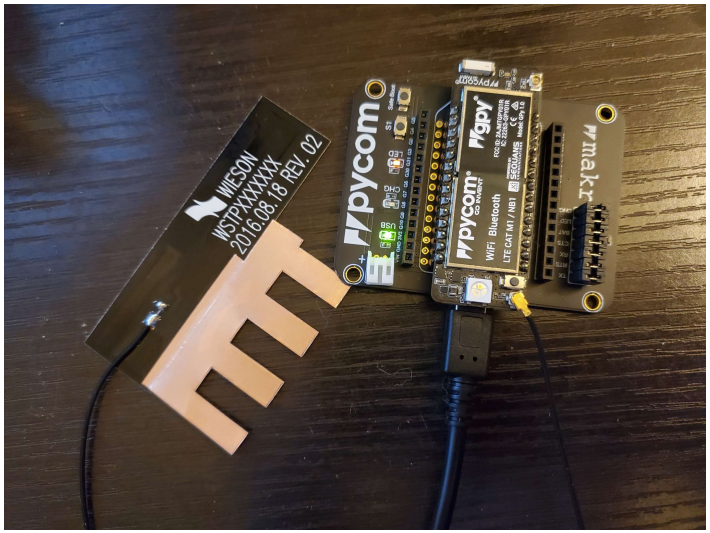
Brandon Stokes

Accomplishments since last update 16 hrs of effort	Ongoing progress/problems and plans until the next presentation
-Validated being able to lose signal and reconnect on WiFi -Validated timing test for sending from Receiver to Database	-Final attempt at LTE -Develop more validation scenarios for GUI

Brandon Stokes

```
30.620995,-96.340089
Time taken for transmit 1.146 s
30.620995,-96.340089
Time taken for transmit 1.072 s
30.620995,-96.340089
Time taken for transmit 1.013 s
30.620995,-96.340089
Time taken for transmit 1.292 s
30.620995,-96.340089
Time taken for transmit 1.59 s
30.620995,-96.340089
Time taken for transmit 1.832 s
30.620995,-96.340089
Time taken for transmit 1.049 s
30.620995,-96.340089
Time taken for transmit 1.731 s
30.620995,-96.340089
Time taken for transmit 1.735 s
30.620995,-96.340089
Time taken for transmit 1.312 s
30.620995,-96.340089
Time taken for transmit 1.922 s
30.620995,-96.340089
Time taken for transmit 1.058 s
```

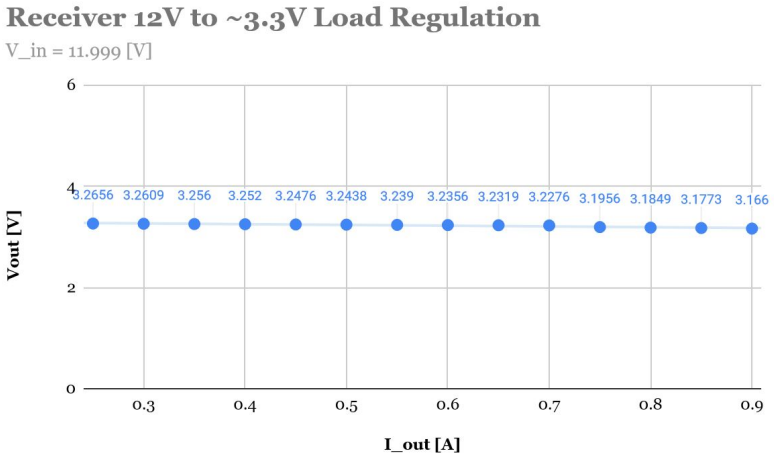
```
Network found!
WLAN connection succeeded!
Connected!
Connected!
Connected!
Connected!
Connected!
Disconnected
Network found!
WLAN connection succeeded!
Disconnected
Network found!
WLAN connection succeeded!
Connected!
Connected!
```

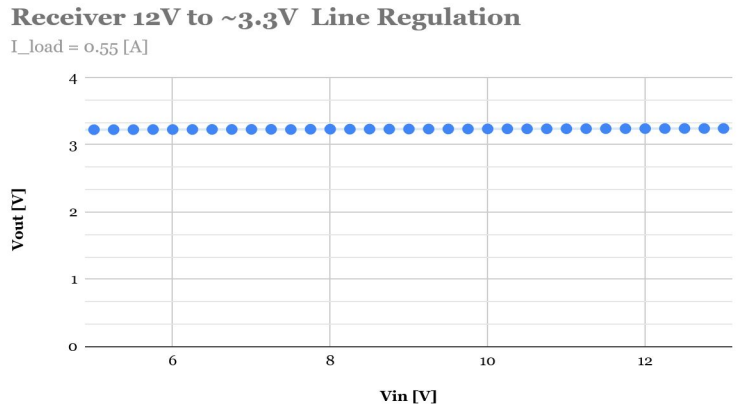


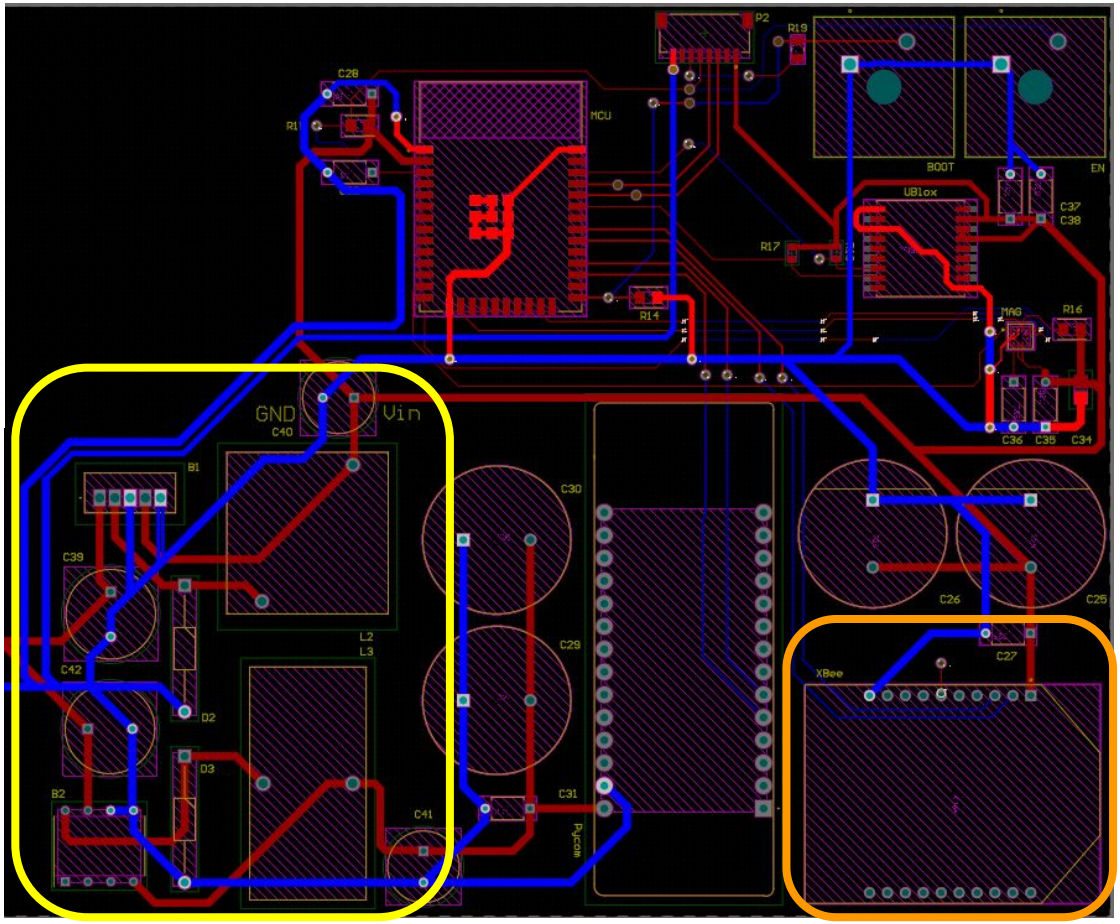
Kathleen Hutchinson

Accomplishments since last update 25 hrs of effort	Ongoing progress/problems and plans until the next presentation
Validated power supply for • 12V to 3.3V • 12V to 5V Validated time to transfer data to database (with Brandon) Finished 2nd PCB version with: • new buck converters • new UART from XBEE to ESP32	Ongoing ESP32 validation with magnetometer & GPS Ongoing XBEE validation with RSSI value Ongoing PCB/Parts ordering

Kathleen Hutchinson







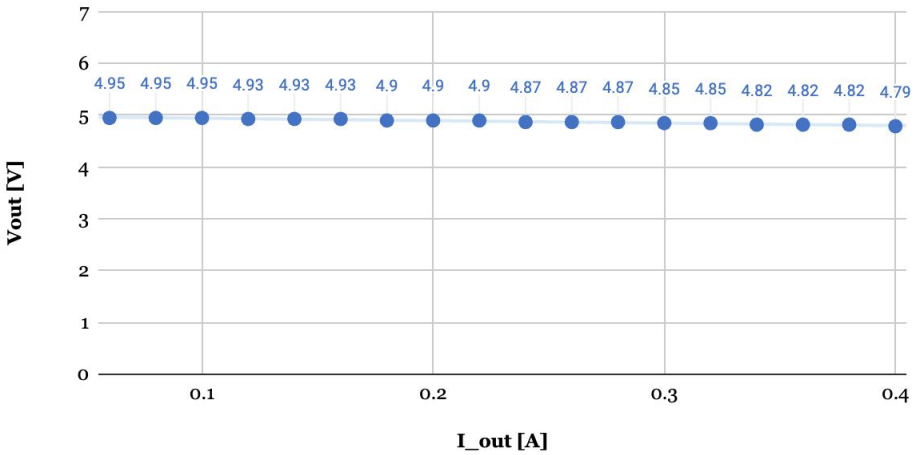
Jack Parkinson

Accomplishments since last update 25 hrs of effort	Ongoing progress/problems and plans until the next presentation
Purchased Antenna Stepper motor control code flashed on to MCU and tested off board New 12V regulator with smaller dropout voltage chosen Validated new 12V to 5V converter	Test the antenna with the Xbee's MCU code integration with Kat Test Motors torque and functionality with Max Finalize last PCB design and order all associated new parts

Jack Parkinson

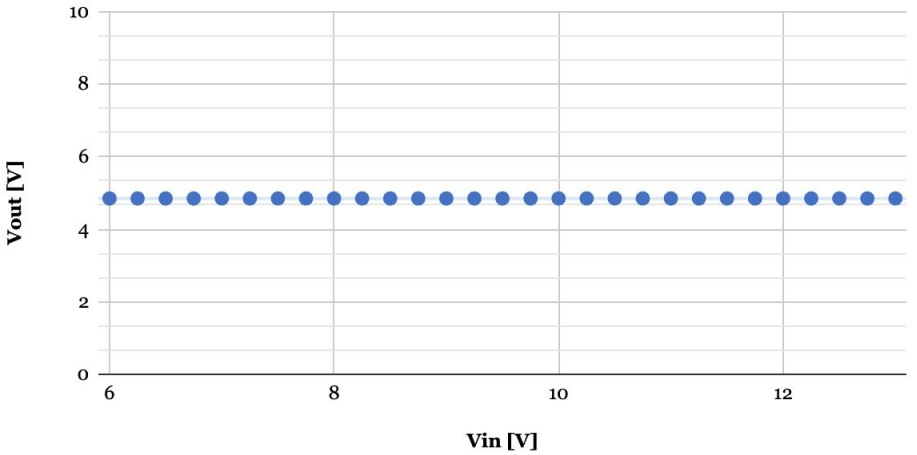
Receiver 12V to ~5V Load Regulation

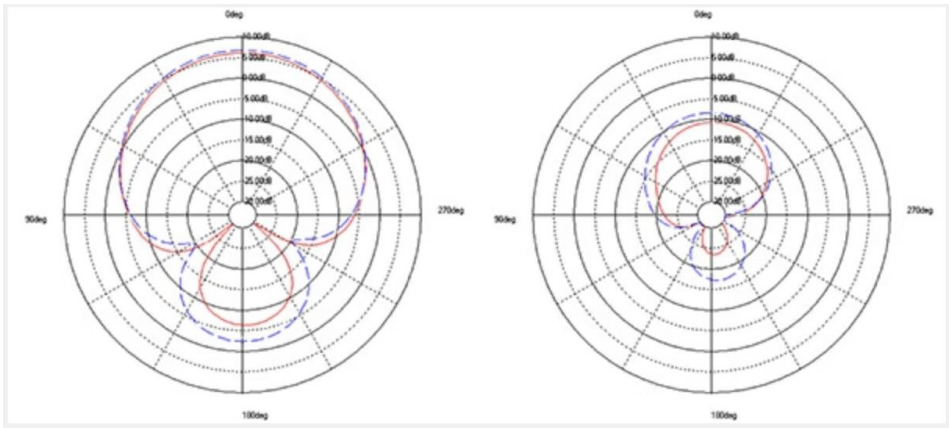
V_in = 11.996 [V]



Receiver 12V to ~5V Line Regulation

I_load = 0.3 [A]





Josh Broyles

Accomplishments since last update 24 hrs of effort	Ongoing progress/problems and plans until the next presentation
Acquired parts needed for Receiver Power Validated power supply for • 12V to 5V	Validate system distance with directional antenna Develop battery lifetime system test for transmitter

Execution Plan

	1/24/23	1/31/23	2/7/23	2/14/23	2/21/23	2/28/23	3/7/23	3/14/23	3/21/23	3/28/23	4/4/23	4/11/23	4/18/23	4/23/23	4/29/23
Ring out PCB															
Test Radio Distance															
Finish Programing MCU															
Assemble PCB															
Validate PCB															
Validate Messages to Receivers															
Finalize Schematic/PCB Design															
Order/Print PCB															
Program Modules															
Validate PCB															
Finish ESP32															
Connect Antenna															
Finalize Antenna Design															
Order/ Build Antenna															
Test Antenna															
Test Motor Controller															
Database to Single Table															
Rework out of bounds situation															
Finish Pycom															
Add Error checking to data															
Integrate Reciever Modules															
Test Inter-Communication															
Complete System Validation															
Final Demo															
Final Report															

Validation Plan

Paragraph	Test Name	Success Criteria	Methodology	Status	Responsible Engineer
3.2.1.1	LTE Stability	The LTE does not drop more than 1 time per 5 minutes and shall reconnect within 20s.	System is put into default operational state (tracking transmitter) and left to run for 30 minutes while Pycom tracks LTE connection	UNTESTED	Brandon Stokes Kathleen Hutchinson
3.2.1.2	Antenna Characterization	Physical antenna has a gain of at least 7 in the direction of the antenna.	Physical antenna will be made and tested inside a characterization chamber with the help of Professor Nowka.	UNTESTED	Jack Parkinson
3.2.1.3	Motor accuracy	The motor can turn with speed and precision while the carrying the weight of the reciever PCB and antenna.	After connecting the system to the motor, it will spin with vairying speeds and steps and be stopped to check accuracy and time.	UNTESTED	Jack Parkinson
3.2.1.4	System Connection	The time it takes to connect and transmit data between the GUI, transmitter, and receiver shall be 30s.	System runs start signal from application to receivers and back to application with data and timed using timer function into code.	TESTED	Brandon Stokes Kathleen Hutchinson
3.2.1.5	Operation Time	System operates continuously on battery power for 30 minutes.	System transmitter and receivers are put into default operational state and left to run for 30 minutes.	UNTESTED	Full Team
3.2.1.6	Detection Range	The detection range shall be an 150m radius from transmitter to a single receiver.	Receiver antenna will be place 150 meters from transmitter and be able to detect and step towards the signal transmitted.	UNTESTED	Josh Broyles Jack Parkinson Kathleen Hutchinson
3.2.2.1	Mass	The weight of the system shall be at max 27lbs.	Measure receiver unit with digital scale.	UNTESTED	Jack Parkinson
3.2.3.1.1	Input Voltage	The input voltage level for the ESP32 and MSP430 shall be 3.3V	Use E-Load to validate line and load regulation	TESTED TESTED	Josh Broyles Kathleen Hutchinson Jack Parkinson
3.2.3.1.2	Input Voltage (Pycom)	The input voltage level for the GPy shall be 5V.	Use E-Load to validate line and load regulation	TESTED	Kathleen Hutchinson
3.2.3.1.3	Input Voltage (Motor)	The input voltage level for the DRV811PWPR (motor driver) shall be 12V.	Use E-Load to validate line and load regulation	UNTESTED	Jack Parkinson
N/A	Full System Demo	A user of system is able to accurately track the transmitter in an open space with a positional error of less than <10%.	System runs start signal to receivers which tracktransmitter's strongest signal with the motor, both stationary and moving, which sends data to GUI that outputs an accurate map with an error of <10% calculated through GPS points.	UNTESTED	Full Team

Thank you for your attention!

Feel free to ask us questions