Dwight Look College of ENGINEERING
TEXAS A&M UNIVERSITY

Team 51: Radio Mobile Foxbot
Bi-Weekly Update 5

Brady Lagrone
Sophia Panagiotopoulos
Miguel Segura

Sponsor: Kevin Nowka
TA: Fahrettin Ay

Project Summary

Purpose:

- Amateur Radio Directional Finding (ADRF) is a sport in which an individual tries to locate a hidden transmitting device. Our goal is to “hide” from an adversary Houndbot, who will be trying to locate our robot. Additionally, our robot will increase the potential of ARDF training and aid in the engineering of directional antennas.

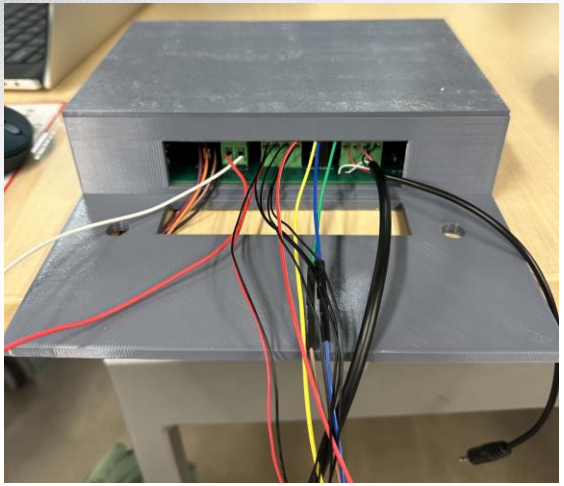
Proposal:

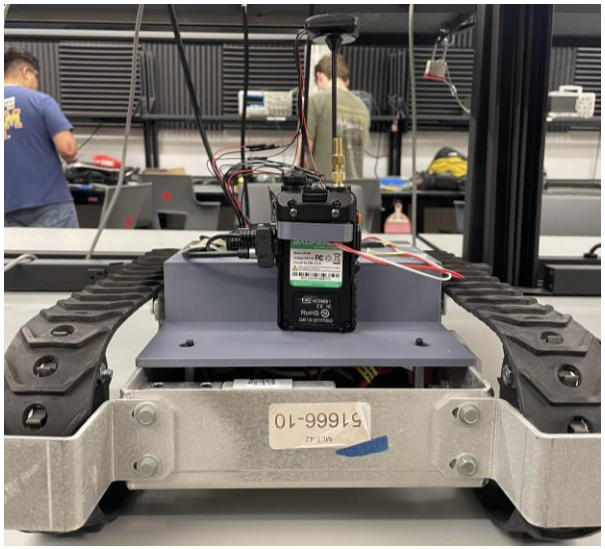
- We have created a radio system coupled with a mobile robot that receives DTMF signals and preforms various functions based on the decoded signal.

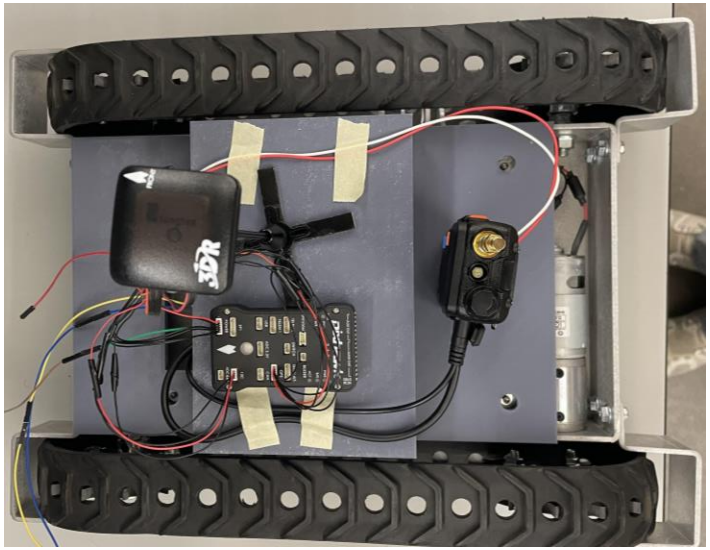
Project Timeline

Subsystem Designs and Testing (completed 01/27)	Integration of power and radio subsystem PTT (completed 2/9)	Integration of MCU and Motor Driver (to complete by 2/14)	Integration of power and radio ADC (to complete by 2/14)	All systems have been integrated (to complete by 3/7)	System Testing (to be completed 3/17)	Demo and Report (to complete by 4/14)

Integrated System Diagram





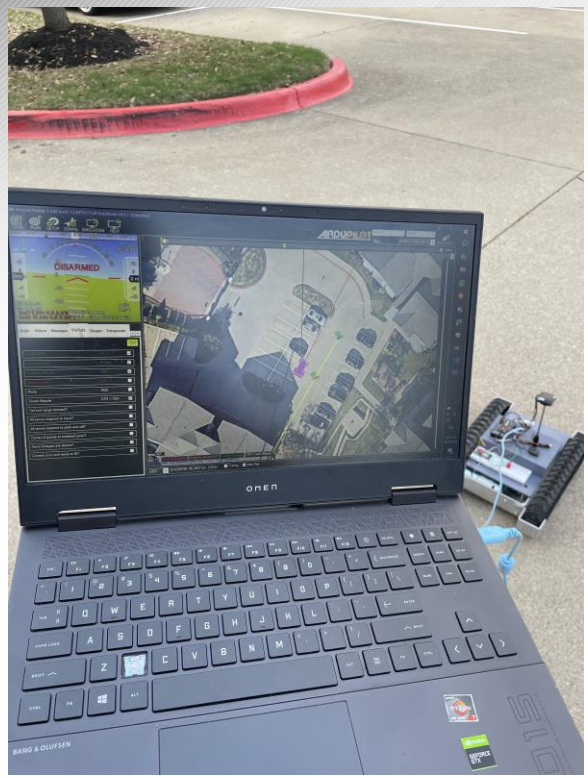


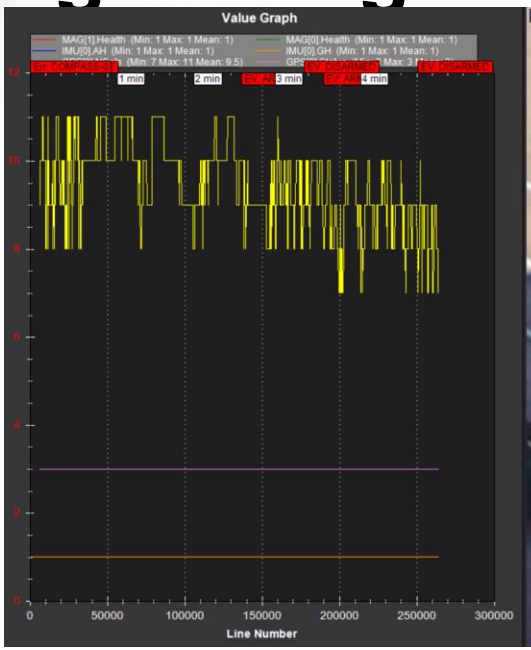
- PCB, Radio, and PixHawk general layout integration
- The 5500mAh battery will be placed below PCB in final design with casing made to hold the other internals that consist of the Radio, UltraSonic Sensors Mounts, and GPS Mount.
- Wires will be sorted and changed with finalized integration of design.

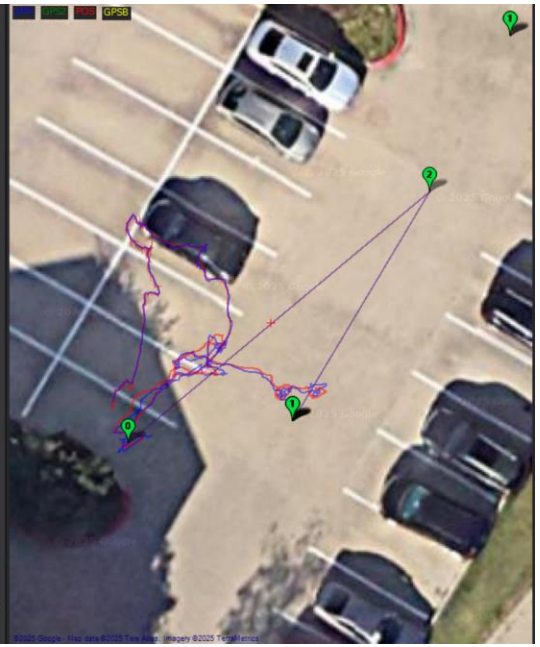
Miguel Segura

Accomplishments since last update 42 hrs of effort	Ongoing progress/problems and plans until the next presentation
• PixHawk autopilot system followed the initial basic testing path (March 20th) • Reconfigured full parameters of new PixHawk • Configured overall system layout • Reprogrammed 403 Code to facilitate testing for my groupmates • Performed rotation tests for Rover to validate motor control using previous code • Connected new MB1202 Ultrasonic Sensor to PixHawk/Rover	• PixHawk is inconsistent for full navigation autonomous control. Seems to be issues with Compass Magnetic Field. • Looking to cover motor controller with electromagnetic shielding material and other items that may be affecting the compass. • Use previously developed motor control code to perform tests for other systems

Miguel Segura







USB cable only used to monitor tests and store data logs to verify conditions since no RC connection.

Compass 1, Compass 2, GPS, and GYRO are all healthy and active. GPS also detects at minimum satellites at all times with a proper 3D-Fix.

```
Duration 0:04:54
Vehicletype ArduRover
Firmware Version V4.5.7
Firmware Hash 52bed8d5
Hardware Type
Free Mem 0
Skipped Lines 0
Test: Autotune = NA -
Test: Brownout = UNKNOWN - No CTUN log data
Test: Compass = FAIL - Large change in mag_field (81.37%)Max mag field length (705.40) > recommended (550.00)
Test: Dupe Log Data = FAIL - Duplicate data chunks found in log (68720 and 153278)
Test: Empty = GOOD -
Test: Event/Failsafe = GOOD -
Test: GPS = GOOD -
Test: IMU Mismatch = NA -
Test: Motor Balance = NA -
Test: NaNs = FAIL - Found NaN in STER.LatAccFound NaN in POS.RelOriginAltFound NaN in THR.Speed
Test: OpticalFlow = FAIL - 'FLOW_FXSCALER' not found
Test: Parameters = GOOD -
Test: PM = NA -
Test: Pitch/Roll = NA -
Test: Thrust = NA -
Test: VCC = UNKNOWN - No CURR log data
```

Brady Lagrone

Accomplishments since last update 16 hrs of effort	Ongoing progress/problems and plans until the next presentation
• Validated different modes of operation and testing • PCB configuration • Alert user DTMF signal was received by the on board radio • Call sign programed • Implemented constant transmitting song	• Radio and ESP integration with Pixhawk pathing and control • Full system validation

Brady Lagrone

Modes of Operation:

- Users sends DTMF signal for each
- Need to send heartbeat to pixhawk each mode
- Check Ultrasonic During modes of operation and alert if object
- First mode (Beep on moving on path) (20 Seconds)
- Second mode (Emitting signal, pause ”hide”, repeat) (10s, 10s)
- Third Mode (Beep on off Stationary)(20s)
- Fourth Mode (Continuous PTT and stationary) (20s)
- Health mode (Check Bot)
    - Battery, GPS, health, ultrasonic check
    - Need to have a reset value
- KJ5HZT (call sign)

Simulate Battery monitor not opperating

```
I (315) gpio: GPIO[13]| InputEn: 1| OutputEn: 0| OpenDrain: 0| Pullup: 0| Pulldown: 0| Intr:0
I (315) gpio: GPIO[27]| InputEn: 1| OutputEn: 0| OpenDrain: 0| Pullup: 0| Pulldown: 0| Intr:0
I (325) gpio: GPIO[26]| InputEn: 1| OutputEn: 0| OpenDrain: 0| Pullup: 0| Pulldown: 0| Intr:0
I (335) gpio: GPIO[14]| InputEn: 1| OutputEn: 0| OpenDrain: 0| Pullup: 0| Pulldown: 0| Intr:0
Binary: 1010, Decimal: 10
I (5845) I2C: I2C initialized successfully!
I (6445) BQ76920: Wake-up pulse sent to TS1
I (6945) i2c_restart: Scanning I2C bus...
I (6945) i2c_restart: Found device at address: 0x08
I (6965) i2c_restart: Scan complete.
I (7465) gpio: GPIO[33]| InputEn: 0| OutputEn: 0| OpenDrain: 0| Pullup: 1| PuI (7465) MAVLINK_ESP32: UART initialized
E (7475) i2c_restart: Failed to read register 0x00: ESP_FAIL
E (7475) i2c_restart: Failed to read register 0x00: ESP_FAIL
Battery Monitor System is Bad
Letter: B, Morse Code: -...
Letter: M, Morse Code: --
  (Word Space)
Letter: B, Morse Code: -...
Letter: a, Morse Code: .-
Letter: d, Morse Code: -..
Binary: 1010, Decimal: 10
```

Sophia Panagiotopoulos

Accomplishments since last update 20 hrs of effort	Ongoing progress/problems and plans until the next presentation
• Validated system packaging for various environmental factors. • Tested and validated battery connector between the radio and 7.4V line. • Validated correct arming and disarming behavior of the Pixhawk. • Tested various modes of operation for transmitting and pathing.	• Continue integrating with motor control to allow different modes of operation. • Develop validation scenarios for Foxbot health updates. • Field testing for range and battery life.

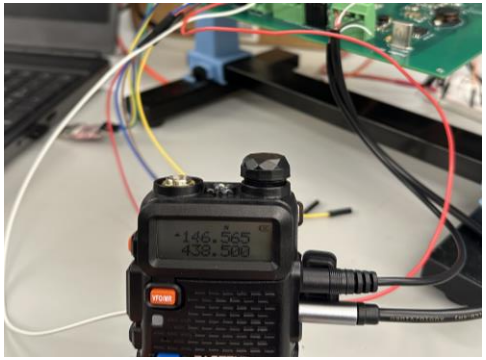
Sophia Panagiotopoulos

```
I (6965) i2c_restart: Scan complete.
I (7465) gpio: GPIO[33]| InputEn: 0| OutputEn: 0| OpenDrain: 0| Pullup: 1| PuI (7465) MAVLINK_ESP32: UART initialized
E (7475) i2c_restart: Failed to read register 0x00: ESP_FAIL
E (7475) i2c_restart: Failed to read register 0x00: ESP_FAIL
Battery Monitor System is Bad
Letter: B, Morse Code: -...
Letter: M, Morse Code: --
  (Word Space)
Letter: B, Morse Code: -...
Letter: a, Morse Code: .-
Letter: d, Morse Code: -..
Binary: 1010, Decimal: 10
```

This shows the initial setup of the system -> bad battery monitor reading will correspond with the Pixhawk not starting its path.

When the system is in 'Health Mode', it will be waiting for a tone to implement that mode's function. When the mode is complete, the system will return to 'Health Mode' and wait for the next task.

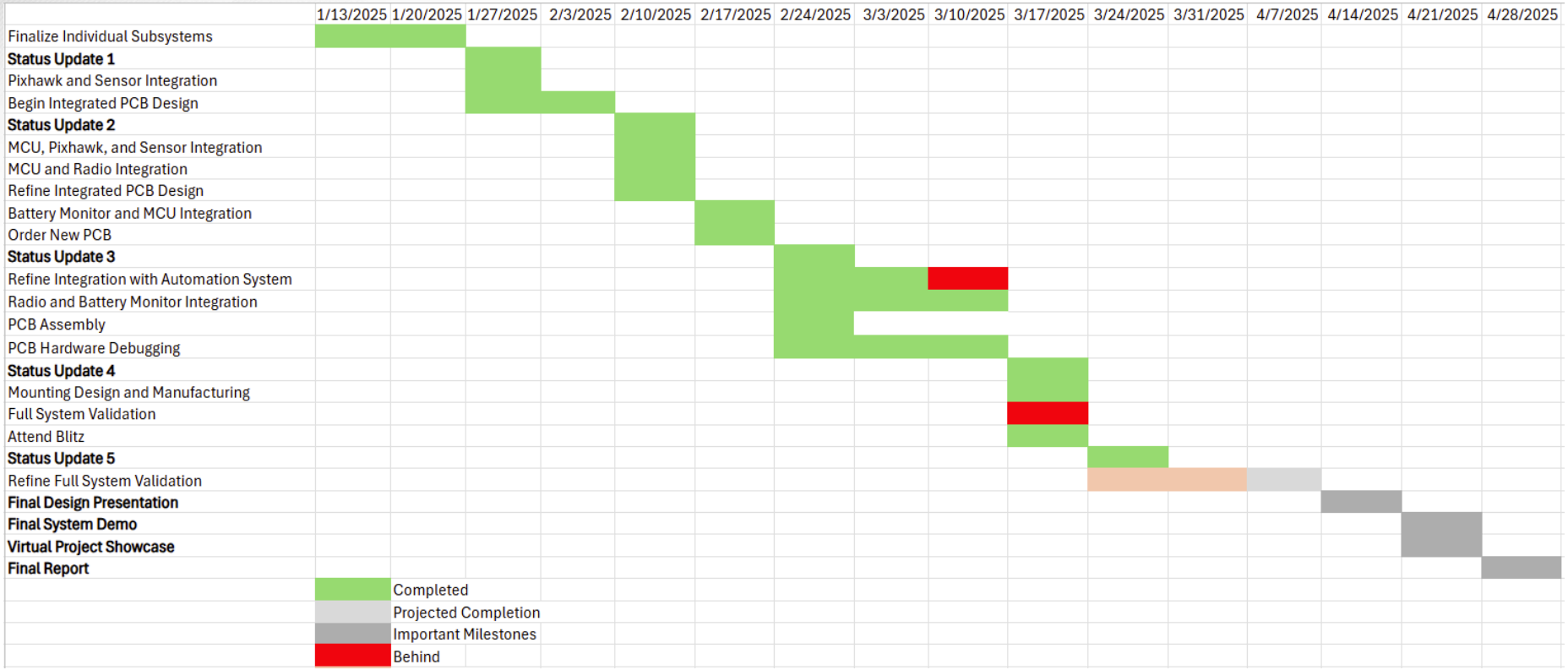
```
Pixhawk HeartbeatThis is back in health mode
Binary: 0101, Decimal: 5
Binary: 0101, Decimal: 5
Binary: 0101, Decimal: 5
Binary: 0101, Decimal: 5
Binary: 0101, Decimal: 5
Binary: 0101, Decimal: 5
Binary: 0101, Decimal: 5
Binary: 1001, Decimal: 9
Overall Health CheckThis is back in health mode
Binary: 1001, Decimal: 9
Binary: 1001, Decimal: 9
Binary: 1001, Decimal: 9
Binary: 1001, Decimal: 9
Binary: 1001, Decimal: 9
Binary: 1001, Decimal: 9
Binary: 1001, Decimal: 9
Binary: 1001, Decimal: 9
Binary: 1001, Decimal: 9
Binary: 1001, Decimal: 9
```



Radio is powered off the 7.4V line where it performs at full functionality (ptt is turned on and off)

The mode will only be executed once with the next mode being performed after a new binary value is read 3 times.

Execution Plan



Validation Plan

Paragraph #	Test Name	Success Criteria	Methodology	Status	Responsible Engineer(s)
3.2.1.1	Transmisison Range	Radio on foxbot is able to pick up signals from user radio within the specified foxhunt region	Radio on the foxbot is able to recognize a sent signal from the user radio by outputting the tone from its speaker.	TESTED	Sophia
3.2.1.2	Operation Time	The foxbot will operate for at least 30 mins	The batteries are able to run the system for 1 hour when left alone.	TESTED	Brady
3.2.1.3	DTMF Decoding Accuracy	A binary value, output of the decoder, will correspond to the keypad number sent by the user radio	LEDs will show the bits that are high or low, indicating the value in binary.	TESTED	Sophia
3.2.1.4	Intutiveness of System	The system shall be straightforward and the user shall be able to troubleshoot if there is an issue	It should take the user not more than 10 minutes to load the path and start up the foxbot.	UNTESTED	Full Team
3.2.1.5	Pathing Accuracy	The foxbot will stay on the user decicded path and will avoid obstacles including trees, ditches, and moving objects.	Place the foxbot in a location and it should be able to determine its path while staying in the programmed range. It will be able to reroute if any obstacles are detected.	UNTESTED	Miguel
3.2.1.6	Morse Decoding Accuracy	The user radio will be able to pick up the transmitted signal from the foxbot radio and decode it using a morse decoding app.	App on phone will be able to decode the sent signal corresponding to a voltage reading or some other message.	TESTED	Sophia
3.2.2.1	Mass	The foxbot will not exceed 20lbs	Weigh the system once all of the componets are mounted.	TESTED	Full Team
3.2.2.2	Mounting	to the top of the chassis	be held down securely to ensure it can withstand hostile movements.	TESTED	Full Team
3.2.2.3	System Packaging	The radio, PCBs, and MCU will be held in custom protective cases	Cases should hold the components and protect them from enviornmental factors like heat, humidity, and water.	TESTED	Full Team
3.2.3.1	Input Voltage (Radio)	The Baofeng will receive an input voltage fo 7.4 V at a current of 1780mA	Use a multimeter to validate input voltage levels.	TESTED	Brady
3.2.3.2	Input Voltage (ESP)	The ESP will receive an input voltage of 3.3V at a current of 160mA	Use a multimeter to validate input voltage levels.	TESTED	Brady
3.2.3.3	Voltage Monitoring	The voltage of the batteries will be read by a GPIO pin of the ESP and will detatch the battery from the battery monitor if the voltage becomes too low.	The voltage is read by the ESP and shows up in the terminal. LEDs can be used to show the battery level as a percentage of a fully charged rating. A trasistor will be activated to break the circuit when the battery levels drop below a usable voltage.	TESTED	Brady and Miguel
3.2.4.1	Enviornmental Resistance	The foxbot shall be able to traverse flat terrain and withstand temperatues in the range of 5°C to 40°C	The system will be placed in various enviornments ensuring the monitors can traverse the terrain.	UNTESTED	Full Team
	Full System Demo	The foxbot will self automate a loaded path from the pixhawk while communicating with the user through DTMF signals and morse. It will hide from the houndbot and will be able to run for 1 hour while avoiding obstacles	Foxbot is placed at a starting location, follows automated path with sending and receiving signals, and avoid getting caught by the houndbot.	UNTESTED	Full Team