Dwight Look College of ENGINEERING
TEXAS A&M UNIVERSITY

Team 51: Radio Mobile Foxbot
Bi-Weekly Update 1

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TA: Fahrettin Ay

Project Summary

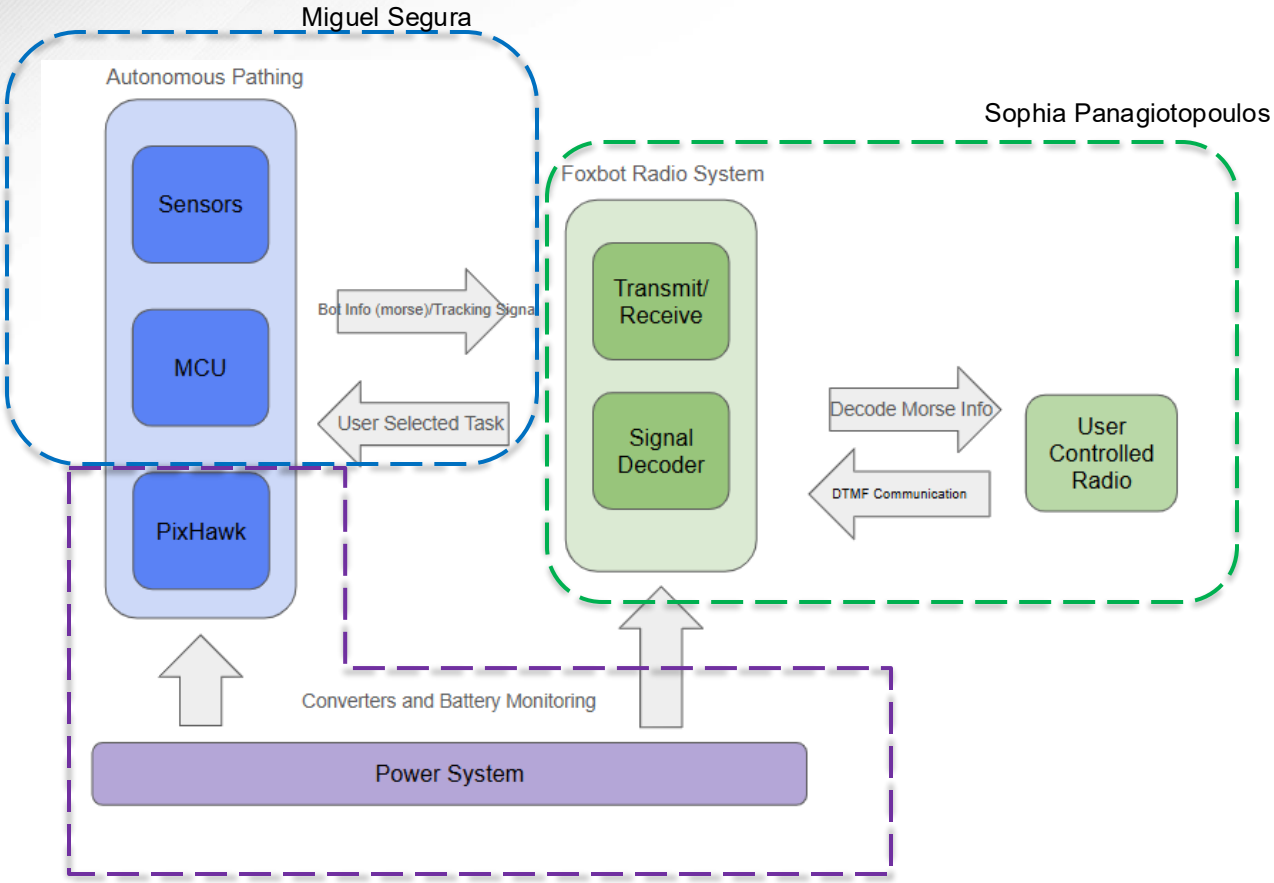
Purpose:

- Amateur Radio Directional Finding (ARDF) is traditionally done with a stationary transmitter, limiting the training abilities.
- Transmitted signals are non-adjustable with little variability for the user.

Our Proposal:

- We will have a mobile robot chassis transmitting user selected signals.
- This will increase the potential of ARDF training.

Project/Subsystem Overview



Subsystem Goal Overview:

Autonomous Pathing System:

- Robot can arrive at user decided destination while avoiding objects by using sensors and Pixhawk.
- MCU will send analog signal to radio transmit while controlling PTT function.
- MCU will receive and control batteries properties

Power System:

- Lippo batteries will be converted for component ratings.
- Battery monitor will send alert to MCU when voltage ratings are low.

Radio System:

- User can send DTMF tone to Foxbot which can be decoded to determine user selected settings (transmit for houndbot or battery health).
- Radio will transmit the formulated signal by the MCU. If the user has requested battery health, morse will be decoded.

Major Project Changes for 404

Major Project Changes: Decided on using a singular ESP instead of 2

- Initially, we had an ESP for pathing and an ESP for battery monitors and radio, but interfacing the ESPs seems out of reach between system integration and our timeline.

Autonomous Pathing System:

- Motor Driver will be directly connected to the Pixhawk and not to the ESP32
- Pixhawk connects to the ESP32 to specifically read values from the ultrasonic sensors

Power System:

- Battery will be monitored by fuel gauge and will send information to and from the ESP using the SCL and SDA lines.

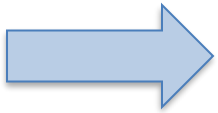
Radio System:

- Going to use a morse decoder app instead of trying to make one.
- Will receive battery information only, where we initially were also going to do coordinates of the Foxbot.

Project Timeline

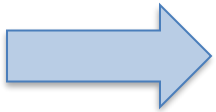
Completed

- Ultrasonic sensor programming with ESP
- DTMF Decoder and transmission circuit
- Voltage converters for each component
- Mission plan from EQUAD to Kyle Field



Underway

- Pixhawk interfacing with motors
- Battery monitor design
- ESP code for transmission and battery monitor readings



Future

- Integrate the battery monitor with the radio system to transmit data to the user
- Sensors connected to Pixhawk for autonomous pathing

MCU Subsystem

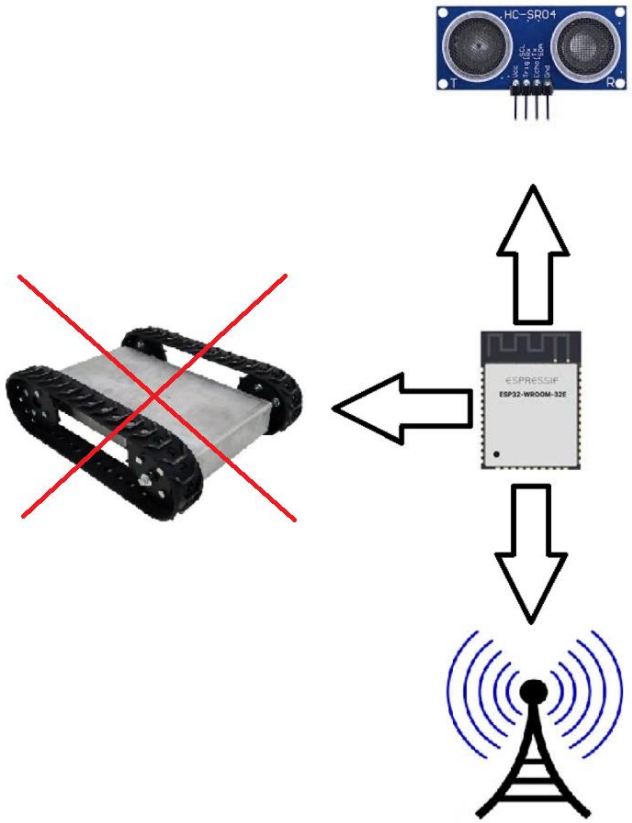
Miguel Segura

Accomplishments since 403 ~8hrs	Ongoing progress/problems and plans until the next presentation
• Reformatted and adjusted the motor control and ultrasonic sensor code that was done in 403.	• Connect Sabertooth 2x12 to the PixHawk and Mission Planner for the autonomous control. • Connect the US sensors to the PixHawk and provide functionality with the code created. • Create firmware that integrates the Radio Subsystem to the ESP32.

MCU Subsystems

Miguel Segura

- ESP32 no longer directly connecting to the Foxbot's motors
- Ultrasonic sensor code works but needs to connect to the PixHawk.
- Code for radio/esp32 needs to be programmed to transmit.



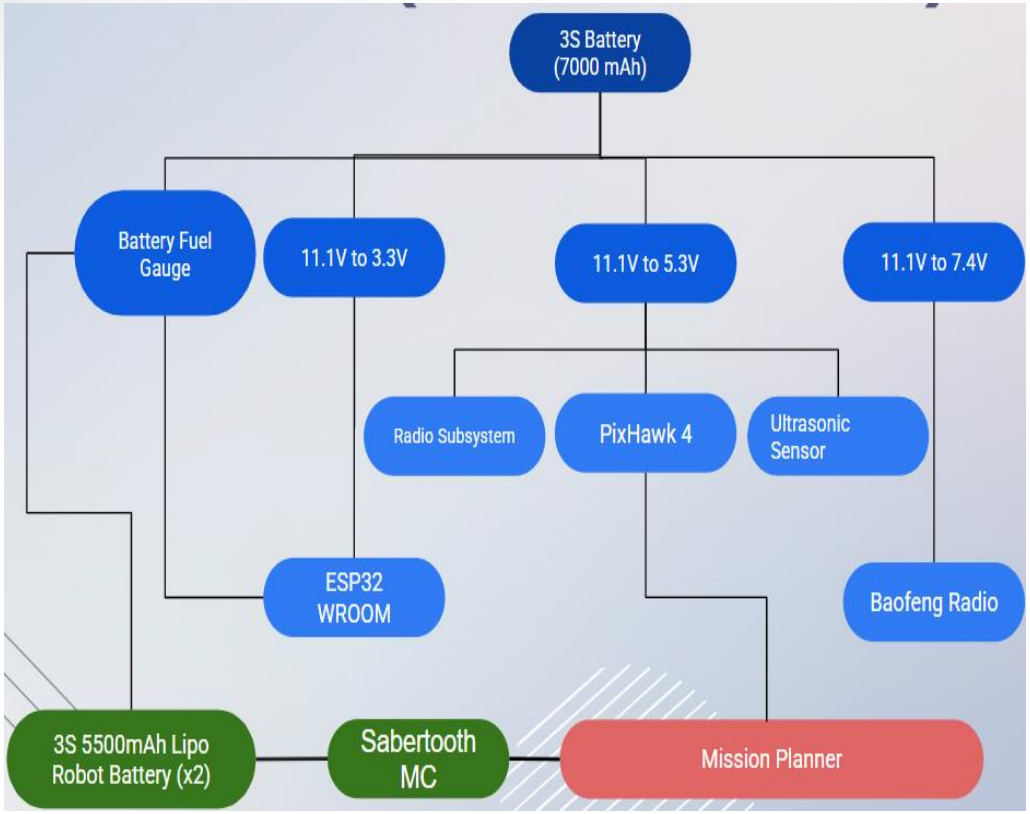
Power Subsystem

Brady Lagrone

Accomplishments since 403 ~15 hours	Ongoing progress/problems and plans until the next presentation
• Three step down converters (3.3V, 5.3V, 7.4V) from 11.1V are still operational from 403 • Working I2C communication (Between ESP32s for now) • Have basic inputs to ESP32 ADC to output into morse (LED)	• Work with Radio Subsystem to connect the ESP32 dev kit to PCB and start testing binary inputs to functions • ESP32 connect to battery fuel gauges or look into other options

Power Subsystem

Brady Lagrone



- Power converters all work at their respective voltage out levels and max current draws.
- Mission planner can handle control of motors.
- ESP32 has basic morse code outputs

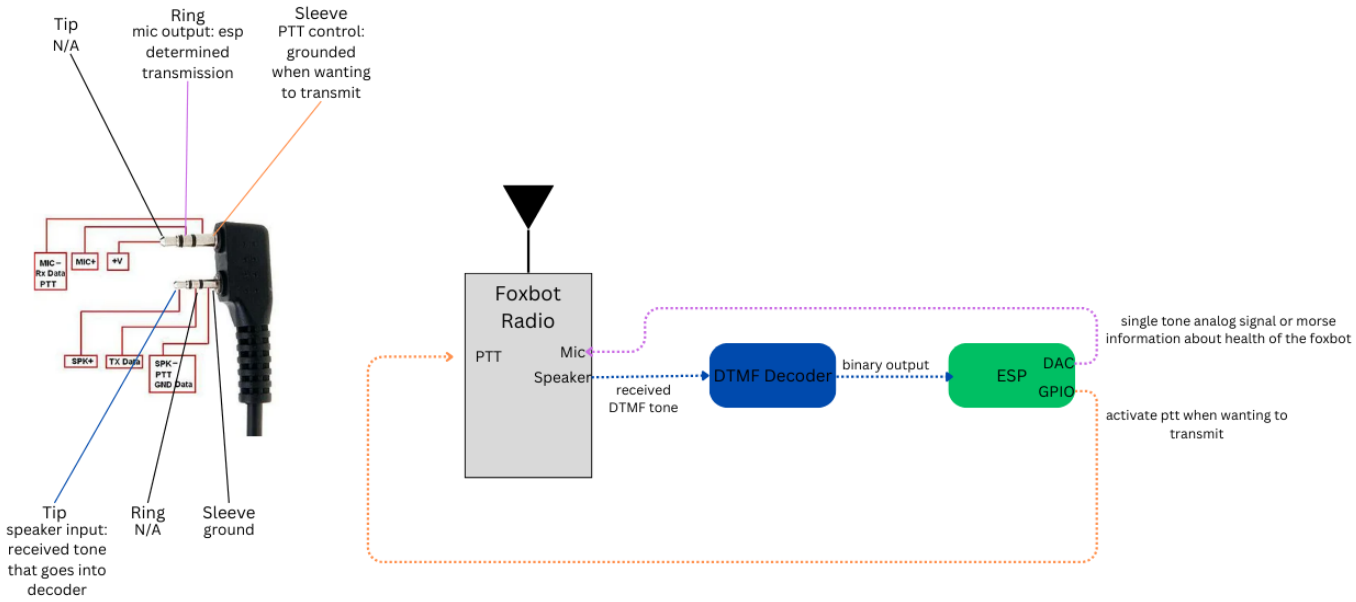
Radio Subsystem

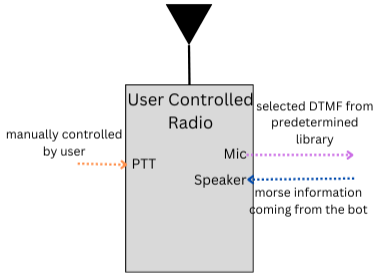
Sophia Panagiotopoulos

Accomplishments since 403 ~20 hrs of effort	Ongoing progress/problems and plans until the next presentation
• Decoder and transmission perform as I left it in 403; decoder properly can identify the DTMF tone sent and, PTT can be enabled by a common ground, and the Foxbot radio can transmit to the user radio via a sinusoidal wave. • Designed and simulated a condensed output line for easier ESP integration	• Enable PTT with a transistor, controlled by a GPIO pin. • Send signals from DAC to user radio. • Finalize ESP pins and map out on integrated schematic. • Designing MUX configuration to condense I2C lines for the battery monitor integration with ESP

Radio Subsystem Figure

Sophia Panagiotopoulos





Works:

- Decoder
- Transistor controlling PTT line

Changing:

- Morse will be decoded by iPhone app

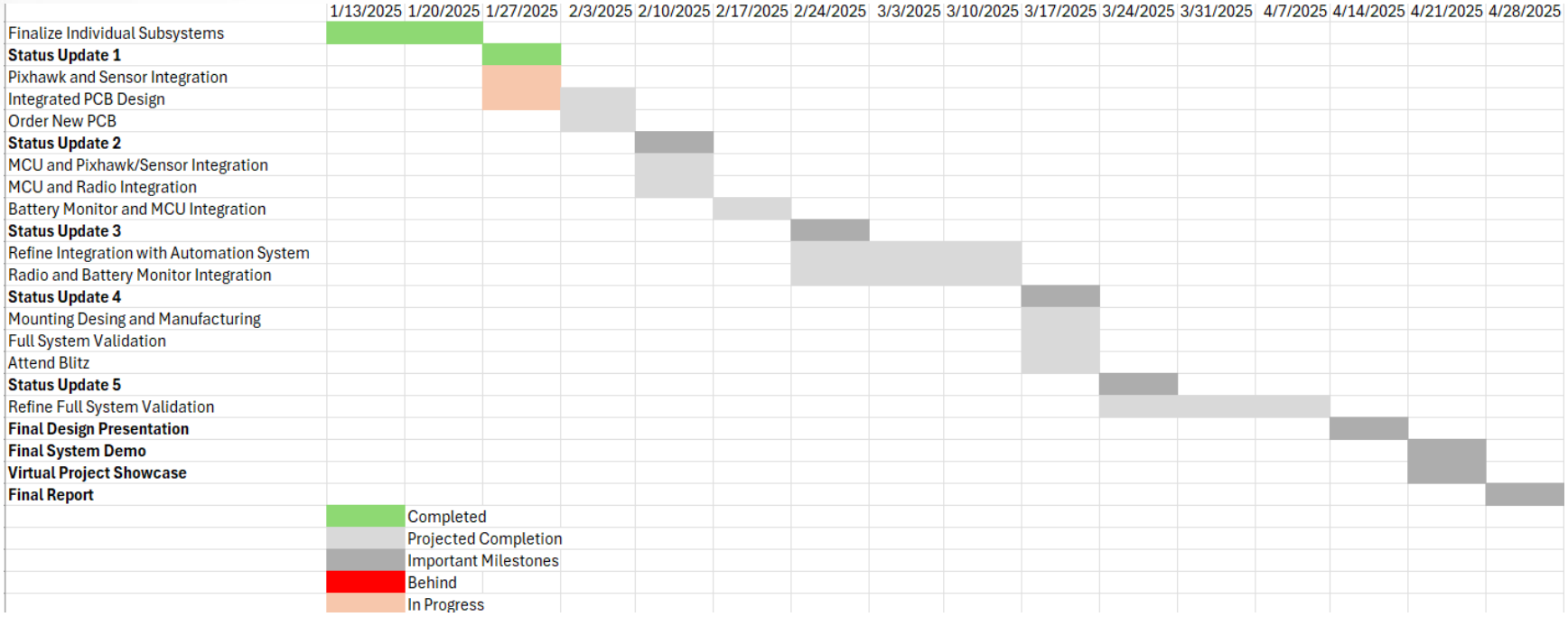
Parts Ordering Status

- Working on making the integrated PCB and plan to get that finished by early February.
- Assembly will start once all parts have come in

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 1 hour	The batteries are able to run the system for 1 hour when left alone.	UNTESTED	Brady
3.2.1.3	DTMF Decoding Accur	A binary value, output of the decoder, will correspond to the keypad number sent by the	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	UNTESTED	Miguel
3.2.1.6	Morse Decoding Accur	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.	UNTESTED	Sophia
3.2.2.1	Mass	The foxbot will not exceed 7lbs	Weigh the system once all of the componets are mounted.	UNTESTED	Full Team
3.2.2.2	Mounting	The sensors shall be able to be mounted to the corners of the chassis and the radio will be	Attatch the sensors to the corners of the chassis and test for accuracy. The	UNTESTED	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.	UNTESTED	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 system if the voltage becomes too low.	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.	UNTESTED	Brady and Miguel
3.2.4.1	Enviornmental Resistar	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

Gantt Chart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4/28/2025
Finalize Individual Subsystems
Status Update 1
Pixhawk and Sensor Integration
Integrated PCB Design
Order New PCB
Status Update 2
MCU and Pixhawk/Sensor Integration
MCU and Radio Integration
Battery Monitor and MCU Integration
Status Update 3
Refine Integration with Automation System
Radio and Battery Monitor Integration
Status Update 4
Mounting Desing and Manufacturing
Full System Validation
Attend Blitz
Status Update 5
Refine Full System Validation
Final Design Presentation
Final System Demo
Virtual Project Showcase
Final Report
Completed
Projected Completion
Important Milestones
Behind
In Progress