Dwight Look College of
ENGINEERING
TEXAS A&M UNIVERSITY

Team 30: Ember Bot
Bi-Weekly Update 1

Jonathan Chen, Kevin Rivera,
Nancy Ramirez Castillo, Yuwen Zheng
Sponsor: Kevin Nowka
TA: Roman Venegas

Project Summary

Problem Statement:

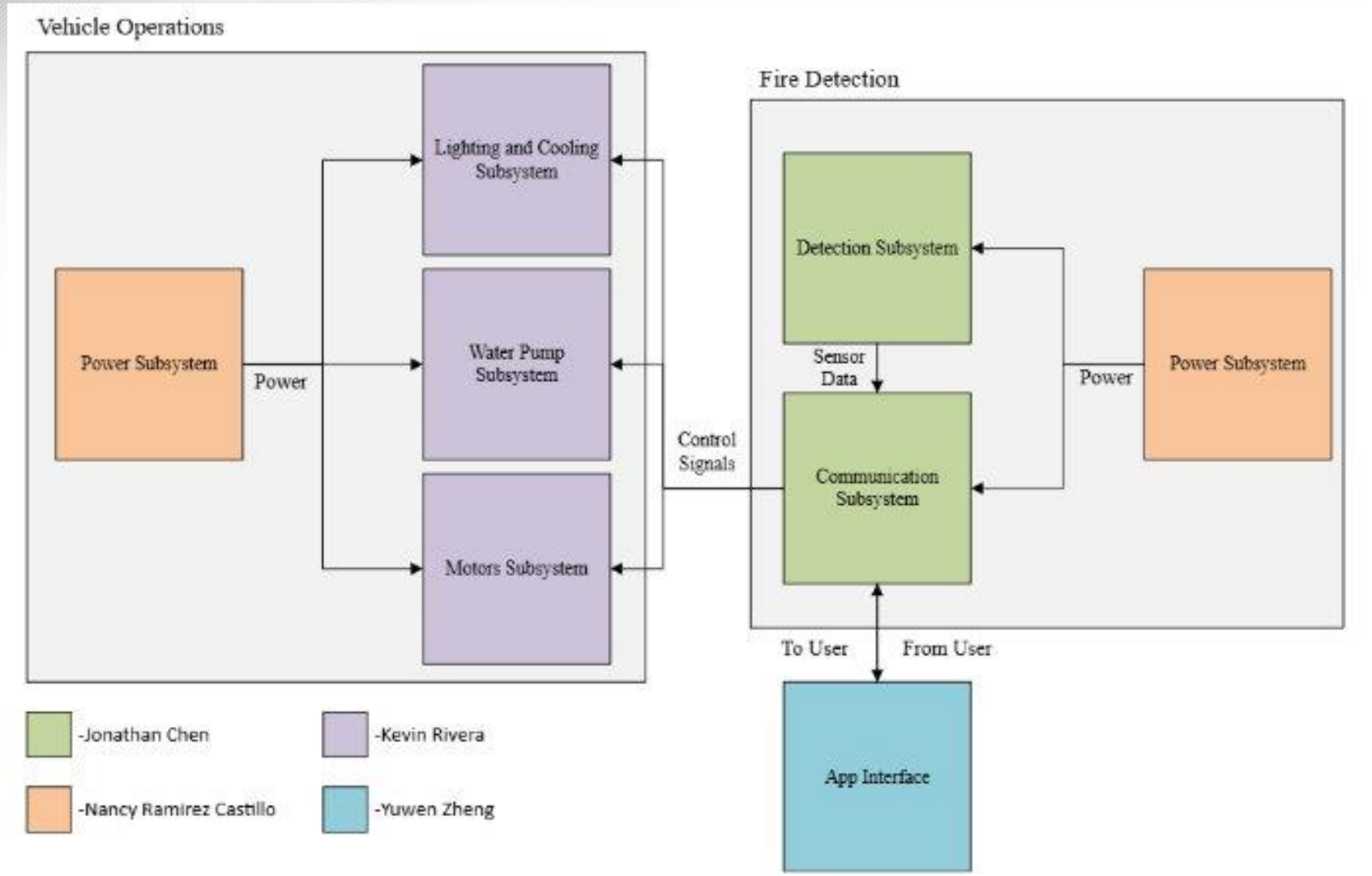
Traditional firefighting methods rely on human intervention, exposing personnel to extreme hazards such as heat, toxic smoke, and structural collapse. These settings can pose safety risks and potential response delays, especially in hard-to-reach areas.

Project Summary

Solution Proposal:

Ember Bot is a fire-fighting robotic vehicle designed to detect and extinguish small fires in high-risk areas through a mobile app. Equipped with IR sensors and a camera, firefighters will be able to control Ember Bot in areas deemed unsafe for humans.

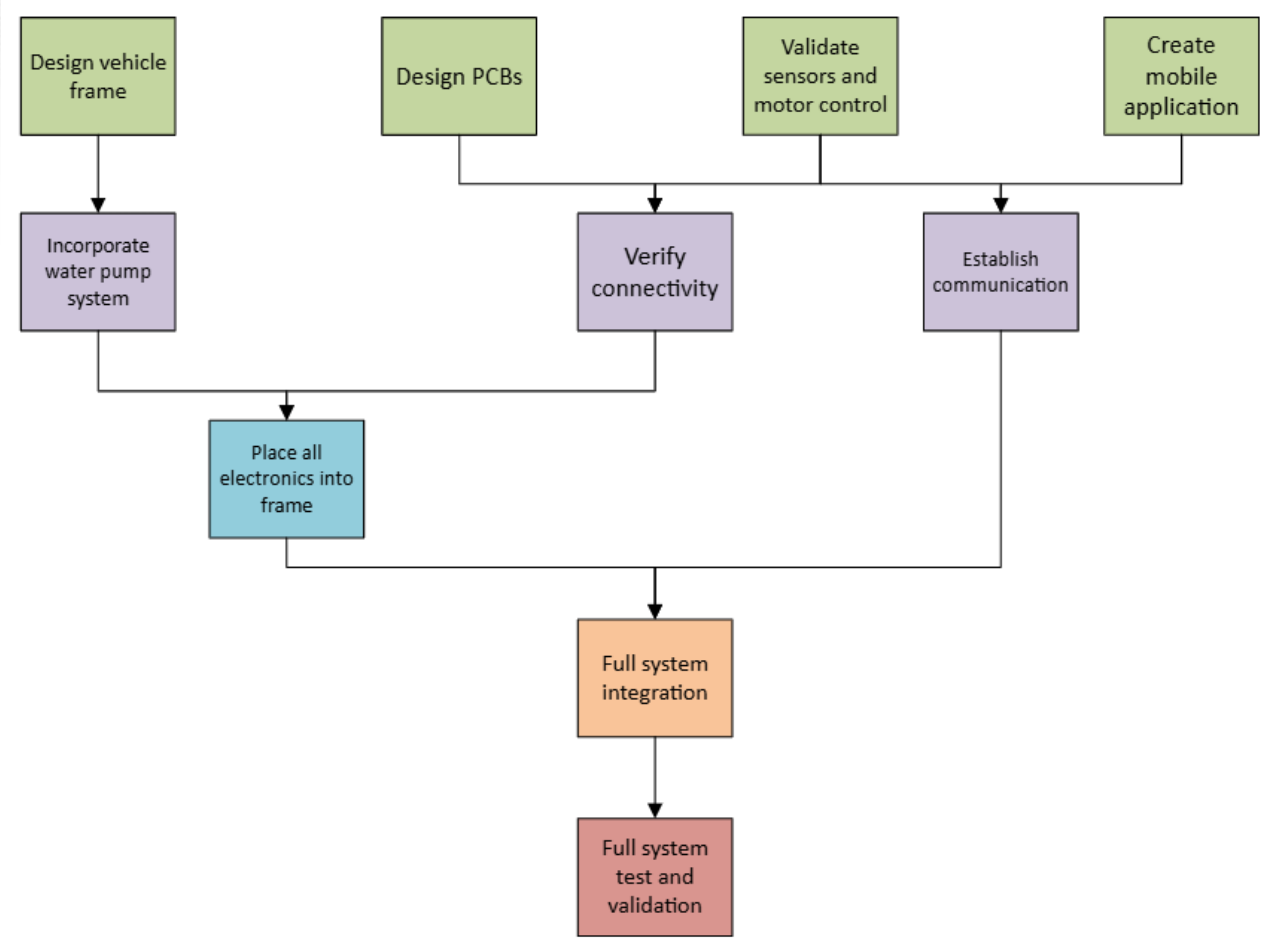
System Overview



Major Project Changes for 404

Major Changes	Reasons & Purpose
• Frame Redesign	• New design to lower center of mass and decrease overall height
• Power Restructure	• No need for the 24V boost converter
• Database & Server	• To store user data
• Collaboration	• For better integration of the project

Project Timeline



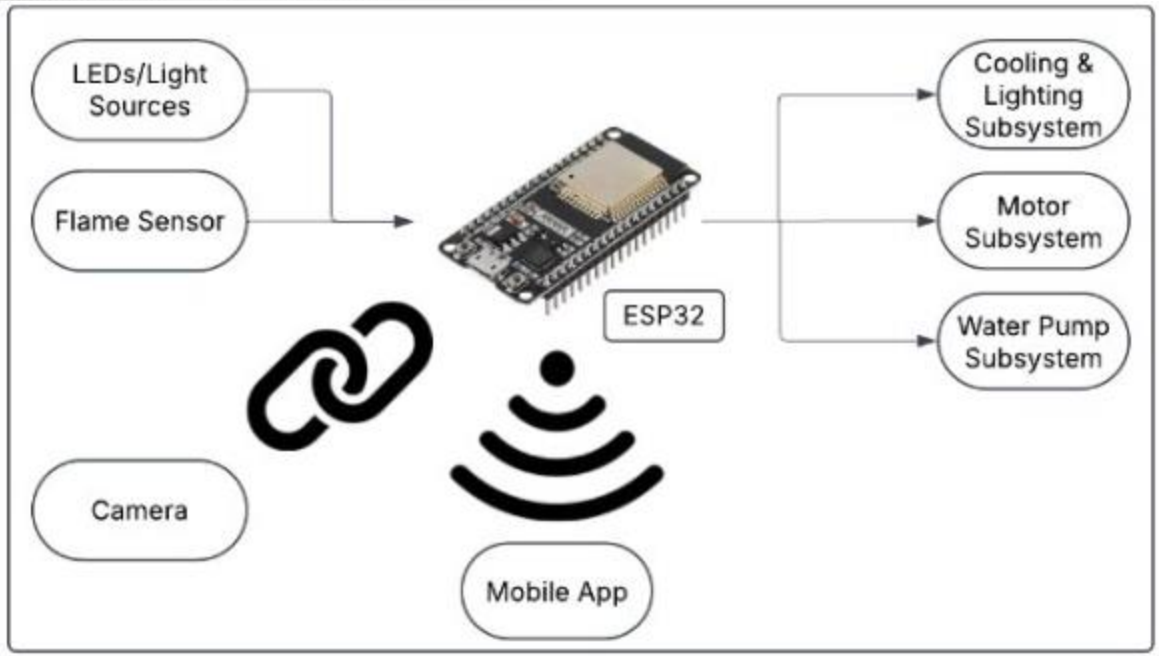
Microcontroller Subsystem

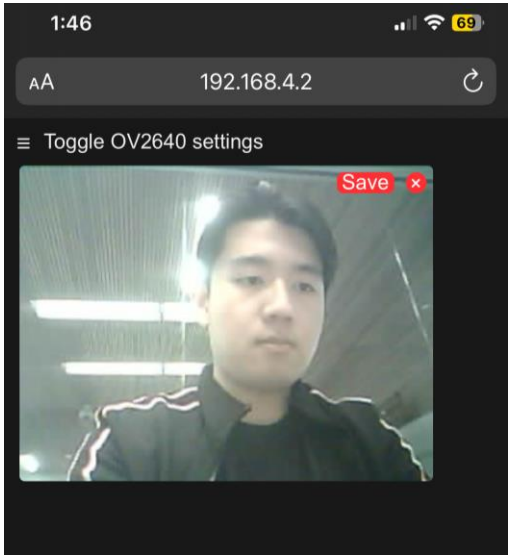
Jonathan Chen

Accomplishments since 403 9 hrs of effort	Ongoing progress/problems and plans until the next presentation
- Set Up IR Detection and Camera from 403 with minor code upgrades - Set Up Static IP Address for Wi-Fi Connectivity	- Started Integrating Camera with Mobile App Interface - Assisting on creating PCBs for components on robot - Looking into Data Server possibilities for other subsystems

Microcontroller Subsystem

Jonathan Chen



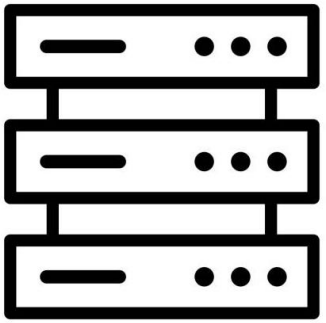


Microcontroller Subsystem:

- Fire Detection
- Camera Live Streaming
- ESP32 Wi-Fi Access Point

KY-026

ESP32-CAM



Data Server?

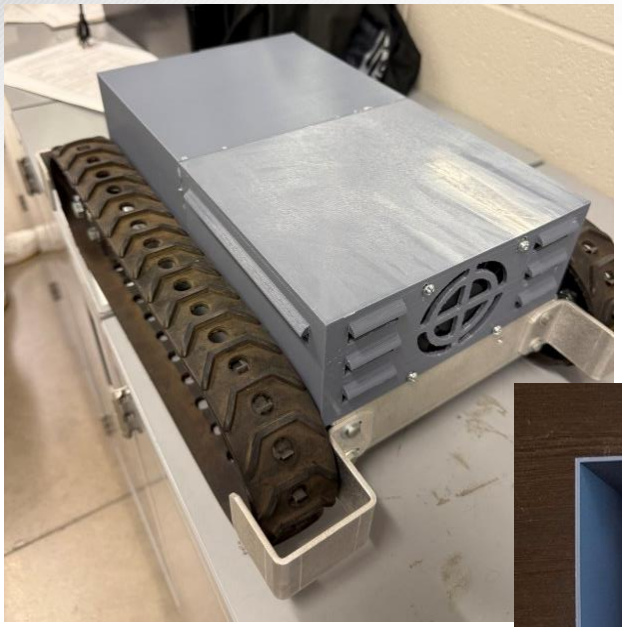
Vehicle Operations & Water Pump

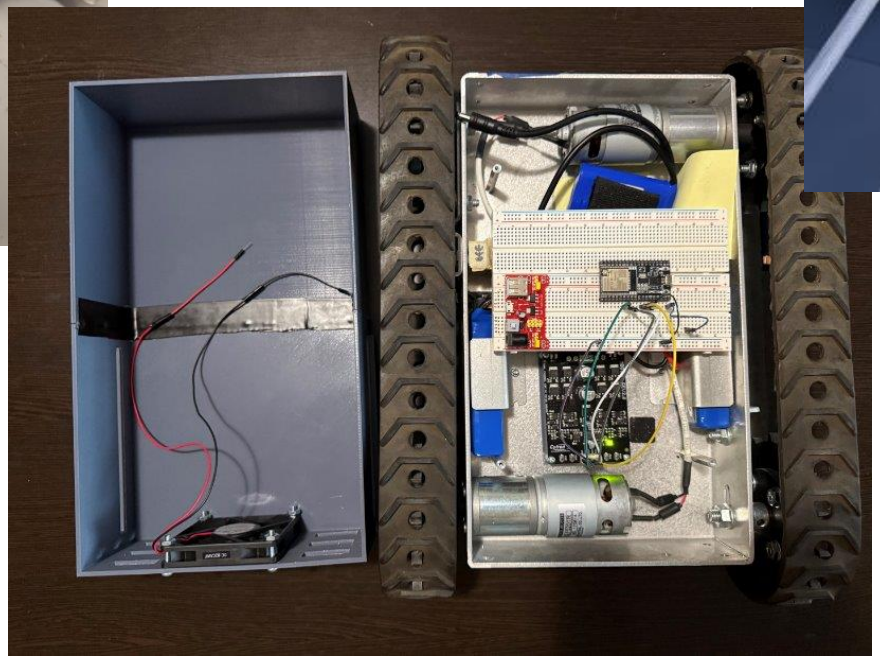
Kevin Rivera

Accomplishments since 403 8 hrs of effort	Ongoing progress/problems and plans until the next presentation
- Completed first version of frame redesign	- Optimize code for motor control and servos - Assist in new PCB designs to connect servos and water pump

Vehicle Operations & Water Pump

Kevin Rivera

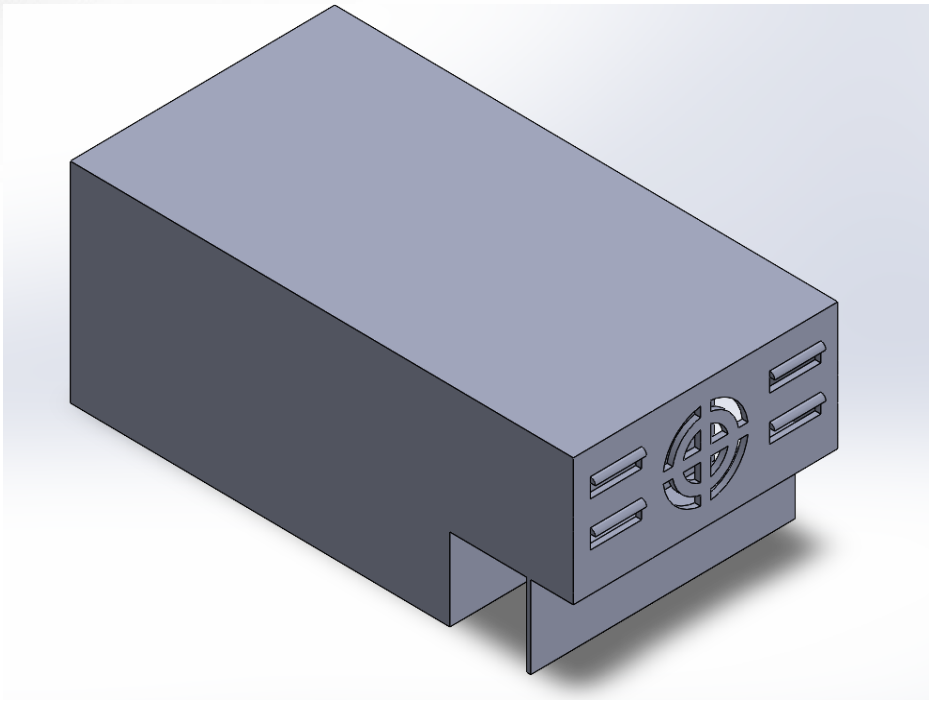


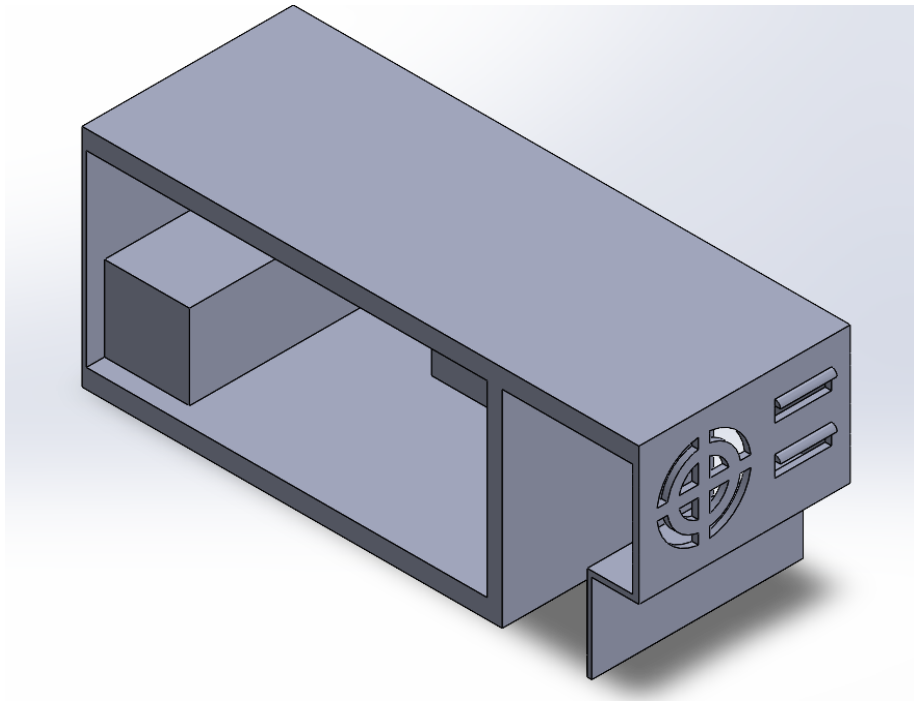


Dwight Look College of ENGINEERING
TEXAS A&M UNIVERSITY

Vehicle Operations & Water Pump

Kevin Rivera





Power & Recharging

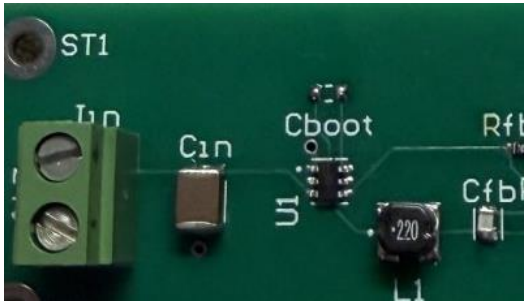
Nancy Ramirez Castillo

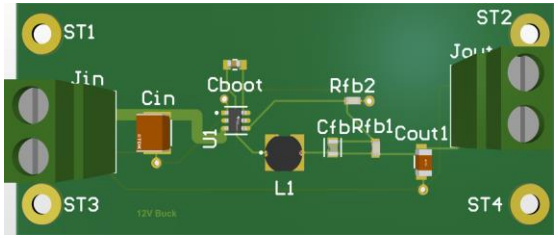
Accomplishments since 403 8 hrs of effort	Ongoing progress/problems and plans until the next presentation
- Battery Charger - Completed editing current PCB traces on buck converters	- Design one PCB to isolate ESP32 and all I/O from other subsystems - Implement battery percentage monitor - Assist in creating a water monitor

Power & Recharging

Nancy Ramirez Castillo

- Traces were too small for the high discharge batteries, so they kept frying while testing, shown on Cboot





- Battery charger has been tested two times and takes ~1.5 hrs to fully charge
- 24V Boost Converter is low priority, eliminating completely

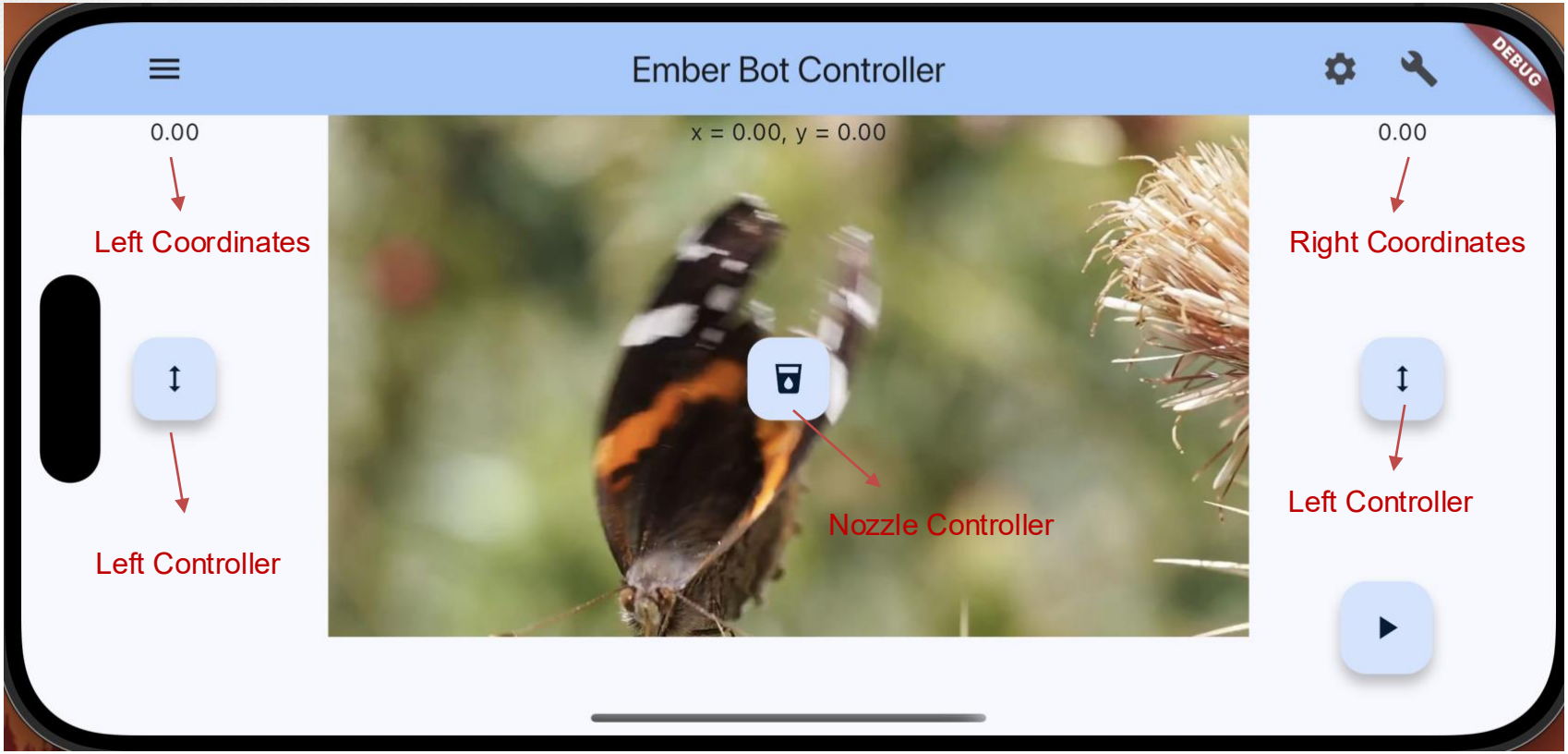
App Interface

Yuwen Zheng

Accomplishments since 403 12 hrs of effort	Ongoing progress/problems and plans until the next presentation
- Reloaded the mobile app on iPhone - The mobile app can send coordinates data to a Python Flask server with different IP Address - The mobile app can display online video	- Implement the code for video streaming - Integrate video streaming with ESP32

App Interface

Yuwen Zheng



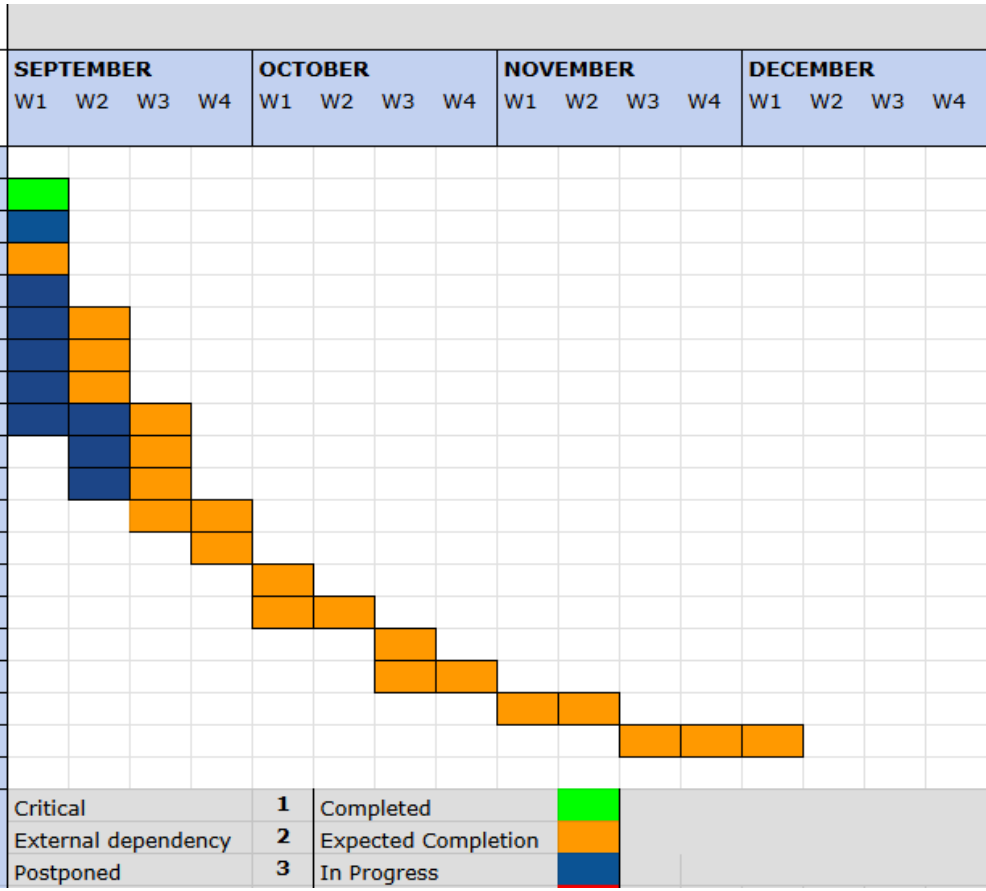
Parts Ordering Status

- ESP32 PCB & Components
  - Will be complete and ordered by next week 9/18
- Extra battery charger
  - Ordering tomorrow, not yet received
- Buck Converters Components
  - None needed, have plenty of extras

Execution Plan

Ember Bot Project Schedule

Deliverable/Task	Owner	Duration
Engineering Milestones		
Add IP Address Page	Jonathan	1 Week
Implement Video Streaming code	Yuwen	1 Week
Real Flame Testing	Jonathan	1 Week
Buck Converters Re-design	Nancy	1 Week
Integrate Video Streaming with ESP32	Yuwen/Jonathan	2 Weeks
Frame Re-design	Kevin	2 Weeks
Nozzle Calibration	Kevin	2 Weeks
Data Server Storage	Yuwen/Jonathan	3 Weeks
ESP32 PCB Design	Jonathan/Nancy	2 Weeks
Motor Control via App	Yuwen/Kevin	2 Weeks
Order PCBs	All	2 Weeks
Implement App User Guide	Yuwen	1 Week
Implement LED Button	Jonathan/Kevin	1 Week
Fine Tune Buttons of UI	Yuwen	2 Weeks
Frame Installation with Water Tank Filled	Kevin	1 Week
Bind Mobile App with ESP32	Yuwen/Jonathan	2 Weeks
Test Mobile App on Different Devices	Yuwen	2 Weeks
Final Integration and Testing	All	3 Weeks
Annotations:		



Validation Plan

Test Name	Success Criteria	Methodology	Status
Real Flame Testing	Able to detect Flame 5 to 10 Feet at Distance	Use the IR sensor on a at a small controlled flame source (lighter) and record baseline data before lighting the flame. Conduct multiple trials at each distance and logging analog sensor output	Untested
Optimizing WiFi Connection	Connect via Wi-Fi Access Point 50-100 Feet Away	Attempt connecting to the ESP-32 Wi-Fi access point at varying distances and with/without obstacles inbetween.	Tested
Frame Installation	Minimal frame vibration during operation	Once installed, the robot will be moved via the motors and the vibration magnitude will be recorded	Untested
Water Holding	Water Tank Does Not Leak	With the designed and printed water tank, it will be filled with water away from all electronics and be observed for any areas of leaks	Untested
Thermal Management	All electronics do not exceed their operating temperature conditions	Place all electronics in the frame and have them run at nominal operating states with the fan on. Temperature of each board will be tracked and recorded every 30 seconds for a total of 5 minutes.	Untested
Movement Speed With Weight	Ember Bot is able to move at 4mph with the estimated full weight of system	The equivalent of the total weight of all electronics/components will be placed on the robot. Verify that the motors are capable of moving the weighted robot at our desired speed by recording the total displacement in 10 seconds.	Untested
ESP32 Data Server	Host a Data Server that holds the last 20 inputs	Configure the ESP32 to hold the last 20 inputs, overwriting the oldest entry when new data arrives. Verify and analyze the data from the sensors, video feed and motor inputs.	Untested
Water Nozzle Aim Calibration	Water Nozzle points to +-10 degrees of user input	Sketching a x-y plane at the recommended distance of 6ft and measuring the accuracy of this distance.	Untested
Video Streaming	Mobile app can receive and display video signals from ESP32	The mobile app will able to display video streaming from the camera on Ember Bot	Untested
LED Button	Mobile app can turn LED On/Off	The LED on Ember Bot should turn on/off when user press the LED button in the app	Untested
App User Guide	App user page can be viewed on the mobile app	Let other group members walk through the user guide to check if it provides a clear instructions to users	Untested
Mobile App on Different Devices	The mobile app can be loaded on to at least 3 other devices	Load mobile app on other group member's devices to test if the app can function as expected on different devices	Untested
Power Boards Testing	Able to supply power under max load	Using different combinations of loads, two buck converters should keep a consistent output for all components needed	Untested
Battery Endurance Testing	Ember Bot can operate for an hour under continuous use and indicate when battery is low	Starting with full batteries, Ember Bot will run all different components for an hour and then will log how much battery power was used.	Untested
Motor and nozzle user test	Control the motors and nozzle movements with no more than a 2 second delay via the mobile app	After connection between the ESP32 and our mobile app is made, have a user send inputs from the app to control the motors and servo motors. Track how long it takes for these actions to take place.	Untested

Dwight Look College of
ENGINEERING
TEXAS A&M UNIVERSITY

Thank You!
Ember Bot

Jonathan Chen, Kevin Rivera, Nancy Ramirez Castillo, Yuwen Zheng

Sponsor: Kevin Nowka

TA: Roman Venegas