EE/CprE/SE 491 WEEKLY REPORT 3

09/27/2024 – 10/3/2024

Group number: sdmay25-04

Project title: Wireless Mesh Network for Pesticide Spray Monitoring and Mapping

Client: Claussen Lab- Iowa State University

Advisor: Nathan Niehart

Team Members/Role:
Ashley Falcon: IDEs and Microcontrollers, Group Communicator
Drew Scheidler: Mesh Networking; Note Taker
Hector Perez Prieto: Microcontroller and IDEs
Henry Hingst: Mesh Networking; Group Leader
Yok Quan Ong: Circuit Design, IDE
Wesley Smith: Circuit Design; Microcontrollers; Note Taker

o **Weekly Summary**
- This week, we met with our client and advisor.
  - Demonstration of IDE manufacturing
  - The client showcased the current circuit
    - Currently having issues with the circuit
    - Data isn't outputting what is expected
      - Will require us to troubleshoot
  - Talked to advisor regarding the direction of the project
    - Tasks thus far have been few and far between
    - We have now been able to establish priorities
- We also met as a group to discuss group direction.
  - We created discrete tasks and assigned them
  - Created a template for future report writing
  - Determined what needs to be ordered for our circuit production
    - Microcontrollers
    - Transistors
    - SD
    - ADS

- Designed an excel spreadsheet (see below) that will aid in assigning tasks
  - Lists discrete tasks
  - Allows us to call out specific members for responsibility
  - Determines expected due dates
  - Adds any pertinent descriptions of task
  - Allows us to add any hindrances

Task Name	Task Description	Due By	Assigned To
How to Program ESP	Need to figure out how ESP32s are programmed. What language (Arduino/C/C++). How to flash to program to the board	Next Meeting	Henry
Learn about Hardware Abstraction Layer	Research API and function code for Use user manual?	Next Meeting	Ashley
Find User Manual for ESP32. Read about register, etc.		Next Meeting	Yok
Decide which raspberry pi		Next Meeting	Drew
Make block network diagram in Figma		10/3	Henry
Place order at ETG	Order consists of components necessary for the IDE circuit	10/3	Wesley/Ashley
Build the IDE circuit provided by the labs		Wait on components	Wesley/Hector/Yok
Finish Empathy Map		10/3	Hector, Drew, Henry
Make Lightning Talk Presentation		10/3	Ashley, Wesley, Yok

- **Past week accomplishments**
  - *Ashley Falcon*:
    - Client and Advisor Meeting Setup
      - Determined date, time, and location of IDE manufacturing demonstration
    - Started diagram of the mesh network
      - How we intend MCUs to interact with each other vs central node
    - Collaborated with Wesley Smith to determine the parts needed
      - Ordered parts at ETG
    - Created a To-Do list
      - Fleshed out project needs
      - Clarified assignments coming up

- ***Drew Scheidler***:
  - Designed a new working template for weekly reports
    - Allowed for flexibility and easier expansion
    - Allowed for more clearly stating collaboration
    - Reduced redundancy
    - Looked more professional
    - Ensured all requirements were able to be easily met
    - Provided helpful clarification on expectations
    - Made replication easy for future reports
    - Aided clarity and organization
  - Aided in developing and distributing a list of tasks
  - Aided in creation of rough block diagram
- ***Hector Perez Prieto***:
  - Attended tour/demo on how the IDEs are created in order to further understand how they are used and how we are going to use them
  - Began to deconstruct and understand the circuit schematics that were provided to us by the client
  - Preparing to build our own circuit in order to be able to test microcontrollers and IDEs
- ***Henry Hingst:***
  - Created a weekly task distribution sheet for us to use
    - Created in Google Sheets
    - Will allow us to better complete the work assigned to us from our advisor and client
  - Began looking into a task assignment software available in GitHub as a more complete solution to our task breakdown structure
    - Seems much more capable but will involve a learning curve for our team
  - Began research into which protocol and frequency will be suitable for our project
    - ESP32 boards support wi-fi, bluetooth, and ESP-Now; all of which will limit our range significantly
    - 900, 440, & 144mhz transceiver modules will greatly increase our range but add cost and complexity
- ***Yok Quan Ong:***
  - Attended demo on created IDEs
  - Looked into the actual circuit they built on breadboard
    - Comes out with some questions about the circuit they built

- *Wesley Smith:*
  - Attended a demo of how the IDEs are created with the client
    - Asked a lot of questions we formulated the past week
  - Also looked into current issues with the circuit
  - Devised a list of what components are needed in order to begin creation of our initial proof of concept
    - 3x ESP32-C6
    - 3x ADS1015
    - 1x MicroSD SPIO
    - Some 2n2222 transistors

o **Individual contributions**

NAME	Individual Contributions	Hours this week	HOURS cumulative
Ashley Falcon	Client Meeting Setup, Project organization	6	12
Drew Scheidler	Client & Requirements Discussion	7	14
Hector Perez Prieto	Research on the schematic and code provided to us by the client	6	12
Henry Hingst	Task assignment structure and signal propagation research	7	13
Yok Quan Ong	Circuit troubleshooting & ESP research	6	12
Wesley Smith	Circuit troubleshooting & Part list derivation	6	15

o **Plans for the upcoming week**
  - How to Program ESP
    - Henry
    - We need to figure out how ESP32s are programmed. What language (Arduino/C/C++). How to flash to program to the board
  - Learn about Hardware Abstraction Layer
    - Ashley
    - Research API and function code for
    - Use user manual?
  - Find the User Manual for ESP32. Read about register, etc.
    - Yok
  - Decide which Raspberry Pi to use for the central node
    - Drew

- Variation in price, performance, etc.
- Build prototype of circuit currently designed by Claussen labs
  - Wesley
  - Hector
  - Form a better understanding of existing schematic

- ## Summary of weekly advisor meeting
  - Reports and Communication
    - Moving forward, regular reports will be sent out to keep track of progress
  - Hardware Decisions
    - We need to decide on the Raspberry Pi model that will be used.
    - For wireless communication, options include Wi-Fi, Bluetooth, or LoRa. We will explore LoRa's potential, especially for long-range communication (100 MHz)
  - Eventually we will need to demonstrate a column of three ESP32s
  - Evaluations and Orders
    - We plan to order and make 2-3 evaluation boards
    - Need 3 ESP32s from ETG for testing, among other things
    - A "blink test" will be conducted to ensure functionality
  - Firmware and Interface
    - We will use either Arduino or C/C++ for programming the ESP32s
    - The Raspberry Pi is powerful enough to run Linux, which gives us flexibility
    - We can assume that the user has basic technical skills
  - We will need to create a broad block diagram of the system, covering both hardware and firmware components like the Raspberry Pi, voltage divider, power supply, and mesh network
  - Mesh Network Considerations
    - We need to check with Griffin regarding the built-in mesh network capabilities of the ESP32
    - If the ESPnow protocol is unsuitable, Wi-Fi is the alternative
    - We'll research the range capabilities of Wi-Fi, Bluetooth, and LoRa, and also consider the use of antennas
  - Protocol Decision:
    - It's likely more efficient to use an existing mesh network protocol rather than creating our own, which would be difficult and time-consuming
    - The two primary options are
      - Using Wi-Fi with a mesh network
      - Using LoRa for direct communication, though it is more costly and requires antennas
  - Next steps include finalizing wireless communication decisions, ordering components, and starting tests with the Raspberry Pi and ESP32s