IoT based water quality assistant for Irrigation

Capstone Mentor Evaluation

Submitted by:

CPG 101

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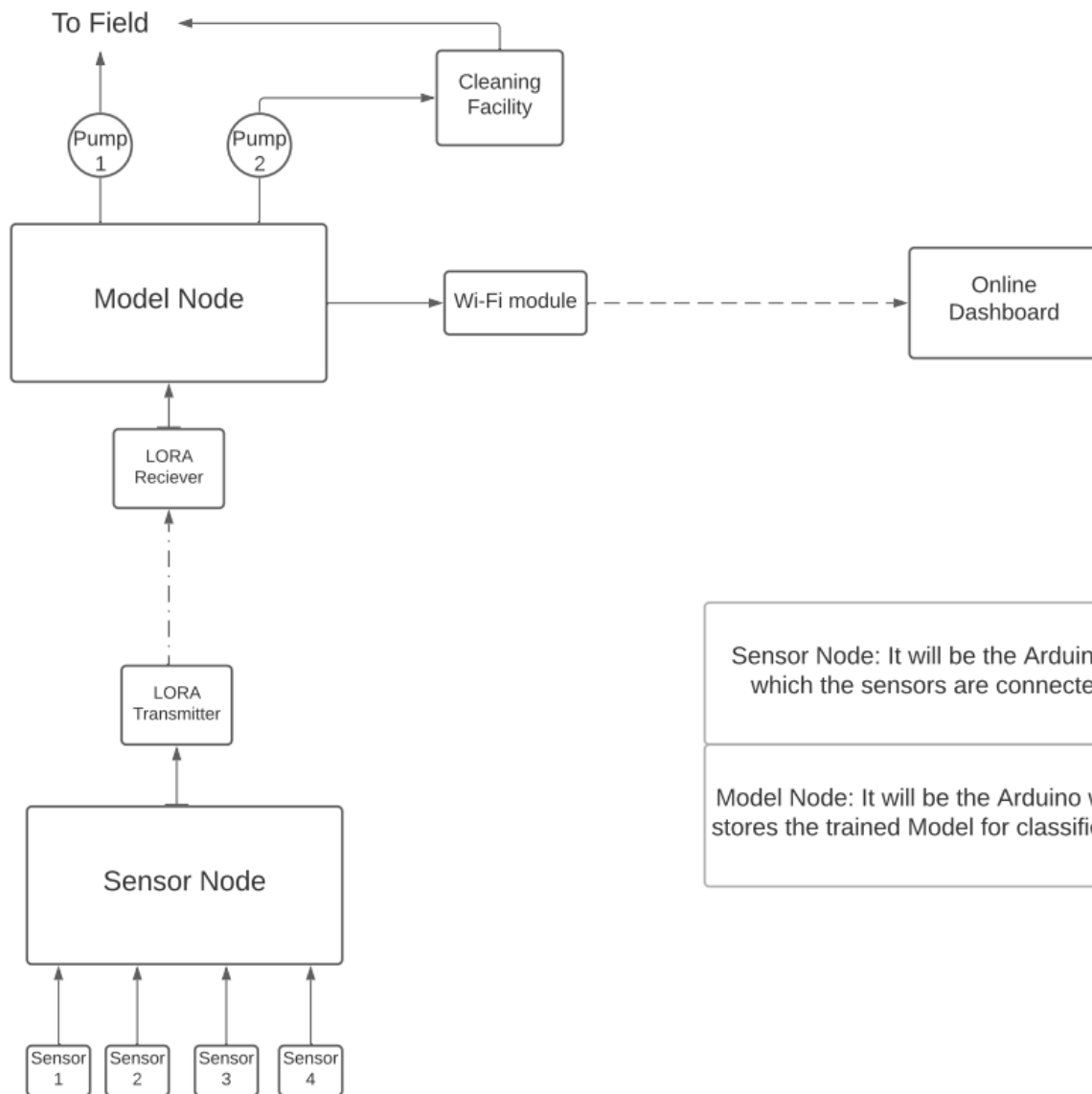
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1. Product Perspective

To Field

Cleaning Facility

Pump 1

Pump 2

Model Node

Wi-Fi module

Online Dashboard

LORA Reciever

LORA Transmitter

Sensor Node

Sensor 1

Sensor 2

Sensor 3

Sensor 4
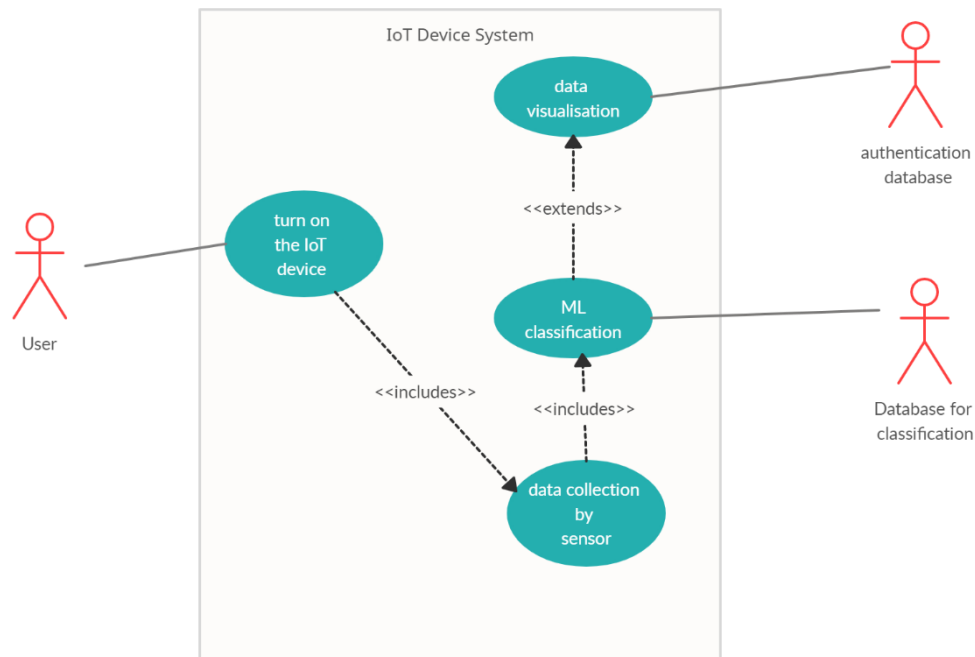
Sensor Node: It will be the Arduino to which the sensors are connected.

Model Node: It will be the Arduino which stores the trained Model for classification
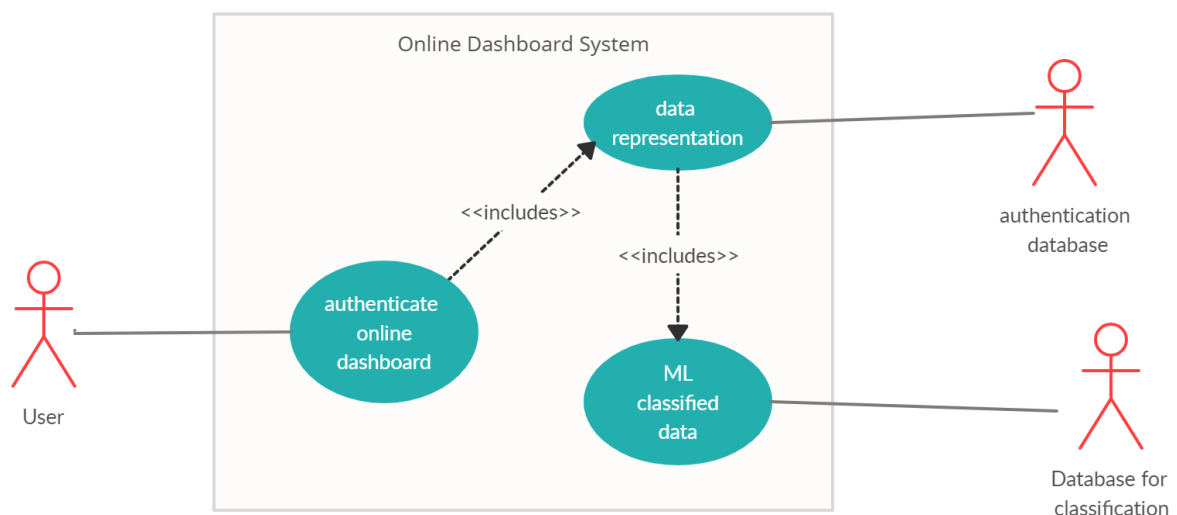
2. Use Cases

Use Case Diagram 1

1. Setting up the Device

Precondition	None
Use Case	Setting up the Device
Actors	User
Purpose	Set up the device to check water quality
Overview	The user has to place the sensors into the water and turn on the Arduino.
Type	Primary
Task Sequence	**Successful Scenario:** 1. (AA) User places the sensors into the incoming stream of water. 2. (AA) User turns on the microprocessors. 3. (SR) The microprocessor LED's begin blinking to indicate that transmission of data is taking place. **Alternate Scenario:** 2. (AA) User does not require wireless transmission and only sets up one microprocessor
Post Condition	1. User will be able to use the system further.

2. Classification

Precondition	1. System is in place
	2. Data is being collected for analysis by system
Use Case	Classification
Actors	None
Purpose	To classify the incoming water as suitable or unsuitable
Overview	The data collected by sensors will be analysed with the help of a Machine Learning model uploaded directly onto the Microcontroller.
Type	Primary
Task Sequence	**Successful Scenario:** 1. (SA) System transmits sensor data to microcontroller 2. (SR) System uses ML models to analyse data 3.(SR) System classifies water quality as suitable 4. (SR)System turns on pump 1 and pumps the water to fields **Alternate Scenario:** 3.(SR) System classifies water quality as unsuitable 4.(SR)System turns on pump 2 to send the water to treatment facility
Post Condition	Depending on the classification water is either sent to fields or to a treatment facility

Use Case Diagram 2

3. Setting up online dashboard

Precondition	1. Microprocessor must be collecting data
Use Case	Setting up online dashboard
Actors	User
Purpose	The online dashboard will help the user to access past data in order to analyse the long term effects of the system as well as make any improvements onto it
Overview	The wifi module will be set up either on one of the microprocessors depending on the user configuration.
Type	Primary
Task Sequence	**Successful Scenario:** 1. (SA) System LED are blinking to indicate transmission of data 2. (AA) User connects Wi-Fi module with the internet by providing the Name and password. 3. (SR) System blinks the Wi-Fi LED to indicate connection with the internet and dashboard **Alternate Scenario:** 2.(AA) The user refuses to connect the Wi-Fi module with the internet 3.(SR)The system does not connect to the dashboard to internet and the Wi-Fi LED does not blink
Post Condition	1. Data will be transmitted to the online dashboard

4. Display

Precondition	1.Sensor data has been analysed and water quality has been classified
Use Case	Display
Actors	None
Purpose	To display analysed data about water quality through graphs on an online dashboard for the user to see
Overview	After the sensor data is collected and analysed the system displays the data in graphical form on an online dashboard which a user can access after authentication
Type	Primary
Task Sequence	**Succesful Scenario:** 1. (AA)The user logs in to the online dashboard after authentication 2. (SA) System displays the analysed data on the online dashboard

	3.(AA) User views the data and can analyse and make decisions based on the data **Alternate Scenario:** 1. The user forgets the password and has to reset it 3.(AA) User wishes to end the session and can log out
Post Condition	1. Sensor data about the water is displayed

Typical Course of Events/Successful Scenario/Normal Scenario

1. (AA) The user starts the IoT device
2. (SR) The field component will collect the temperature, pH value, turbidity, SAR value and flow of water
3. (SR) The LORA module transmits the data to microcontroller receiver
4. (SR) The ML models analyse the data and determine whether water is fit for irrigation or not
5. (SR)The microcontroller diverts the flow of water based on the result obtained
6. (SR) The system uploads data online on a dashboard
7. (AA) The user creates an account on the online dashboard and logs in
8. (AA) The user accesses the data for his own use

Alternative Flow Of Events

1. The user has change of mind and does not turn on the device
7. The user opts out of creating an account on the online dashboard

Exceptional Flow Of Events

1. The field sensor is not properly placed due to which it is unable to function properly giving a wrong reading
7. The user enters the incorrect password causing an error
8. The user is unable to access the data due to session expiration

3. Tasks and Subtasks

1. Hardware

    1.1 Gathering of equipment

    1.2 Exploring different types of sensors

    1.3 Soldering of equipment

    1.4 Configuring hardware with the sensors and tuning them

2. Data collection
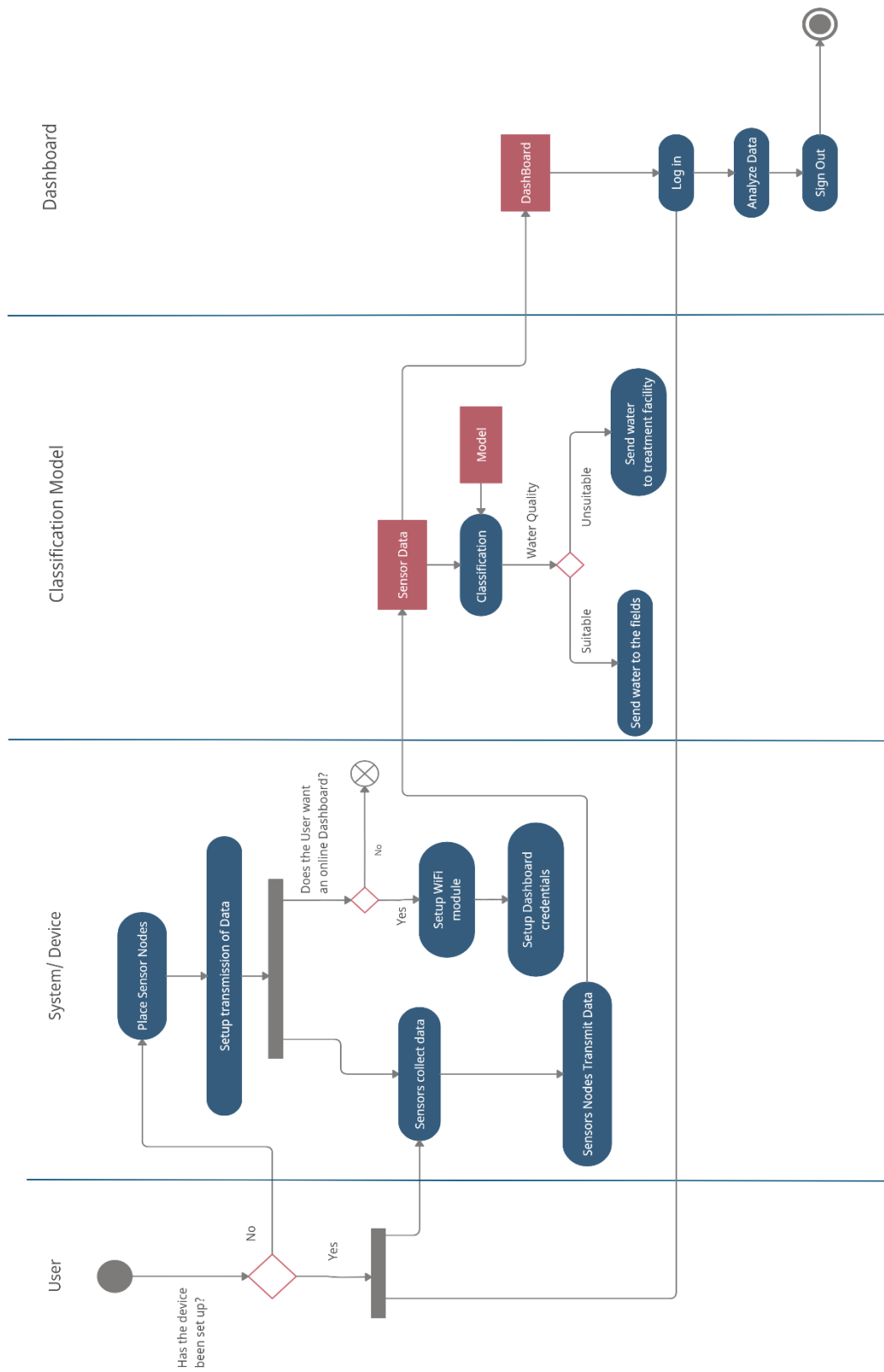
    2.1 Collection of data

    2.2 Analysis of data

3. Creation of Model

    3.1 Exploration of classification models

    3.2 Evaluating and choosing one classification model

    3.3 Training the model

    3.4 Uploading the model onto the Arduino.

4. Implementation of UI
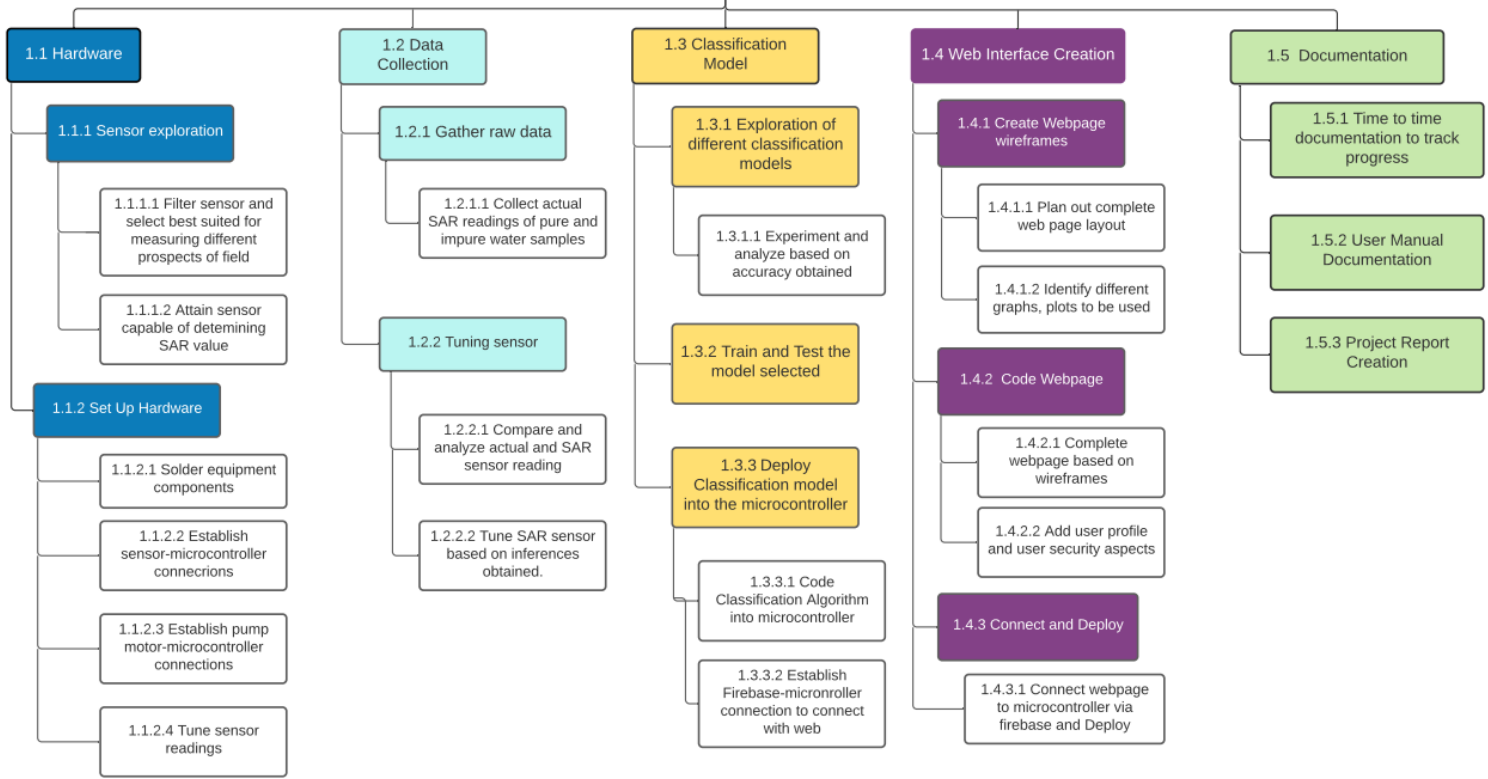
    4.1 Creating wireframes for flow of the website

    4.2 Choosing which graphs to implement and show

    4.3 Creating the UI

    4.4 Establishing User profiles in the backend for authentication and login

    4.4 Connecting with the firebase database that stores the sensor data.
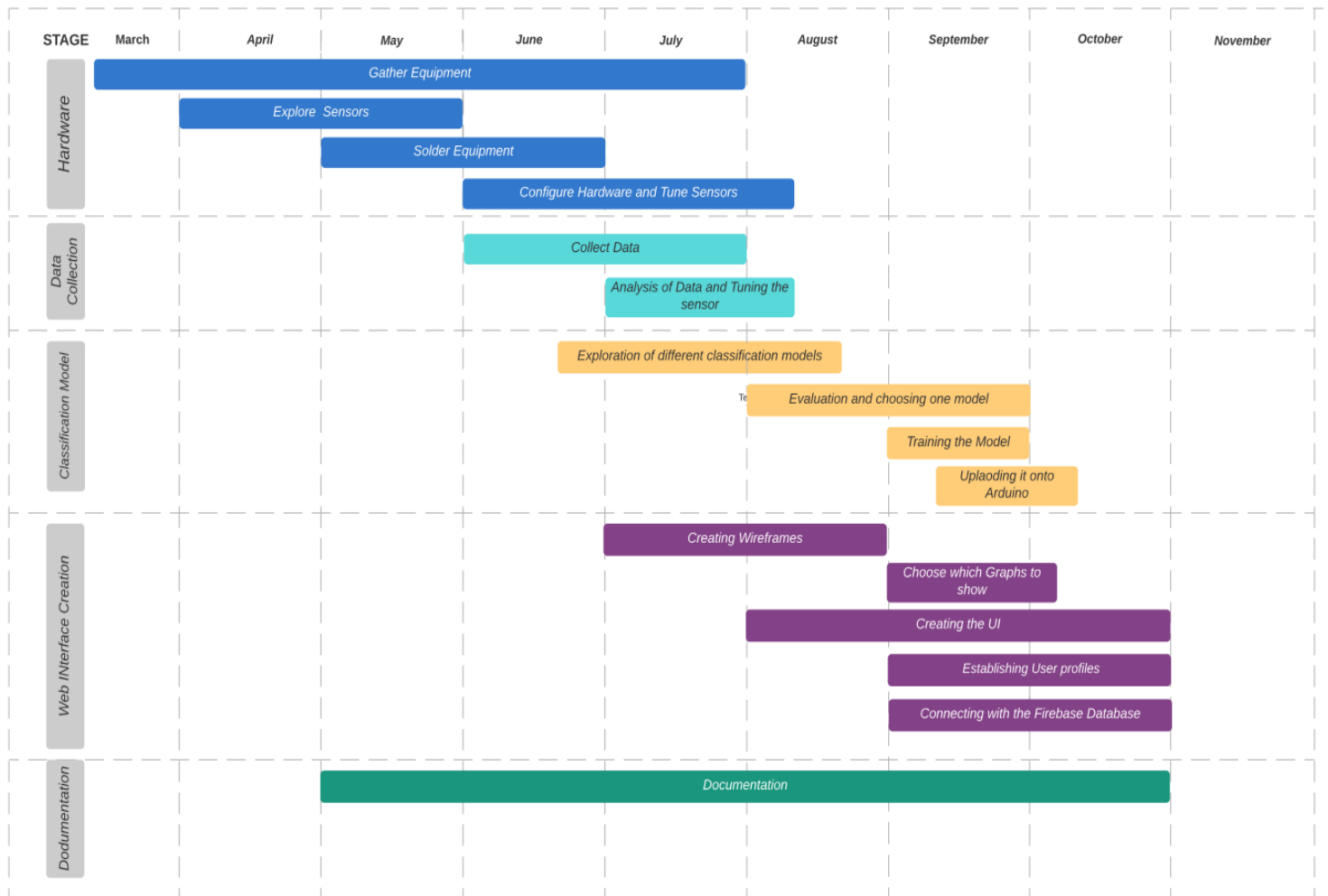
4. Activity Diagram

5. Work Breakdown Structure

6. Gantt chart

STAGE	March	April	May	June	July	August	September	October	November

Hardware
- Gather Equipment (March – July)
- Explore Sensors (April – May)
- Solder Equipment (May – June)
- Configure Hardware and Tune Sensors (June – August)

Data Collection
- Collect Data (June – July)
- Analysis of Data and Tuning the sensor (July – August)

Classification Model
- Exploration of different classification models (June – July)
- Evaluation and choosing one model (August – September)
- Training the Model (September)
- Uplaoding it onto Arduino (September – October)

Web INterface Creation
- Creating Wireframes (July – August)
- Choose which Graphs to show (September)
- Creating the UI (August – October)
- Establishing User profiles (September – October)
- Connecting with the Firebase Database (September – October)

Dodumentation
- Documentation (May – October)

7. Functional and Non Functional Requirements

Functional

- Web interface should provide user with plots and graphs which should be easy to comprehend.
- Classification algorithm should be able to segregate water direction based on classification result obtained from the microcontroller.
- Water should be directed towards treatment plant by the pump if classified impure.
- Web portal should alert user if extreme readings are obtained from any sensor.
- Hardware setup should be integrated with web portal using shared database.
- Sensor should be able to provide data and microcontroller should be able to take classify water via underlying classification algorithm.
- Sensor should be placed at appropriate positions for them to perform optimally.
- User should have access to a water treatment plant.

Non Functional

- Users must change the initially assigned login password immediately after the first successful login. Moreover, the initial should never be reused.
- Sensors and microcontroller should be kept under a protective layer to prevent damage from natural causes
- Privacy of information, the export of restricted technologies, intellectual property rights, etc. should be audited.
- User should not be allowed to tamper web portal database. Such attempt should be reported to the security administrator.