UE17CS490B – Capstone Project Phase – 2

SEMESTER - VIII

END SEMESTER ASSESSMENT

Project Title :IMPLEMENTATION OF AGRICULTURE MONITORING SYSTEM USING RASPBERRY PI AND CROP PREDICTION USING MACHINE LEARNING ALGORITHM

Project ID :PW21CBR01

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Outline

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ABSTRACT

- In olden days farming was the main occupation but people from the rural areas where shifting to urban areas for economy propose. In those days they used to predict climate conditions based on the previous day's soil moisture, water level, temperature, humidity etc.
- Farmer sometimes are away from the farm he may not the condition of the farm and need human effort he cannot be all time in farm to observer the condition So to get an easy way out of this we can use sensors which gives us the above mentioned parameters details with accurate value. We also use cloud that is Thing speak.
- We use the graph to see the present change in the climate and temperature, humidity, soil wetness etc.in thing speak we can access those data information in the format of xml file and using in algorithm so that prediction of the crop will be easy based on the prediction farmers can grow their crop depending upon these but in some cases this may be not that accurate to use such as defect in hardware's those will affect the prediction may get false output this may be considered as disadvantage of this method other than this there is no issues in using this advantage is that the farmer will be aware of the condition of farm well before so that he can take the precautions well before.
- He will also get the sms alert if any changes happen so that he may be aware in all the aspects. For example, let's consider temperature should not increase by 35c and humidity should not decrease by 35c, when temperature increases by 35 then user will get the notification saying that temperature is more and relay automatically no the water to the field where as in humidity when temperature increases humidity decrease he gets the sms saying that humidity is less.
- Similarly, in soil moisture when the sensor sense if there is no water detected then it shows output as no water detected and relay no the water automatically here relay works as the switch where it no the motor and off it whenever required based on the condition given.

ABSTRACT

- When the above condition is obeyed then we will get an accurate value for the dataset and can use it to algorithm. In the process of the working algorithm it first imports all the necessary modules required for the present file. Here we use decision tree algorithm that can be used for both classification and Regression problems, but mostly it is preferred for solving Classification problems.
- We are using raspberry pi 3 B+ model for our project so before implementing the code we have to install the packages required for the project and software required such as pandas, numpy, importing the modules can be done only after downloading particular software required. Then after all the imports dataset is read the details of how many rows and columns will be displayed and then assign a variable to dependent variable and independent variables.
- Here independent column is temperature, humidity, soil moisture sensor, PH sensor. dependent column is crops name. then slitting the dataset in ratio of 20:80. 20% is for testing and 80% is for training the dataset. As the algorithm is used to predict the accurate value.
- We have used a simple GUI for displaying the output, we have used tkinter for the GUI it has four input fields temperature, humidity, soil moisture, ph sensor. When user gives the input value it predicts the value based on the values and it gives the crop name which can be grown in the that particular area and how much of production can be done in that place in that much of area can be done in the future enchainment work

Team Roles and Responsibilities

- As this project is done all together to specify who has done which part ,we have divide our part based on hardware & software(coding ,presentation etc.)

- Anusha & Veena had taken software part,
  - ✓which includes installation of suitable software tools and requirements which were needed for project.
  - ✓Setting up of raspberry pi and including the software into the raspberry pi
  - ✓All the report and presentation part has been divided equally by Anusha & Veena

- Amala and Sharada had taken hardware part
  - ✓As in phase-1 we have worked on sensors, are sensor individual working properly
  - ✓In phase-2 integrated code & hardware, combine the all sensors respectively to project
  - ✓Project model done & equally done by Amala and Sharada.

Summary of Requirements and Design

REQUIREMENTS SUMMARY

- Hardware
- Software

Hardware requirements

- Raspberry pi 3 B+ Model
- DHT 11 sensor
- Flame sensor
- Soil Moisture sensor
- Relay(5v)
- Power supply
- Jumper wires
- Bread board
- ADC converter
- Ph. sensor
- 5V Battery

Software requirements

- Raspbian os
- Things Speak
- Visual Studio code
- Anaconda python
- Tkinter

Design Constraints, Assumptions & Dependencies

ADVANTAGE

- This can be introduce in trace gardening as well
- It gives accurate information of the situation of the field
- Human effort will be less in this process
- With proper information and if process is done accurately then there may be the possibility of get highest profit
- Productivity may enhanced
- It also reduces the cost of traditional framing equipment's

DISADVANTAGES

- Productivity may or may not be effected
- We cannot estimate weather conditions as pollution is increasing gradually
- If there is any fault in equipment it may effect in the readings while capturing
- There will be network issues in rural areas so there should be a proper network.
- Farmer should get to know about the usage of technology.
- As per the dataset, if the dataset is not correct the getting the accuracy while using this technology

Design Constraints, Assumptions & Dependencies

Functional Requirements

The main functional are:

- When the water content decreases in the soil the system should automatically ON the pump for the flow of water.
- If detected water level is less than the predefined value then the system continuous the cycle of notifying the user, turning on the pump, then if it reaches its level the pump automatically turns off and same is notified to user.
- The temperature, humidity values are taken from the sensor which may be exact so that the farmer can get good yield by using this method
- When sensor senses the data from the field it is taken to things speak to store the data for further use of data set when the data set is taken in the xml form from things speak, in things speak visualization will be showing simultaneous while taking the reading from the sensors
- When the algorithm is processed completely, when program is executed a simple GUI will be popped up i.e. is user interface.

Design Constraints, Assumptions & Dependencies

Non Functional Requirements

- Maintainability: If the water level reduces to less than the minimum level, then the soil losses its moisture level the sensor notifies the user through SMS so user can maintain the moisture level.
- Reusability: The previous dataset can be reused for the improvement of the yield. The dataset will be stored in the cloud by this we can collect the dataset.
- Portability: Here the things like sensors are fixed we cannot carry the sensors from one place to another place.
- Performance: We have a two parameters called Temperature and Humidity, soil moisture, ph. value then we will get a values of these parameters based on this farmer will grow the crop and the dataset will be stored in cloud we can fetch the data from the cloud by using Thing speak.

Design Description

User Interface Diagrams

The parameter details will be sent to the user mobile and to the cloud through respective SMS and Thing speak. As our system doesn't have any screen. It has only the interface which the user can interact (notification).

External Interfaces

The system will be connected with the Wi-Fi module. Diagram is same as High Level System Design.

1) Wi-Fi Module: Used to connect to Thing speak.

2) Power pins: Used to supply power to microcontroller.

3) Analog pins: Used to provide analog inputs to the microcontroller.

4) Digital pins: Used to provide the inputs in the digital form to the microcontroller

5) Pump : Used to connect to motor from Raspberry pi.

Design Description

Report Layouts

The project contains the report for verification and validation for following:

1)Sl.No.

2)The material used for testing.

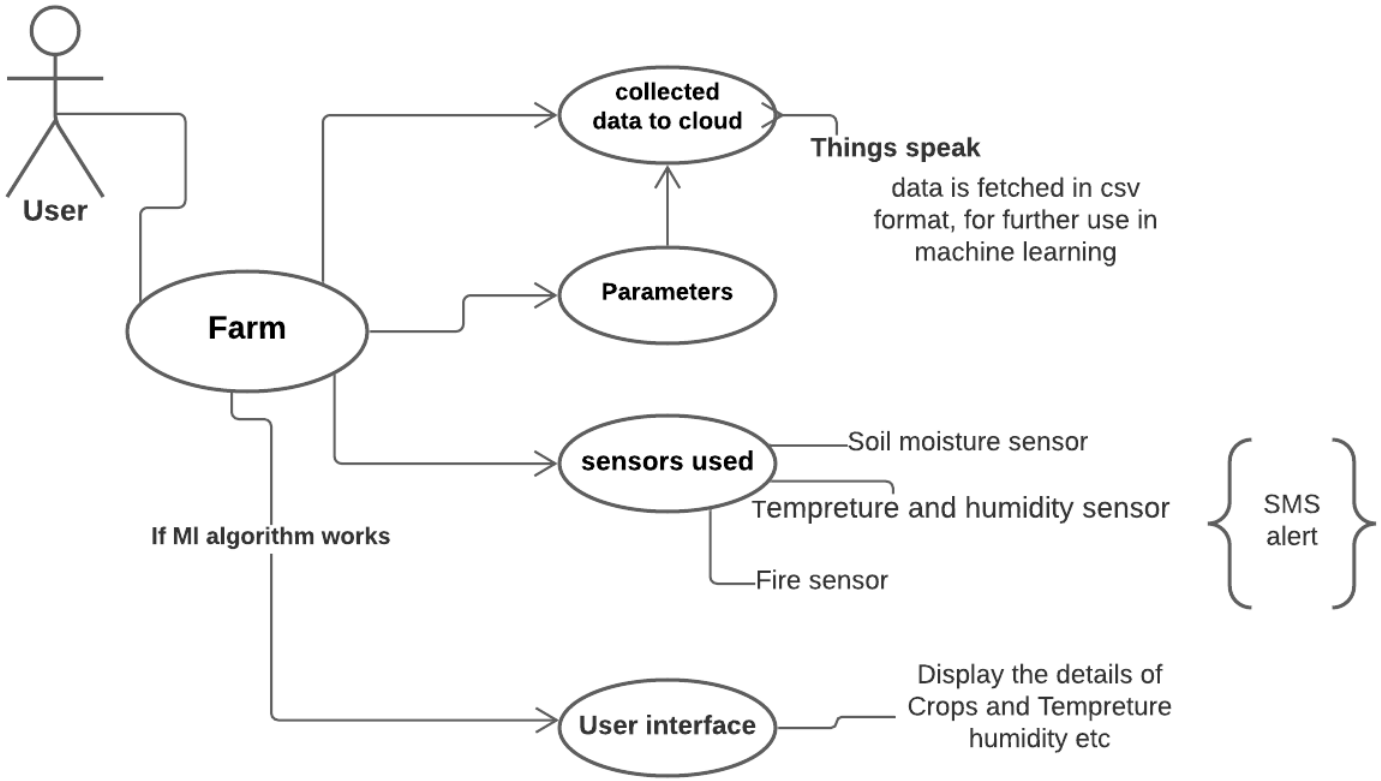
3)Class of the material output by the system.

4)Actual class of the material.

Summary of Methodology / Approach

Proposed Methodology

a) Model Architecture



Summary of Methodology / Approach

- ✓ We have approached the easy way, in which the farmers can get the parameter values easily using sensors and accurate value
- ✓ To enhance the productivity of the crop there by supporting both farmer and nation we have to use the technology which estimates the quality of crop
- ✓ Wireless sensor network are sensors of different types are used to collect the information of crop conditions and environmental changes these information is transmitted through network to the farmer or devices that initiates corrective action.
- ✓ It also helps in collecting information about conditions like weather, moisture, temperature and fertility of soil, level of water, pest detection, and animal intrusion in to the field, crop growth, and agriculture.
- ✓ The proposed model aims at developing a smart system that would provide an ideal environment for the crops. The sensors sense the soil moisture and the humidity levels

Decision Tree Algorithm

- Classification is a two-step process, learning step and prediction step, in machine learning. In the learning step, the model is developed based on given training data. In the prediction step, the model is used to predict the response for given data. Decision Tree is one of the easiest and popular classification algorithms to understand and interpret.
- Decision Tree algorithm belongs to the family of supervised learning algorithms. Unlike other supervised learning algorithms, the decision tree algorithm can be used for solving **regression and classification problems** too.
- The goal of using a Decision Tree is to create a training model that can use to predict the class or value of the target variable by **learning simple decision rules** inferred from prior data(training data).
- In the beginning, the whole training set is considered as the **root.**
- Feature values are preferred to be categorical. If the values are continuous then they are discretized prior to building the model.

Design Description

- The primary challenge in the decision tree implementation is to identify which attributes do we need to consider as the root node and each level. Handling this is to know as the attributes selection. We have different attributes selection measures to identify the attribute which can be considered as the root note at each level.
- Records are **distributed recursively** on the basis of attribute values.
- Order to placing attributes as root or internal node of the tree is done by using some statistical approach.
- Decision Trees follow **Sum of Product (SOP) r**epresentation. The Sum of product (SOP) is also known as **Disjunctive Normal Form**. For a class, every branch from the root of the tree to a leaf node having the same class is conjunction (product) of values, different branches ending in that class form a disjunction (sum).

Design Description

- **Data Collection**

In general, sensor sense the parameter values from the filed and it will be stored in the thing speak then the data will be converted in CSV file format. So for algorithm purpose we download the data from kaggle website.

- **Data Preparation**

The data taken from the website may not be completely segregated in classified form like missing data/empty cell in csv file will be filled using mean, clustering, scraping of data.

- **Data Input and pre-processing**

Data will be split in two sets testing and training, to measure the accuracy of the model. Splitting the data in 80:20 ratio i.e. 80% of the data will be used for training the model while 20% will be used for testing the model that is built out of it train the model means create the model. Test the model means test the accuracy of the model.

- **Data Visualization**

The extract output will be represents in form of graphs. Visualization of data gives summary of information which makes it easier to identify patterns.

Modules and Implementation Details

- **Sklearn** : it is machine learning package which includes a lot of Ml algorithm
  - Here we use some of it modules like train_test_slipt, Decision tree classifier & accuracy_score
- **NumPy** : it is a numeric module which provides fast math function for calculations
  - It is used to read the data in numpy arrays & for manipulation purpose
- **Pandas** : Used to read and write different files
  - Data manipulation can be done easily with data frames

- **Pseudocode**:
  - Collecting the data set
  - Now find the dependent and independent attributes
  - Split the training set of the dataset into subsets. While making the subset make sure that each subset of training dataset should have the same value for an attribute.

Modules and Implementation Details

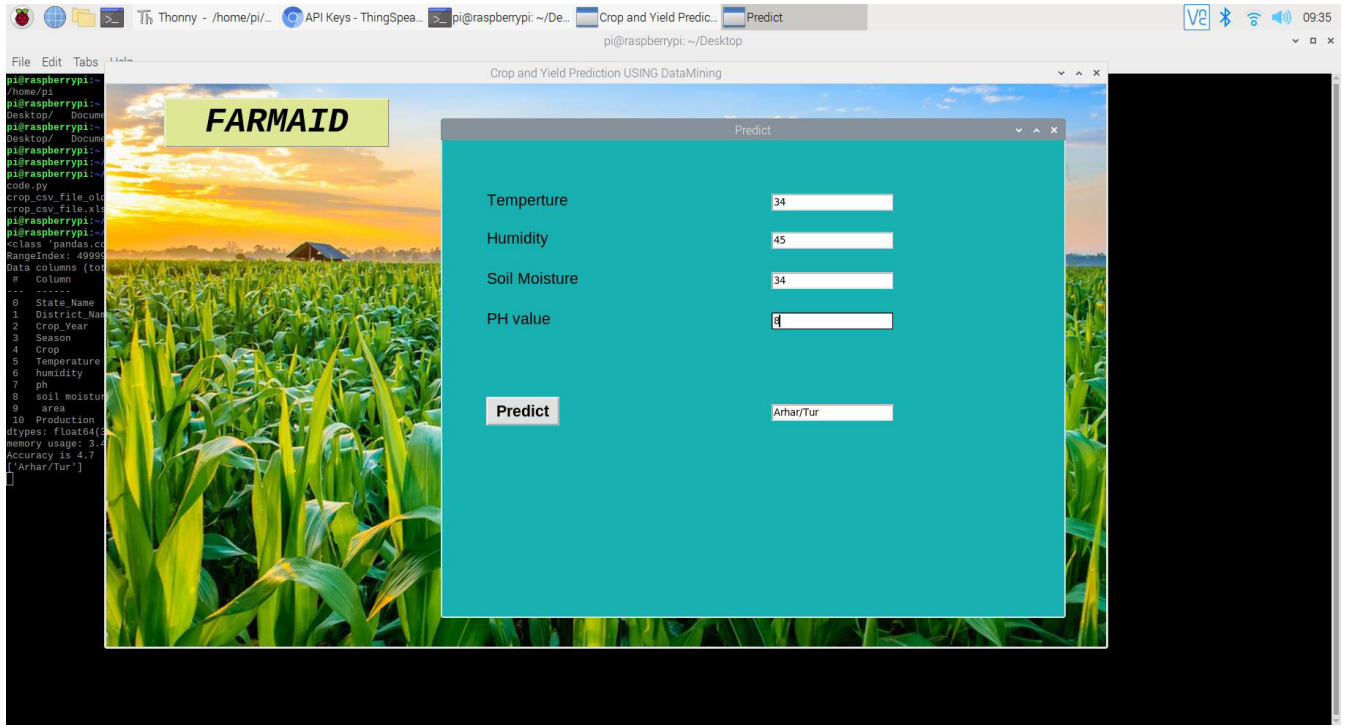
- While implementing the decision tree we will go through the following two phases:
- Building Phase
  - Preprocess the dataset.
  - Split the dataset from train and test using Python sklearn package.
  - Train the classifier.
- Operational Phase
  - Make predictions.
  - Calculate the accuracy.

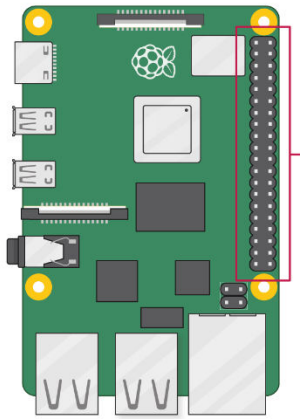
Data Slicing :

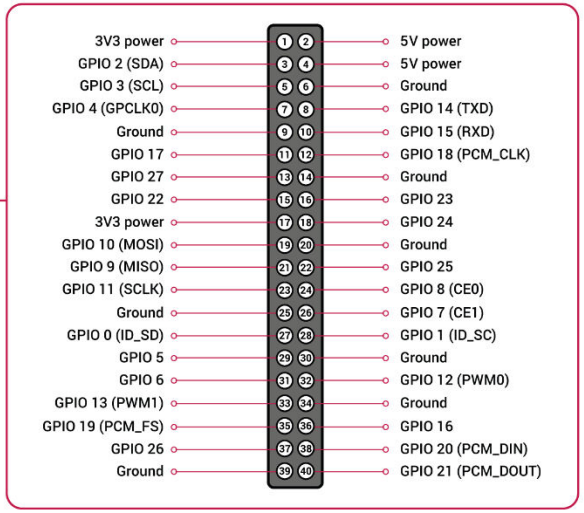
- Before training the model we have to split the dataset into the training and testing dataset.
- To split the dataset for training and testing we are using the sklearn module *train_test_split*

Project Demonstration

Walkthrough







Test Plan and Strategy

Applications

- The farmer can monitor the value and all the related activities of the field.
- The soil moisture senor uses to get the water level in the soil and also to maintain for good production.
- The growth of the plant can also have been observed
- The algorithm helps to get the correct predicated crop
- Here they can use large some of data set which help to segregate the data into training and testing dataset.
- They can get predicated crop type which can be grown in their land.
- Main application in the algorithm used is to get the production details of the crop. The growth of the plant can also have been observed

Results and Discussion

- Our project can give accurate values like temperature humidity soil moisture and ph. values, these all parameters helps to get better yield and suitable crop for particular area and also these parameters sends to former mobile as notification through SMS and we planned for same result while we are starting, as our project title its precision of agriculture monitoring system and crop prediction using machine learning algorithms and we enhance it little like yield can be predict by this parameter for particular area

Documentation

- Project report
  - https://drive.google.com/file/d/1UZMDi7uIWIPugZU3JI61GzZlCRO4fxJj/view?usp=sharing
- IEEE
  - https://drive.google.com/file/d/1DRgkg8LH7nqVu0sDKAOiiVGv1d_fMrYB/view?usp=sharing
- Video
  https://drive.google.com/file/d/1n3yujlWCeNGyu7RYgJsWcbSt371hZeBN/view?usp=sharing
- GitHub repository link.
  - https://github.com/anushree2706/Capstone-
- Poster
  - https://drive.google.com/file/d/1VwIb-VzrO146Lz3N2yx1A_Elf5AT_M9I/view?usp=sharing
- Artifacts
  - https://drive.google.com/drive/folders/1Lvj47ak09XU_blefTlVfUaN2KOVMYQ3z?usp=sharing

Lessons Learnt

- We have learnt working of raspberry pi, installation and setting up the raspberry pi. Main problem was installation of the software's required to project in the raspberry pi
- Then integrating the complete code in single code was one of the problem
- Working of algorithms which were need for our project.

Conclusion and Future work

- Basically our project is precision agriculture monitoring system using raspberry pi and machine learning algorithm. Our project plan, monitoring system and use those data for future use to predict the which all type of crop can be grown in their field to those particular conditions.
- In phase-1 we have worked on the installation of the raspberry pi os and its working, then first started working on the sensors connection with raspberry pi and then connecting it with things speak to store the live data from the field. So that there will be less of human effort in the field.
- Farmers used to do a lot of manual effort to get the productivity high and profits, so overviewing this farmer can use this new technology so solve their problem and work easily without any mistake.so that was working properly as thought of doing it.

Conclusion and Future work

- In Phase 2 we worked on machine learning algorithm so taking dataset from the things speak or from kaggle website, first we worked on the process of the algorithm those are per-processing the dataset, then choosing the dependent and independent column of the dataset, then testing and training the dataset in the ratio of 20:80.
- This is categorical data handling slitting the data into test data and train data. The machine should be trained as per the algorithm, we have tried on 4 different types of algorithm such as SVM, logistic Regression, Naïve Bayes, Decision tree. The most accurate value we got for decision tree algorithm so we thought of going with that algorithm. We also used a simple GUI to display the output.

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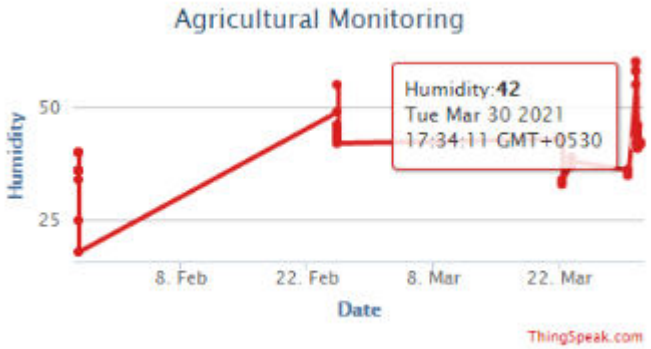
Any other information

Visualization

➢Temperature:

Humidity :



➢Ph :

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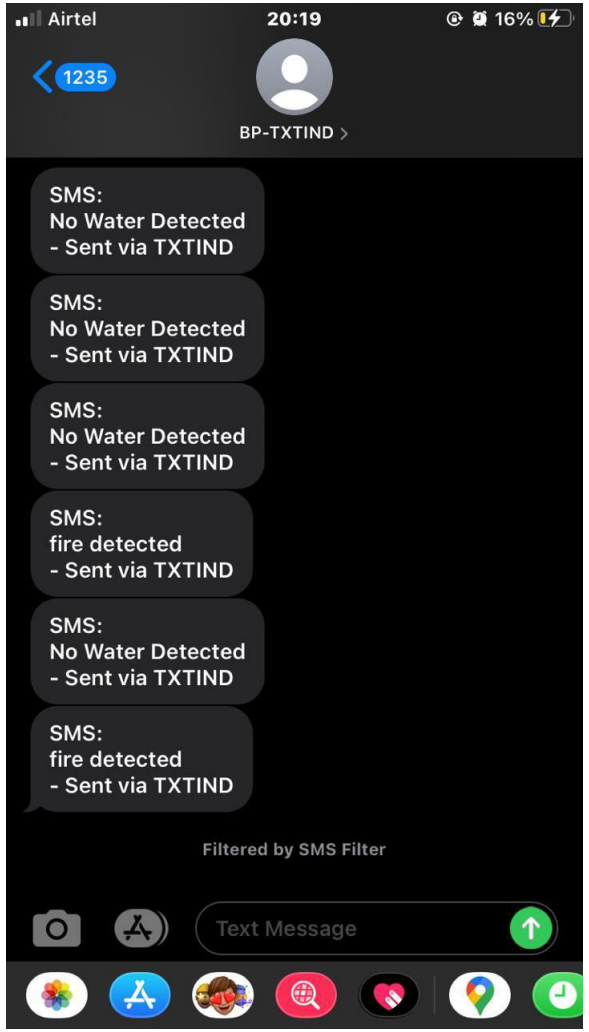

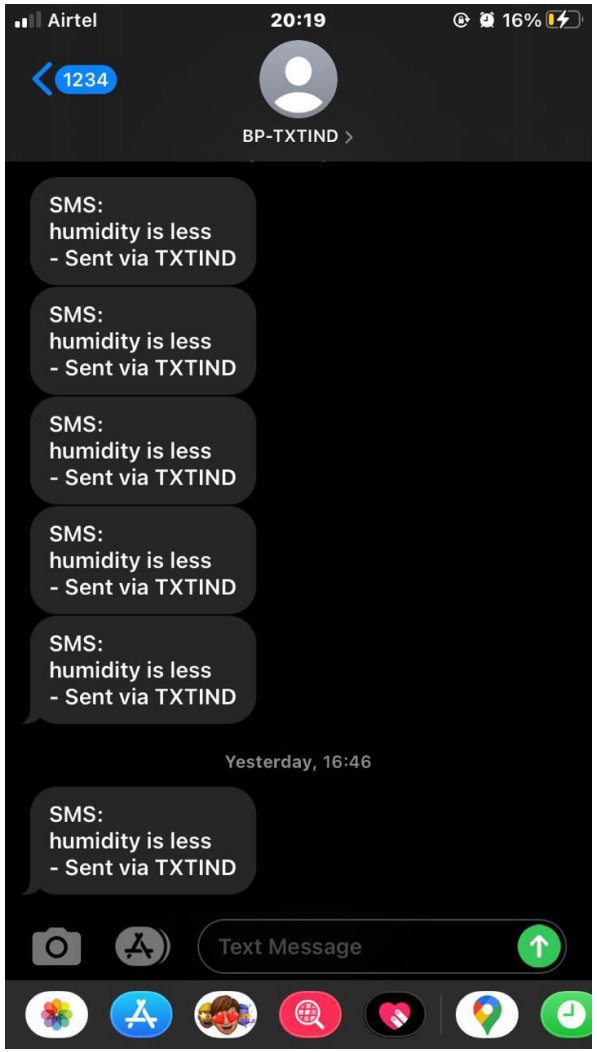

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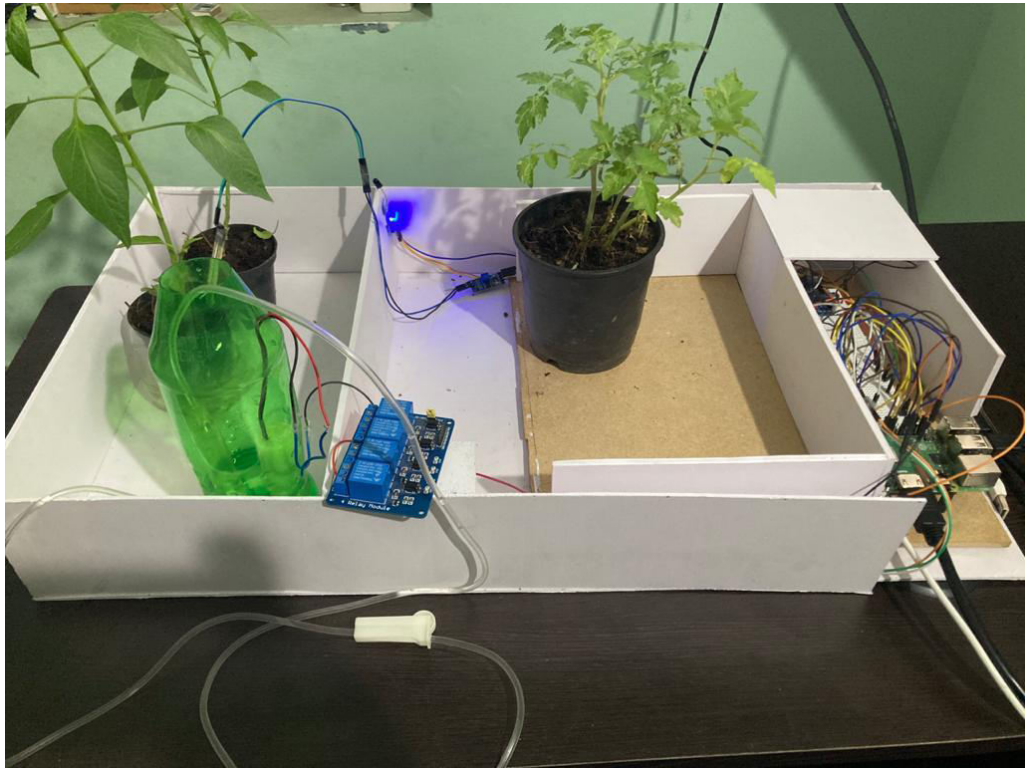

Thank You