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Iot & ML Based Smart Irrigation System for Water Pump Control and Notification Alert Using Raspberry Pi

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Abstract

Agriculture makes major role in the economic growth. 70% population depends upon agriculture and capital comes from farming. Issues is agriculture is still following the old process. India has a variety of climate conditions due to this managing and minimizing water wastage is a challenge. One of the proposals for modern farming for renovate the existing procedure in farming. The main aim is proposed system will help farming advanced by utilizing new technology with Internet of things and Machine learning. An irrigation system monitoring soil of the land, temperature and humidity of the environment, light intensity, rain, level of the water tank, and everything will be displayed on LCD. Depends on soil data using AI/ML algorithm proposed system will predict whether the soil is dry or wet and hence system controlling the dc motor and it will alert the farmer by sending mobile notifications. The highlighting features of this proposed system were farmers able to access and monitoring information and process the data which is hosted in Cloud using AI/ML algorithms for accurate output.

Keywords: *IoT, raspberry pi Microcontroller, cloud service (ThingSpeak), sensors, Twilio app for notification, AI/ML algorithms.*

1. Introduction

Farming plays a crucial position for growth of economy of the country. Growth in an agricultural area is very indispensable necessary for all the improvement of the financial circumstance. But most people make use of historical regular techniques consequences in low yield. Many areas technology has been implemented, human beings' changes using automated methods, the overall yield has been improved. Hence, it's required to use new technique in the farming sector. The Advance System is an Internet of things based totally machine successful in modernizing the irrigation procedure evaluate the land condition also local weather situation like temperature, rainfall. Wastage of water should be maintained in the farmland. IOT is a massive community linked gadgets collect records about in which environment how and they have operated and utilised. IoT works in unique domains of farming to enhance time effectively of controlling water management, soil management. Some systems are computerized and there is no need for human help.The sensor readings are transmitted to a Thing communicate channel to provide graphs for a couple of analyses. By taking the sensors reading ML algorithm helps to predict the accuracy. Internet of thing based advanced farming, device constructed for maintaining the yield discipline with the use of devices and advancing system. Agricultural zone is very important improving of financial stipulations.

Related Works

After exploring several types of methods in the farming observed that the yield of agriculture reducing drastically. The use of advanced techniques in discipline of farming performs essential function in productivity and minimize the manpower effort

[1] Ahmed Imtiaz Tanveer Rahman, Muhammad Kamrul, and Saika Zaman in March 2020 publised a paper on IoT-based Smart Irrigation System using Raspberry Pi3. The advanced agriculture model is essential in many areas, where water is needed at regularly. Present smart drip farming to water the plants using devices like Raspberry pi3, Arduino microcontrollers. ZigBee helps to control the system

wirelessly. User will notify the status. We essentially take two issues into considerations: 1. The proposed system has poor data storage and analysis for predicting the accuracy of the system.2. The system is not user-friendly.

[2] Riaz Shaik, Farzana Syed, Kalluri. Venkata Ratnam and Chatto Bhargavi proposed IOT based automated irrigation method uses Raspbian Pi in 2020.Inthis New model Low-cost land moisture detecting device is used. The system is developed evaluate data which is received to check with the threshold. If soil moisture is less than threshold value motor will switched ON and if the soil moisture crosses the certain level of value the motor switched OFF. We essentially take three issues into considerations: 1. The proposed system doesn't incorporate the latest technology to manage the Data for analysis and predicting the future results.2. Sensors' data values are not accessible and it's restricted. 3. Sensors' capacity is poor and results are not accurate.

[3] Dr. Ayyasamy S1, Eswaran S2, Manikandan B3, Mithun Solomon S P4, Nirmal Kumar S5 developed IoT-base smart irrigation system March 2020.Measure nutrients available in land and improve quality for measure soil condition. When condition of soil reaches a special point, the Cloud Service Brokerage instructions the relay to switch ON the motor. The motor will remove the extra water. The fundamental goal of this proposal is to manage the extra waterlog in the farmland. This proposal additionally helps to analyse content of soil. We essentially take two problems into considerations:1. The water managing machine is semi-automated. 2.Climate at that certain location can analyzed however it will anticipate for subsequent 10 days with the utilization of prediction algorithm.

[4]R.Laksiri, H.A.C.Dharmagunawardhana, J.V.Wijayakulasooriya, proposed loT Based advanced farming System in Sri Lanka 2019.Main objective is to enforce a less cost loT and climate-based farming system with capable maintaining, advancing water supply based on soil condition. In weather parameters from field are stocked in a remotely located database. Using colected weather data,such as temperature, humidity, and rainfall, an investigation on local weather, prediction is calculated. We essentially take three issues into considerations:1. Sensors data is stored remotely and it's difficult to manage and access the data when it is required. protect the plant from surrounding animals using the leaser system. 2.Data server is not hosted in cloud.

Objective

The main goal of this venture is to make agriculture smart with the usage of automation with Internet of things and Machine Learning techniques. The elements of project using sensors data like soil data, rain data, light intensity data, temperature data, humidity values will be loaded to Cloud server (ThingSpeak). All data from the cloud will be fed into AI/ML algorithm to find the data accuracy and controlling the motor pump(on/off) based on soil type prediction i.e, either dry or wet. Using Twilio software alert message will be sent to the registered mobile.

PROBLEM DEFINITION (EXITING SYSTEM)

Major problems in modern new cities are water scarcity. Increase in the level of water wastage in the irrigation system is an alarming problem. Due to variety of climate conditions in India can also motive the low yeild. [5] Resulting soil is unfit for yield. Many crops consume different levels of water and soil that impacts the products in farmland. Hence water degrees should be handled for different variety of plants, crops, respectively. Most of the farmers still follow the traditional methods of farming and they will not come to know that whether the water pump is ON or OFF. Hence clever agriculture via modernizing the cutting-edge regular strategies of agriculture is the sole answer to this problem.

Proposed System

The proposed system is helpful to farming smart using advanced technique with IoT and Machine learning. In an irrigation system monitoring soil of land, temperature, and humidity of the environment, light intensity, rain, level of the water tank, and everything it will be displayed on LCD. Depends on soil data using AI/ML algorithm proposed system will predict whether the soil is dry or wet and hence system controlling the dc motor and it will alert the farmer by sending mobile notifications. The highlighting features of this proposed system were farmers able to access and monitoring all information from the cloud, help to process data using AI/ML algorithms for accurate output. Recommended system includes monitoring the sensor's data and making use of cloud technology storing the data in the cloud server. Hence system makes the data available to the user at anytime from anywhere. Using the proposed model, we can apply an ML algorithm on the stored data to train the proposed model to get the accuracy value of the system and predict output. It also detects the condition of the water. System introducing Cloud Computing, Machine Learning, and cloud server technology to build the advanced automation system. Hence proposed system makes it more user-friendly.

SYSTEM DESIGN AND ANALYSIS

a) Fig. 1 Describes the block diagram

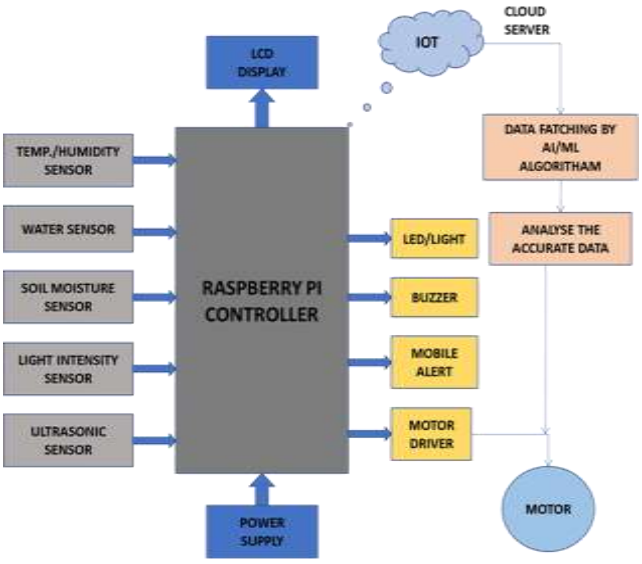


Fig.1 Block Diagram

b) Fig. 2 Describe the Architecture diagram.

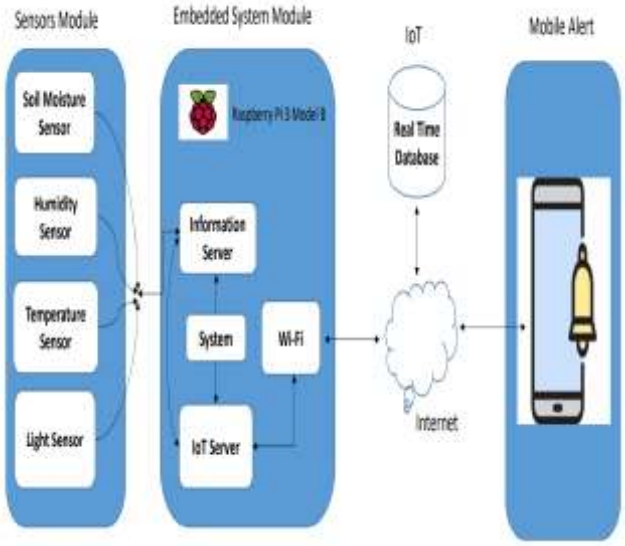


Fig.2 System Design Architecture

Hardware COMPONENTS AND SPECIFICATIONS

a) Table. 1 Describes the Required Hardware and its necessary specifications to build the proposed system.

Hardware Requirements	Specifications
Raspberry Pi Microcontroller	Memory 1GB RAM ,32GB ROM
Water Sensor	Display Either 0 or 1. Threshold 1 for Detect Rain,0 for not Detecting Rain.
Soil Moisture Sensor	Display Either 0 or 1. Threshold 1 for Detect soil Dry condition,0 to detect soil moisture condition.
Temperature/Humidity sensor	Measured in Degree range 0-50 degree. The threshold will be >30 for high temperatures.
Light Intensity Sensor	LDR sensor range=0-1023, Threshold >500 for Darkness and <500 for Brightness.

Ultrasonic Sensor	Sensor range =0-2300 up to Infinity.
DC Motor	Motor ON if the soil is dry and if the tank is half.
Motor Driver	Handles current and Higher voltages than the standard.
LED/Light	LED is on if it Dark
Buzzer	Alarm device
LCD	Display

Table1. Hardware Requirements

Fig. 3 Describes the Hardware experimental setup of the proposed system

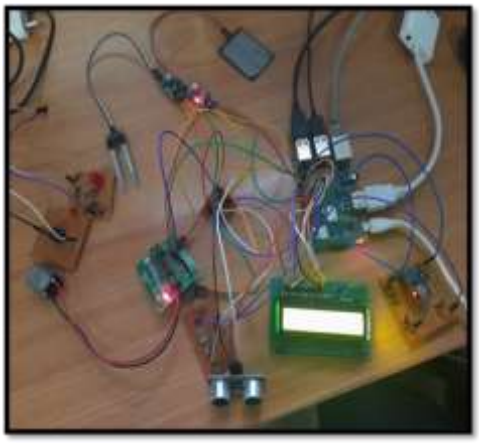


Fig 3. Hardware setup

SOFTWARE COMPONENTS AND SPECIFICATIONS

a) **PYTHON**: It is a very helpful programming languag has convenient to examine and approves programmers to use few lines of code than other other language such as assembly, C, or Java. It is scripting language for Linux.

b) **Bayesian Algorithm**: Bayes Theorem to predict the output.

Operating System	**Raspbian.**
Advance Technique	ML & IoT.
UI	Tkinter
Python Version	Python 3.7 or higher.

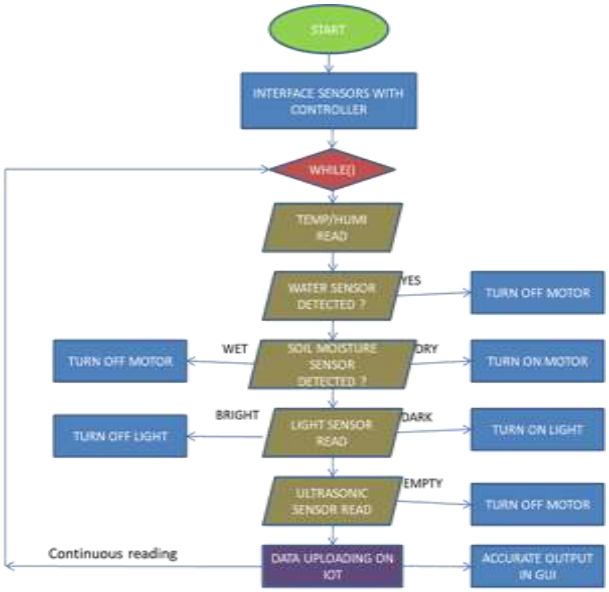
TABULATION (DATA SHEET)

Table. 3 provides the Data set which is taken from all the sensors periodically and will be inputted to the ML algorithm to train the system to get the accuracy and predict the output to the set of sample data provided.

created_at	entry_	temperatu	humidit	rair	soil	ldr	ultrasonic
2021-03-02 05:10:37 UTC	1	25	46	0	0	4264	95.11549
2021-03-02 05:10:52 UTC	2	25	45	0	0	4513	3.569591
2021-03-02 05:11:08 UTC	3	25	45	0	0	4266	445.9863
2021-03-02 05:11:28 UTC	4	25	45	0	0	11382	2215.702
2021-03-02 05:11:49 UTC	5	25	45	0	0	5229	446.0558
2021-03-02 05:12:08 UTC	6	25	45	0	1	4397	77.43109
2021-03-02 05:12:23 UTC	7	25	45	0	1	4517	5.524075
2021-03-02 05:12:39 UTC	8	25	45	0	1	3891	5.564964
2021-03-02 05:12:54 UTC	9	25	45	0	1	4720	3.512347
2021-03-02 05:13:10 UTC	10	25	45	0	1	10540	3.53688
2021-03-02 05:13:25 UTC	11	25	44	0	1	10617	3.508258
2021-03-02 05:13:46 UTC	12	25	45	0	1	10734	3.50008
2021-03-02 05:14:01 UTC	13	25	44	0	1	5175	3.520525
2021-03-02 05:14:21 UTC	14	25	44	0	0	11520	4.583633
2021-03-02 05:14:37 UTC	15	25	44	1	1	4381	4.293323
2021-03-02 05:14:52 UTC	16	25	44	1	1	4761	4.346478
2021-03-02 05:15:07 UTC	17	25	44	1	1	4664	4.256523
2021-03-02 05:15:23 UTC	18	25	43	1	1	10496	4.166567
2021-03-02 05:15:47 UTC	19	25	43	1	1	4747	2235.271
2021-03-02 05:16:03 UTC	20	25	45	1	1	4724	2226.374

Table.3 Data Set

FLOW DIAGRAM OF A SYSTEM



a) Working

•A prototype module will be developed for the project. It consists of a raspberry pi board for all interfaces following the block diagram. Every Sensor will be connected with jumper wires.

•Water sensor is used to identify level in the water pump

•The moisture sensor shows the stage of moisture in the plant and sends the signal if water is needed.

•Light intensity sensor indicates the darkness or brightness in a farm. And light we can control.

•The temperature/humidity sensor checks the weather temperature and humidity in the atmosphere.

•An ultrasonic sensor indicates the level of water in the water tank.

•The motor/water pump exhilarates water to the plants until the optimum moisture level is met.

•Data will be uploading to IoT (Thingspeak). The IoT (ThingSpeak) data generated will be applied to ML technology (algorithm).

•We are using GUI to predict the output.

•The accuracy will be displayed.

•Based on IoT data we use ML technology to turn ON or OFF based on the soil moisture value, water sensor value, and ultrasonic sensor value.

- Hence irrigation system is monitored using ML on Raspberry pi

XI.FLOW DIAGRAM OF A SYSTEM

Bayesian algorithm used to predict the output. Deterministic classifier, which means it predicts based on the theoretic of an object.

Naïve:Because it assumes that the occurrence of a certain feature is independent of the occurrence of other features.

•Bayes: Depends on principle of Bayes' Theorem. Bayes' Theorem: is possibility event (A) will occur given that another incident (B) occurred.

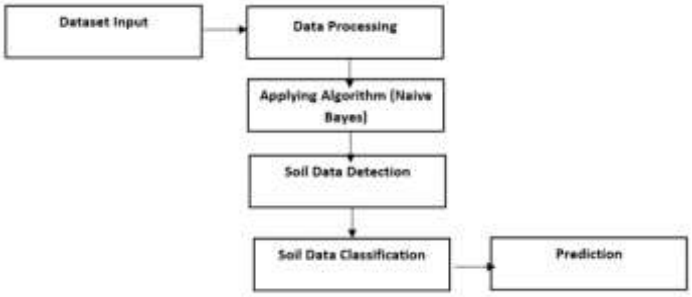
Bayesian algorithm given by the below equation:

A and B =Occurrence

possibility (A or B) = possibility of A given B is correct

possibility (B or A) = possibility of B given A is correct

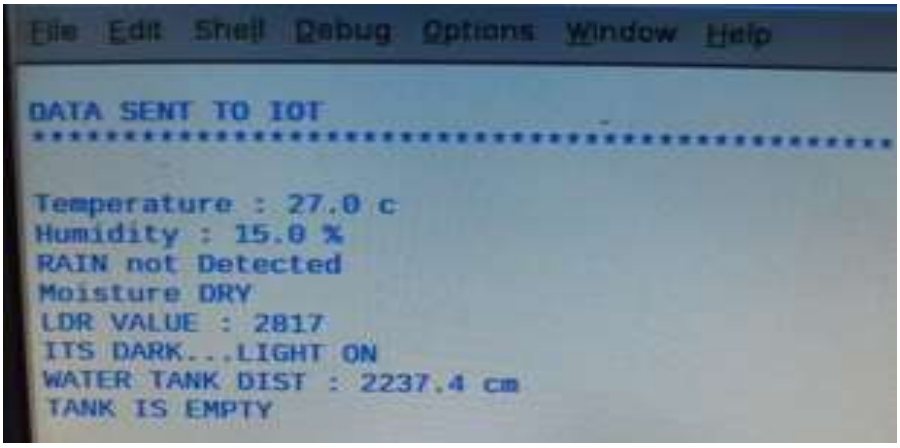
possibility (A), chances (B)= self-reliance possibility of A and B



3. Results and Discussion

Data captured from the sensors like Temperature/humidity Sensor, Water Sensor, Soil Moisture Sensor, Light intensity Sensor, Ultrasonic Sensor will be collected and uploaded to Thing Speak IOT cloud server.A graph is to analyze data. The application also helps to import/Export the data set in the form of a CSV file.

1) Different Sensors Data readings will be captured periodically and uploading to IoT



2) Fig. 7 explains the graphical representations for Temperature data readings.

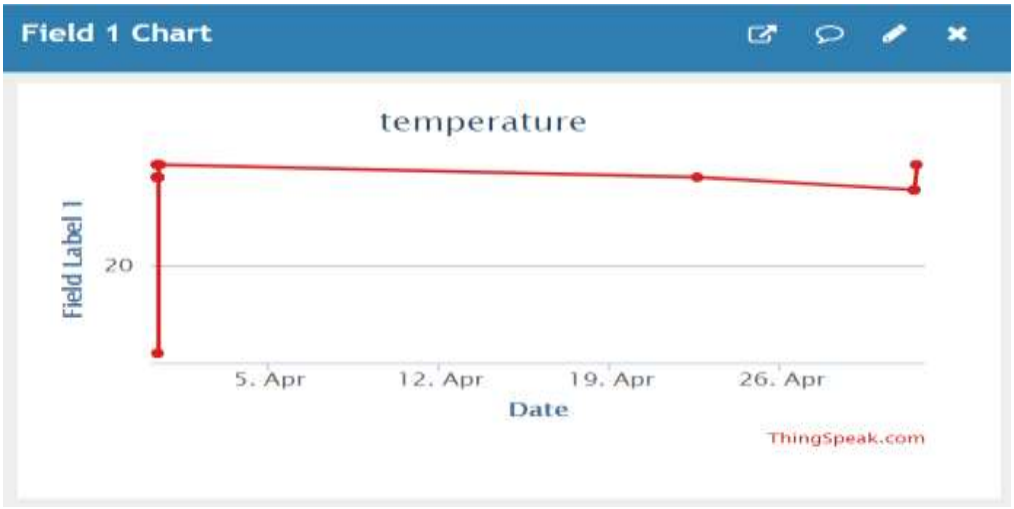


Fig.7 Temperature Sensor

3) Fig. 8 explains graphical representations for Soil Humidity readings.

Fig.8 Humidity Sensor

4) Fig. 9 explains the graphical representations for Rain sensor Data Readings

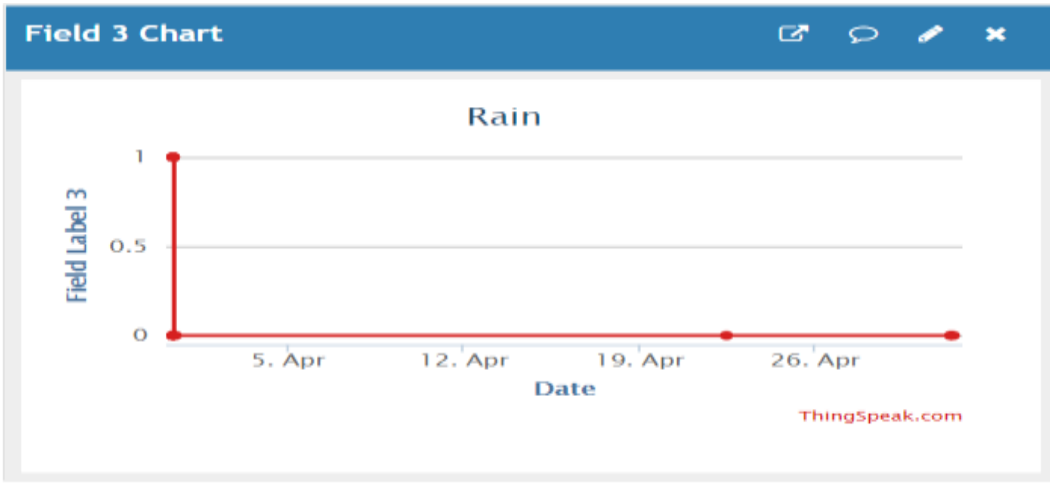


Fig.9 Rain Sensor

4) Fig. 10 explains the graphical representations for soil moisture sensor Data.

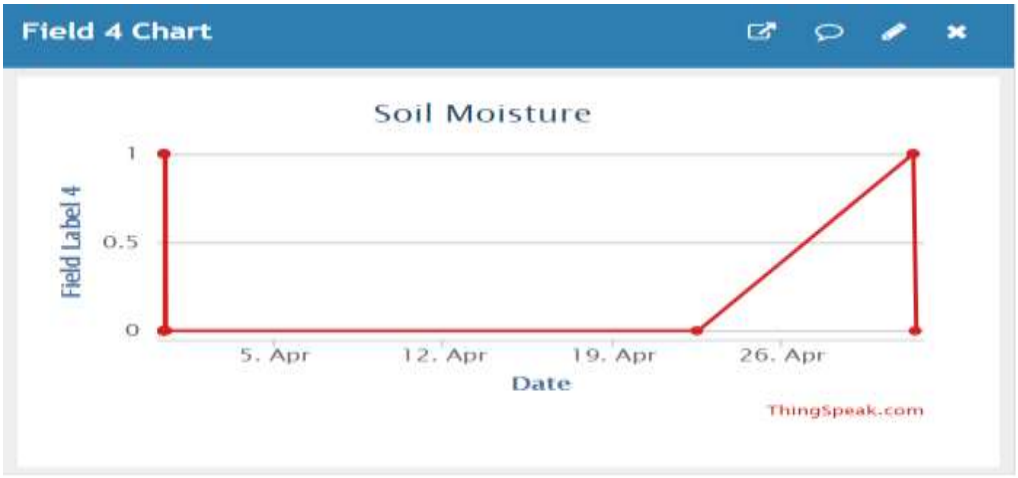


Fig.10 Soil Moisture Sensor

5) Fig. 12 explains the graphical representations for Ultrasonic

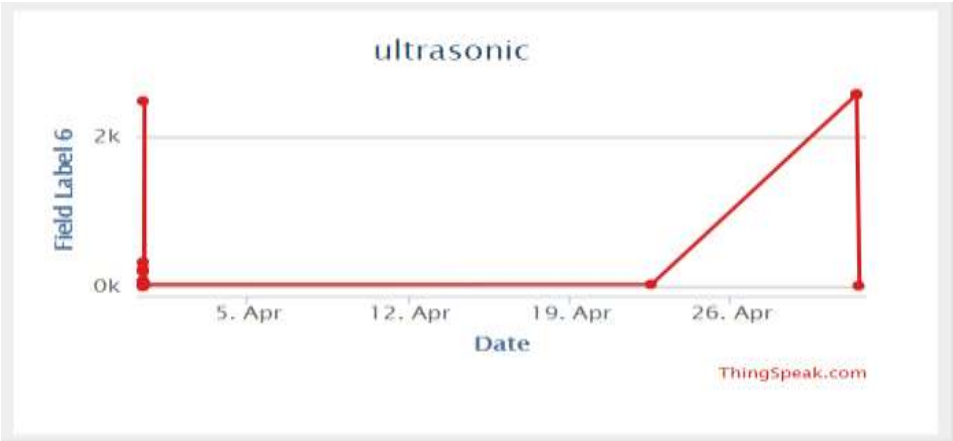


Fig.12 Ultrasonic sensor

XIII. GUI TO DISPLAY OUTPUT

a) Fig. 13 explains the GUI of the proposed project.

Fig.13 GUI

b) Fig.14 explains Using the Naïve Bayes algorithm Accuracy will be calculated once the system is trained based on the provided Sensors data sets.

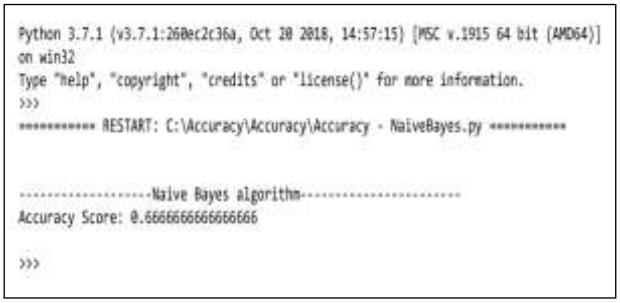


Fig.14 Accuracy

c) Fig.15 explains based on the soil moisture condition Algorithm will predict either 0 (Soil is wet and farmland doesn't require water. Motor should OFF) or 1 (Soil condition is Dry and farmland requires water. Motor should ON)

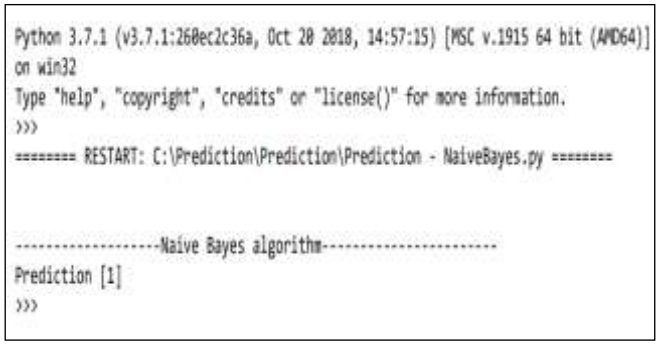


Fig.15 Prediction.

4. Conclusion

This project uses structured modeling, capable for supply the accurate results. The device is capable of handling the condition of land, determines the needs of water to the farmland. Model utilize expert system to differentiate values obtained from the devices with a testing data will upload to the system algorithm. Output is whether farmland required water or not. Based on this result in the motor will be operated automatically either on/off. The farmer receives an alert message to the configured mobile. The farming technique provides output data with Accuracy and Prediction.

Future Enhancement- In the future, we can apply an automated irrigation system to detect the water quality, and depends on water quality we can automatically control the motor on/off with notification on our mobile.

References:

[1] Ahmed Imtiaz, Tanveer Rahman, Muhammad Kamrul Hossain, and Saika Zaman in March 2020, on IoT-based autonomous percipient irrigation system using raspberry pi.

[2] Riaz Shaik, Farzana Syed, Kalluri. Venkata Ratnam and Chatto Bhargavi proposed IOT based Automated Irrigation System using RASPBERRY PI, 2020.

[3] Dr. Ayyasamy S1, Eswaran S2, Manikandan B3, Mithun Solomon S P4, Nirmal Kumar S5 on March 2020 proposed IoT based Agri Soil Maintenance Through Micro-Nutrients and Protection of Crops from Excess Water.

[4]G.C.R.Laksiri, H.A.C.Dharmagunawardhana, J.V.Wijayakulasooriya, proposed Design and Optimization of loT Based Smart Irrigation System in Sri Lanka in 2019.

[5] Chandana Thakur, Shaguftha Taskeen, Pavithra S, Monisha S, Namratha KS & Minnie Peter in 2018 proposed Internet of Things (IoT) based Irrigation System with and without Internet and Pump Set Control.

[6] Nor Syafikah Pezol, Ramli Adnan, Mazidah Tajjudin Design of an Internet of Things (IoT) Based SmartIrrigation and Fertilization System Using Fuzzy Logic for Chili Plant,2020