Paper11

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Submission date: 03-May-2021 08:08PM (UTC+0530)
Submission ID: 1576815857
File name: IEEE-converted-converted-converted.pdf (332.19K)
Word count: 3363
Character count: 16663

Implementation of Precision Agriculture Monitoring System using Raspberry Pi and Crop Prediction using Machine Learning

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Abstract*— The Internet Of Things(IOT) refers to the growing of connected objects that are able to collect and exchange data in real time using sensors. The devices and machines are connected to each other and to Internet and performs specific tasks based on the information given to the devices. As we know that, most of the Indian people have agriculture as their occupation. Farmers will have the ethos of growing or planting the crops, with the help of fertilizers. A 5years ago Machine learning is used in different industries, research. So we got an idea to use Machine Learning(ML) in agriculture field to help the farmers. In olden days farmers used the manual method of yielding the crop, testing the soil pH value, and based on some assumptions they predict about the climate conditions. Farmers can get the field details easily through these sensors with accurate values.

Keywords- DHT11, Flame Sensor, Soil Moisture, pH value, Relay (for motor).

INTRODUCTION

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.

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

I. PROBLEM STATEMENT

Agriculture is the unpredictable way of yielding the crop where the farmers only test the soil such as moisture level, soil type, and soil moisture. Whenever soil losses its moisture level the water pump should be ON immediately so the farmer should ON the pump. It takes the time for farmers to do the manual work. The farmer uses pesticides to get the high yield of the crop, without knowing much about the pesticides and how much about the pesticide and how much quantity should that be used. Farmer should check the daily climate condition or the previous year's parameters he should go through for the present yielding purpose.

II. COMPONENTS USED

A. *Raspberry Pi*

We have used Raspberry Pi B+ model, which fully functional computer and also low cost. The raspberry pi board has 5V of two pins,3V3 of two pins & total of 9 ground/0V pins, 5V of power supply is directly supplied from main adaptor Raspberry Pi Board.

B. *DHT11 Sensor*

DHT11 is the sensor to detect the surround Temperature and Humidity. Output values of temperature and humidity will be serial data. It can fetch temperature from 0-50 degrees Celsius and humidity from twenty to ninety percent. This sensor is used to fetch surrounding temperature and humidity values precisely It senses the temperature and humidity of the field and stores in the cloud.

DHT11 Sensor

C. *Flame sensor*

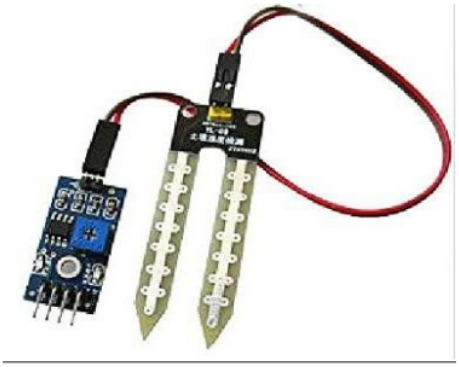
This sensor is used to fetch surrounding temperature and humidity values precisely. In one input pin, one pin is for ground connection, another one is for vcc of 5v.

Flame sensor

D. *Soil Moisture Sensor*

This sensor is used to detect the soil proprieties such as the moisture content in the soil tell us that how much of water is required to the plant, this sensor has totally 3pins which are connected respectively i.e., ground(GND), vcc of 5v(power), input pin which is given by user.

Soil Moisture Sensor



E. *Relay*

Relay acts as a switch, which help the user to on and off the pump easily so that there will be no human effort for this propose, such as whenever the soil moisture sensor detects the dryness in the crop then relay will automatically on. So this is will work as the switch whenever it is required it automatically on and off purpose

Relay

III. PROPOSED METHODOLOGY

The proposed method is to build the smart system that gives the ideal environment for crops. The sensor gets the soil moisture, humidity, temperature then these details will be stored in the cloud system. When the soil moisture level is low then the relay will get ON then motor will get ON, then plants will get the water. And also when the flame is detected relay will get ON then motor will get ON then fields will get the water. These fluctuating data are recorded in the things speak that is one of the iot platform where you can store the daily data. Further that data can be used. We have used the machine learning algorithm to predict which type of crop can be grown in such conditions. so when those data are taken into the algorithm. Steps to process the algorithm like pre-processing the dataset, if missing field found in the data filling with mean value to get accuracy appropriately and next step is splitting the dataset into training and testing.

IV.LITERATURE SURVEY

Abstract: Smart agriculture uses wireless sensor for monitoring the field. They use raspberry pi for monitoring the agriculture field. These are dependable and efficient to get parameters detail. This helps the farmer with less human effort and gets the precision value. The sensor used to monitor the condition of farm and microcontroller used to control the farm. If the farmer is away from the farm he can monitor the farm using these sensor and controller in green house condition. In this iot is used that is Thing speak which can help the farmer to take an accurate value and decision by which he can get the good productivity.

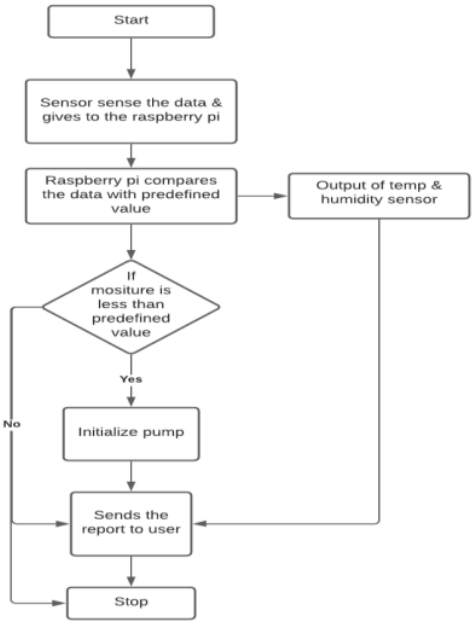
Introduction: Precision agriculture has become well know method in the field of greenhouse effect. A wireless sensors network is independently distributed to monitor physical or environment condition that are humidity, pressure, temperature etc., and pass the collected data to the main location. The very old technique is that the farmer personally gets the reading of the parameter values. This may be not that accurate. Another way is that the farmers get the SMS, through GSM services and communicate the farmer. In this system there will be less human effort and easily get the accurate values of the parameter by sensor. In this system, crops get prefect greenhouse effect like environment. The sensed information can be used for the high yielding but with required conditions such as water content in soil and temperature, humidity, light etc.

Proposed Model: The proposed model is to build the smart system that gives the ideal environment for crops. The sensor gets the soil moisture, humidity level, this details will be sent to ZigBee network to system. The system can control motor and humidity that are located in the field. This reduces the human effort much more, and to get the prefect environmental condition for crop.

Working Process: The soil moisture sensor gets the moisture level. If the level is below predefined level, it notifies the user via GSM sending the SMS to farmers mobile so that to turn on the pump. The relay of the pump turns on the motor so that water can start to flow. The moisture sensor notes the values every minute as mentioned in the algorithm and algorithm checks the level of moisture which is required for the soil. When the soil gets its moisture level then pump automatically turns off and same
is notified to farmer via SMS

Result: The data which is sensed that are displayed in the user interface. And the graph is plotted using the digital values using moisture values and humidity values, temperature. To get the digital values we use communication port and enable that communication between ZigBee and system.

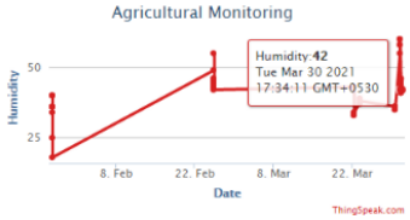
V. FLOW CHART



VI.VISUALIZATION

A. Temperature:

B. Humidity:



c. pH:

VII. SYSTEM DESIGN

Here our project flow is represented in the above diagram, raspberry pi B+ model is used for this project, and four sensors are used to fetch parameters value from the farm. The live data is take and stored things speak. We have taken the dataset from the kaggle website for now as well the live data is also in process to collect the data, decision algorithm is for regression and classification purpose. The data set is sub divided into class form. The main node is the root node and sub nodes are leaf node as per the decision algorithm. When have tried doing with other algorithm such as SVM, Logistic Regression, Naïve Bayes algorithm, Decision algorithm. We were getting the highest accuracy value from this algorithm compared to other algorithm.

In process of algorithm the first process is pre- processing dataset means cleaning the dataset, if there are any missing data found then to get the predicted value as per the expected value we go for filling the missing value by doing the mean of the entire column we can fill the column by that value then dividing the data set like dependent variable and independent variables. That is divide into ratio of 20:80 which is used as training and testing purpose. 20 is for testing and 80 is for training.

The sensors used for this pro[10] are soil moisture sensor and flame sensor, ph. sensor, DHT 11(temperature & humidity) sensor. When the soil moisture sensor senses the moisture content and detects as less moisture content in soil and automatically motor is on so similarly when temperature is increased then also water motor is on same to humidity also. While this process ph. value is also collected and stored in the cloud. If in case the fire detected in the field it notifies the user through the SMS. Also the user gets the notification whenever there is change in the field it notifies the user of the temperature & humidity change as per the pre-condition given. For example, if the temperature is set to 35c then if temperature is greater than this per mentioned condition then user get notifies with the message saying that temperature is more automatically motor will be on. Similarly, whenever the temperature is less than the mentioned value also user will be getting the SMS. Similarly, with humidity we have taken condition value as if humidity value is less than 35c user get notification.

VIII. MACHINE LEARNING

a) K-Nearest Neighbor:

This algorithm is simple ML algorithm. it is a supervised learning, in this algorithm we see the attribute which are dependent and independent attribute. We see the comparison between new data/collected data and previously present data that is to see in which category the new data belongs. This algorithm is used to stores all the available information that are present previously based on that, new data/information are classified. This is also used for Regression & classification but mainly for classification purpose.in this algorithm we cannot make any assumption based on the primary data. This is also known as lazy learner algorithm.

b) Decision Tree:

Decision tree algorithm is used for classification and regression, but likely used for classification problems.in this first dataset is divided into root node and leaf node. It is root node and sub node which is also in the tree structure format, it basically starts from root node and ends sub node which is based on the condition given decision is taken. It is may be help for decision linked problems. In this algorithm cleaning data set requires less requirements.

c) Naïve Bayes:

In this algorithm, it is based on the conditional probability. The dataset taken is divided into dependent and independent column. In this algorithm the dataset is first trained and then tested but in the ratio of 20:80. First 20% of the dataset is tested and other 80% dataset is trained. This is because machine should be trained as per the dataset so that we could get the accuracy value as per the prediction. Naïve Bayes algorithm can take high level dimension feature with less dataset with a scalable classifier.

d) Support Vector Machine(SVM):

SVM is supervised learning which is used for classification and regression, mainly it is used foe classification propose. Support Vector Model algorithm creates a model. The output of the SVM algorithm is to do the decision boundary that can divide into n-dimensional space into classes so that we can segregate new data in correct category in future. SVM selects the vector to help in forming hyperplane.so these vectors are called as support Vector, so this is called as Support Vector Machine.

IX.APPLICATION

- 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 be observed
-

X. ADVANTAGES

- Based on the exact value of humidity, temperature of their environment framer can grow the crops.
- Farmer can water to fields periodically, based on the soil moisture level by soil moisture sensor. By this sensor it waters to the field only when and where it is needed.
- It reduces the cost like labor cost.
- It provides the crop production in High Quality.
- We will get the data in real time from the cloud.
- Automatic process of watering the fields will be done.

XI.DISADVANTAGE

- 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.
- There will be sudden fluctuating in climate changes or weather conditions it may effect to get exact humidity and temperature value.
- We should be aware of the working of sensor like is it working correctly or not.

XII. CONCLUSION

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.

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. 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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