Fine Tuning and Tools Development for Plantain Grove Protection Using Iot and Machine Learning

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Abstract: Agriculture plays a vital role in a country's economy. In agriculture banana groves are as important as paddy fields. It is difficult for the farmers to protect their banana groves from natural disasters like wind, heat and flood. In order to protect the banana groves from natural disasters we provide a modern solution using Machine learning and IoT. In this project we will be calculating the temperature , sunlight intensity , pH level of the soil, moisture content in the soil and air, level of the water, amount of water should be delivered in hour basis with the help of sensors and speed and direction of wind using wind and pressure level sensors and all the calculated values are displayed in LCD display . These data are collected and processed by using machine learning algorithms for future predictions . It will give alert message and Buzzer if the temperature level goes above 95'F and below 22'F(the plant growth will be slow) so that we can reduce the temperature by using pump irrigation method . For instance 4000 plantain can be planted in a acre of land(square planting) which needs around 950 litres for 1 hr, if water level increases or decreases for a certain amount of time it will leaves a alert message and buzzer so that we can protect our trees from rotting. Plantain tress also gets damaged by the speed of wind i.e if 30 mph will break stalks attaching the leaves, wind of 40mph can break the main stem and winds of 60mph can topple the whole stands of banana plants, if the speed of the wind goes above the respective speed given above it will gives an alarm so that we can do some measures to protect the plantain trees. The pH sensor is used to display the pH value in LCD display and also suggest Fertilizers and Pesticides according to the pH value. By the using Arduino we are installing pump which retrieve and release water in the field . In the existing project they have SMT32 controller which works only in 0° and in 180° but we use Arduino which is more efficient than SMT32 controller and we also gives notification when the value of wind and temperature goes high, and predict it using Machine Learning.

Keywords: IoT, Cayenne app, Machine Learning, Sensors, Arduino.

1. Introduction

The low productivity in agriculture sector in India will affect the food security negatively. One of the main reasons for poor productivity in agriculture is uncertain weather and its associated natural disasters. A natural calamities can be defined as a major adverse event caused by the natural processes of the Earth. During occurrence of natural disaster, higher level of force will be resulted with in small period causing enormous loss to the crops, animals and human beings. Hence, natural disasters can cause loss of life or property damage, and result in severe economic damage during the process Plantains at a vegetative stage broken or irreversibly bent by weather - related disasters are topped at a height that does not interfere with their hypothetic blossoming. Hence in our project we use wind sensor to predict the wind speed in earlier and intimated in IOT to the farmers. Crops can grow from the poorest to the richest type of soil with varying success. The soil should be tested before crops cultivation. We use PH sensor to calculate the ph range of soil. Soil moisture sensor is used to moisture present around cultivation. During the flood time banana trees are surrounded with full of water, In our project we use level sensor to detect the level of water and notified in the IOT. We use DHT11 sensor to detect the temperature and humidity.

A. Background

Now a days the population is increasing rapidly. Therefore it is difficult to serve the entire world with food. The number of farmers are reduced ,so we use a technology using iot and machine learning to improve the quality of yield and protection of our natural wellbeing. The background has different types of sensors which monitors and gives data to the microcontroller. The Arduino microcontroller transfers these data to the cloud and these are further processed using machine learning algorithm for the future prediction and analysis of the weather conditions. These messages are transferred using the wifi module ESP8266.The coding is done in Embedded c language for the processing of information in the application. Some sensors only predict temperature level by using ultrasonic sensor to measure the temperature and gas level of surface [10].

B. Motivations

Lots of destruction due to natural calamities affect the agriculture in several ways and most of the farmers are pushed to death due to poor yield of crops .This risk can be avoided using the modern technology and pave way for the farmers for protecting their valuable and trusted source of farming.

C. Problem Statement

The survey of IoT was done [11]. The Existing system monitors only the telemetry data such as soil moisture, humidity and temperature .The system is designed using STM32 microcontroller and soil moisture sensor to check soil moisture. It does not provide any accurate data for wind, its direction. The system does not suggest any measures to overcome the different situation and it cannot predict the future conditions. The farmers do get alert only about the situation or condition; there is no suggestion on how to overcome the future or current situation. So, there is a need for developing a monitoring system for the protection of agriculture in the world.

D. Objectives

The main moto of this project is to develop and implement a system which can sense the conditions like temperature, wind, pressure, pH, soil moisture, humidity, water level for future and also for current situation. The machine can learn through data sets which can predict the future conditions, which will be very useful for all people who indulge in agricultural works.

E. Problem definition

Develop a system which can monitor the weather and suggest suitable measures for precise farming. To finely tune the process using algorithms and provide a better solution for easy farming and protection of plantain grove, since all parts of plantain is edible. Plantain needs large quantity of water and mild wind can lead to breakage, therefore we need a precise system for protection of the plantain grove.

F. Proposed Solution

Crop plantation is still one of the most pivotal sectors of the Indian economy. It is important for human survival and also for economic growth. The moisture in the land is monitored using the soil moisture sensor. When the moisture level reaches a point, it will be updated in IOT. In order to maintain the plantation land in well manner, we monitor temperature and humidity of the land using DHT11 sensor and value will be displayed in the LCD and can be monitored in the IOT. Wind sensor and pressure sensor are used to detect the speed and pressure of the wind around the land. If any of the sensor value is deviated from the normal level to abnormal then the buzzer will be turned on and can be monitored through iot.At last all the datas received from the sensors are transmitted to the PC using USB to TTL converter, for machine learning process.Using PH sensor we can predict the types of crop which to be planted in that land according to the soil PH value.

2. System Block Diagram

The system

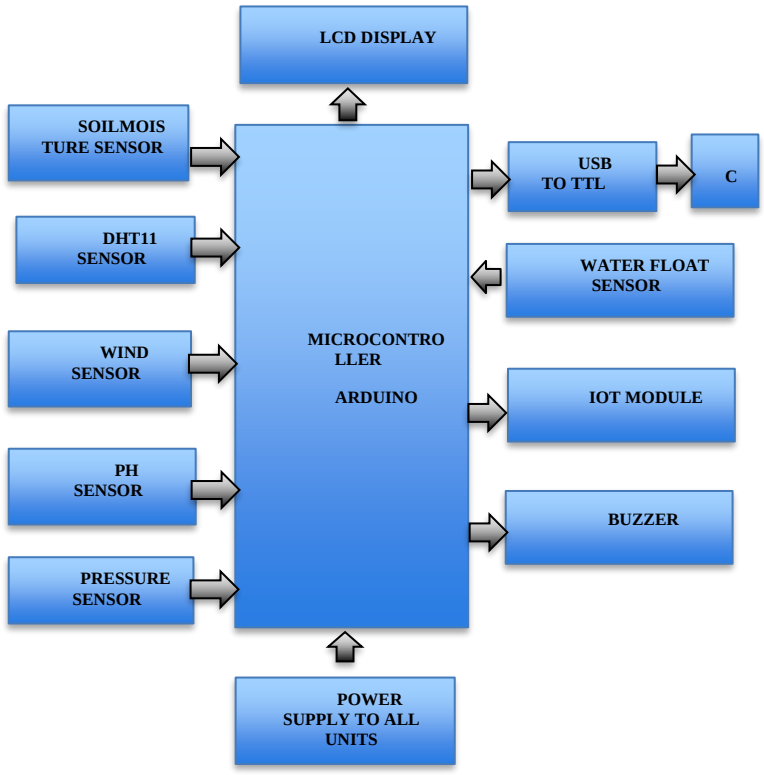

Figure 1: system block diagram

3. Working Principle

In this project the sensor values are the input values are given to the microcontroller Arduino board. Arduino is a platform for hardware and software companies to build a digital device with microcontroller boards or microcontroller kits. From the Arduino board the input values are transfers to NodeMCU by wireless communication by using internet. NodeMCU is a open source platform used for IOT. It initially included firmware which runs on the ESP8266 Systems, hardware which was based on the ESP-12 module. From NodeMCU the values are transferred to IoT module. In IoT module the sensor values are displayed in LCD ,if the values exceed the range it will automatically gives alarm and send notification through sms and calls. These values are uploaded in the Cayenne cloud channel using MQTT protocol. MQTT is a open source light weighted network protocol that used to transfer the messages to the cloud.This protocol runs in TCP/IP. By using USB to TTL convertor the values are transferred from Arduino to PC. In PC by using KNN prediction algorithm machine learning is performed to predict the abnormality and normality in percentage. The pH value sensor displays the pH value of the soil and display suitable fertilizer and pesticides according to the pH of the soil. DHT11 sensor indicates the temperature value, if the values exceeds the range the buzzer will alarm and the pump will automatically waters the field. If the water exceeds the limited level the water float sensor gives alarm and the pump drains the water till it reaches the level,the pump has been controlled and functioned by Aurdino.

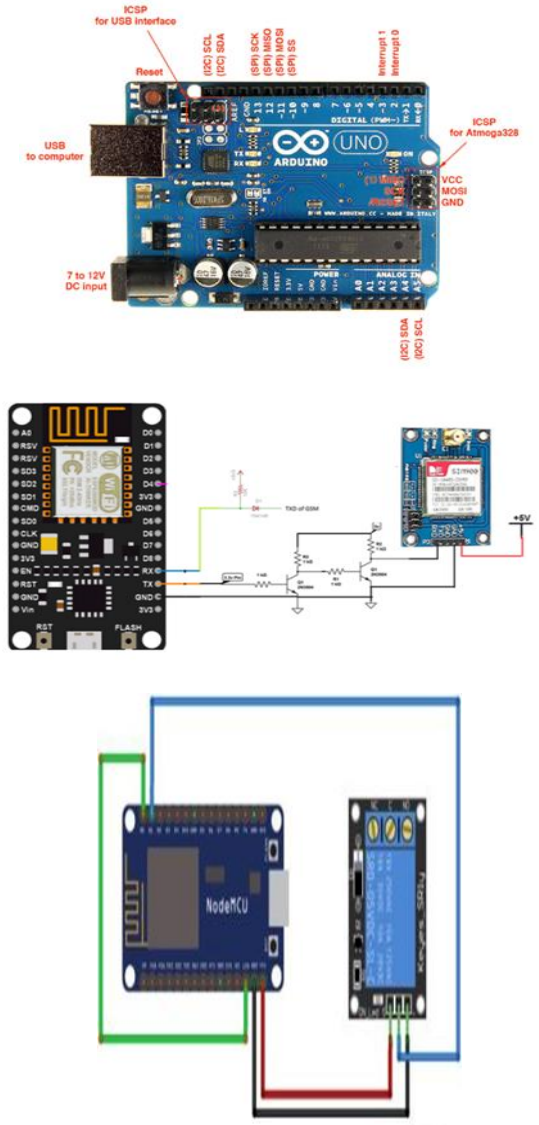

Fig.2 working system

4. System Architecture

The code employed for the system is embedded C and the machine learning is performed by using KNN algorithm and python is used for prediction. The system is initialized on power ON when the condition is detected to be abnormal the buzzer will turn on and notification messages and call are send to the user. The pH of the soil

is displayed in the LCD and the system will suggest pesticides and fertilizers according to the pH of the soil. When the water level increases/decreases beyond the limit the Pump will release and drain water according to the water level present in the field. The direction and speed/pressure of the wind is measured using the wind setup. These values are then transferred to the cayenne cloud using MQTT protocol for prediction process.

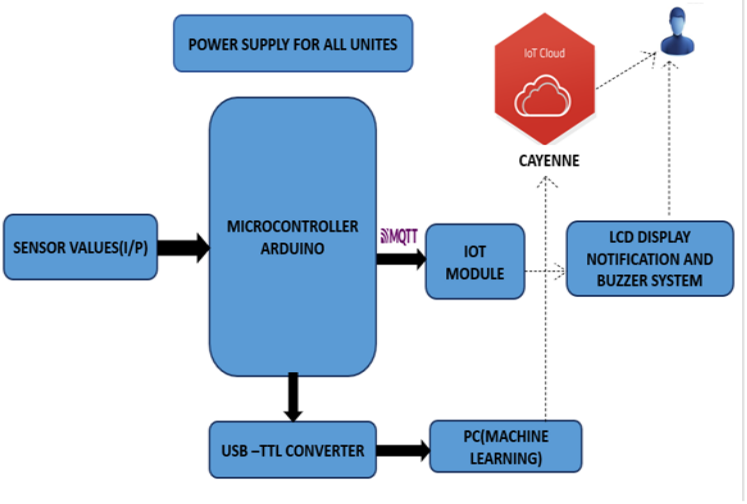

Fig. 3 system architecture diagramm

A. Power Supply Module

The Power supply is a source of electrical power. A device or system that supplies electrical energy to an output load is called a power supply unit. The term is most commonly applied to electrical energy supplies. Power supplies for electronic devices can be divided into linear and switching power supplies. The linear supply is a simple design that becomes increasingly bulky and heavy for high current devices; voltage regulation in a linear supply can result in low efficiency. A switched-mode supply provides rating as a linear supply will be smaller, is usually more efficient but will be more complex.

B. Input Module

In a system there will usually be dedicated modules for inputs and dedicated modules for outputs. An input module detects the status of input signals such as water float sensor, DHT11 sensor(temperature and humidity), wind sensor, pressure level sensor, pH sensor, soil moisture sensor. These input values are given to the Microcontroller, from microcontroller using NodeMCU ESP8266 the values are transferred to the IoT module.

C. IoT Module

The Internet of things (IoT) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuator and connectivity which enables these objects to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing internet infrastructure. In IoT module the values are evaluated by using embedded C programing if the values goes above certain range it will gives alert msg/call and buzzer, Nowthese values from the IOT module is transferred to the cayenne cloud for machine learning and future purpose.

D.CAYENNE PLATFORM

Cayenne is used for real time visualization, monitoring, alert and design IOT solutions. Its a tool used to visualize real time and past records generated in iot and also to control the connected devices .It has the scheduling of lights, motors and actuators .Cayenne is free project builder for Arduino and Raspberry Pi. Its an application which can be accessed through smartphones or computer. Cayenne has an elegant user interface and has an inbuilt communication protocol called MQTT. The Cayenne MQTT Library is a collection of code, known as sketch files, that makes it easy to connect and send data to and from sensors, actuators and devices connected to Arduino boards. Cayenne sketch files can be combined with other sketch files for IoT projects. Its an efficient tool for building an IOT system.

There are 3 major elements within the platform:

- Cayenne App - It is to add, manage and control sensors and actuators from the phone's dashboard from a library of drag and drop widgets. Easily setup microcontrollers and boards. Quickly connect Arduino, ESP8266, Raspberry Pi boards and other devices to be managed remotely.
- Cayenne Server - IoTserver consist of highly reliable industrial computer and non-programming data integration software. It equips standard data management functions developed especially for data collection,

process, saving, notice and publishing. Cayenne server connects to the Internet and supports data exchange with other devices connected to the IoT platform .It has the efficient capability for information exchange.

Fig .4 CAYENNE APP OVERVIEW

- Cayenne Libraries - The Cayenne MQTT Arduino Library provides functions to easily connect to the Cayenne IoT project builder. It has the connection to different source and integrates the system in easier way.

E.PREDICTION MODULE

The Artificial intelligence system built on machine learning algorithm have the capability to learn from past experience or historical data. It provides development or computer program which can access data and use it to learn for themselves .K-NN algorithm assumes the similarity between the new data and available data, put the new data in the categories among the available categories. It is used for classification and regression. KNN is a non-parametric algorithm which does not provide any assumption on underlying data. Non parametric models are statistical models that do not often confirm to a normal distribution as they rely upon continuous data rather than discrete values. In this project by using machine learning KNN prediction algorithm it will classifies the values obtained from the sensor and predict the percentage of abnormality or normality present and it gets updated in cayenne cloud for future predictions and uses.

Fig 5 OUTPUT OF PREDICTION

5. Conclusion

We propose the system for efficient crop protection in agricultural fields. The system monitoring of soil moisture, temperature and humidity, Ph of the land and water level in the land. The water control has been proposed by using automatic pumping system by using Arduino . The proposed system was effective with growth rate, productivity and water saving, also farmer can add fertilizers to the soil according to the Ph level which will be suggested through Emails.

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