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IOT BASED AGRICULTURAL FEATURES FOR SUPPORTING FARMERS

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ABSTRACT
Agriculture sector has an important role in the country's economy. A steep decline in this sector is observed as the crop loss and the suicide rate of the farmers are increasing day by day. The young population of the country is disinterested in this profession and the methods used for cultivation are predominantly unscientific. The climatic conditions and the soil components have drastically changed, thus olden methods of cultivation are not very effective. The soil wants to be clinically tested to find the NPK (nitrogen, phosphorus, and potassium) values. Other parameters considered are temperature, humidity, soil moisture, and soil pH which are obtained in real-time from the sensors. This proposed system uses many sensors to detect the current soil condition and the need of fertilizer or water giving the farmer a comfortable zone to cultivate the crop. The use of these new technologies makes a change from traditional methods to precision farming. Crop loss can be reduced thereby increasing the profit of the farmers. The system is developed as a web application where the farmers can easily check out the suitable crop right into his smartphone. The proposed system is very beneficial for the farmers to take a valuable decision. Thus more young populations with low experience can engage in farming and increase the economic growth of the country.

INTRODUCTION
Agriculture has a key role in the food industry and it is the backbone of our economy. As there is a great increase in population and increasing demand of the economic growth, the agriculture industry should be able to meet it smoothly. But we are facing a great decrease in GDP [4] However, nowadays people are losing hope in agriculture sector due to the unexpected losses they face. One of the major reasons for this is that the traditional way of making assumptions couldn't meet the expectation [3]. The natural disasters just take over the essence of the soil, making it contaminated. Thus the changed soil nature cannot match farmer's assumption. This leads to massive crop loss. Precision farming is not familiar to most of the farmers. They are often ignorant of the scientific methods available in farming. Due to massive pollution of air, soil and water, the soil and the climatic conditions have changed drastically. Thus a change from traditional methods to precision farming is critical nowadays to lift up the agricultural sector. In this paper, we introduce a system through which one could analyze the soil nature and hence plant the crop, according to the nutrients present in the soil.

1.1 OBJECTIVE
Agriculture is one of the professions which is being practiced for decades. But as year passes this profession is losing people's faith. One of the reasons behind this is an unscientific way of practicing agriculture. As time passes, traditional methods are becoming less effective. To overcome this, the system proposed here analyses the given environmental and soil conditions and predict the suitable crop for that situation. Farmers can analyze the soil, its moisture content, whether the soil is alkaline or acidic, temperature and its humidity [1]. This helps to use minimal use of fertilizers and protect the soil from contaminating from chemicals. We do precision farming, by using sensors we are analyzing real time data and sending the same in cayenne app to the farmers' smartphones. Farmers can know the required amount of fertilizer for the land and put it accordingly, instead of dumping excessively [2]. Through this paper, we encourage the unskilled population of the country to choose agriculture as their occupation, by making it more profitable and sustainable.

PROPOSED SYSTEM
1. The components to be used are as follow:
2. DHT11(Temperature and Humidity sensor)

3. DS18B20(Temperature sensor)
4. GSM Module(900A)
5. LDR module
6. MCP3208 12bit 8channel
7. Moisture Sensor module
8. Water pump
9. Warming light
10. Cooling fan
11. Plant cover system for small area during strong summer

This sensor data are taken together in order to get the real time condition of the soil so the farmer can work accordingly. Here we have implanted some automatic features such as the cooling fan, pump, warming light during night covering the plants during heavy sunlight with each step taken by the system the farmer will be notified using SMS by the GSM module so he could be updated with the information or he can also manually control the situation using the app from anywhere in the world.

2.2 HARDWARE COMPONENTS

Raspberry Pi 3 B

The Raspberry Pi is a small single-board computer. There are 40 pins for general purpose input/output. The sensors are interfaced here. The operating system is loaded and data are stored through a micro SD port. The Raspberry Pi 3Bhas a Broadcom BCM2837 SoC and a 64-bit processor. A 5V power supply has to be given to the raspberry Pi. This model has been choose due to its advantages:-

a) Compact Size
b) Low cost
c) Low power consumption
d) All data structures can be used

Soil Ph Sensor

The soil pH can be categorized into three: acidic, alkaline or neutral. It is one of the important factors determining the soil fertility. The general pH ranges of the plants varies from 5.5 to 7.5 with exceptions like Sweet potato, blueberries etc. which prefer acidic soil and pine, oak etc. which prefer alkaline soil. Therefore for proper estimation of PH realtime we use this sensor. The presence of microorganisms and availability of nutrients is also strongly determined by the pH of soil.

Soil Moisture Sensor

The sensor is used to measure the volumetric water content and the other plasmatic materials in soil. The two exposed pads forms the probe of the sensor. More the water in the soil, better conductivity between the pads are observed. This pads are connected to a module and the module is finally connected to a ADC(MCP3208 12bit 8channel) chip to analyses a convenient output produced by the sensor.

DHT11 Sensor

A low cost sensor to measure the temperature and humidity. A capacitive humidity sensor and thermistors are used to measure the air. The digital signal is send to Raspberry Pi. It is commonly used and fairly simple to use.

DS18B20 Sensor

This is pre-wired and waterproofed version of the DS18B20 sensor. Handy for when we need to measure something far away, or in wet conditions. While the sensor is good up to 125°C the cable is jacketed in PVC so we suggest keeping it under 100°C. Because they are digital, you don't get any signal degradation even over long distances!

GSM Module (900A)
A GSM/GPRS Module is an IC or chip that connects to the GSM Network using a SIM (Subscriber Identity Module) and Radio Waves. The common radio frequencies in which a typical GSM Module operates are 850MHz, 900MHz, 1800MHz and 1900MHz.We connect it with the raspberry pi for the interface and to send SMS to the farmer as programmed.

LDR Module
LDR sensor module is used to detect the intensity of light. If you want to make a light controlled switch, a single photoresist or might be useless since you will need the digital signal according to the brightness. This module is designed for that purpose. We use this sensor to check the conation of light and in intensity of the sunlight.

Water pump
A water pump is connected with the relay to the raspberry pi to give the soil the water it need when it dry up.

Warming light
This light can be put on automatically by the system to grow the crop faster and in a good way this is totally automatically controlled by the system but could be manually controlled by the farmer through the app.

Plant covering system
Small area of plantation, like greenhouse a system can be added to close the roof during the day time when the intensity of the sunlight is too high saving the chlorophyll of the plants from getting damaged.

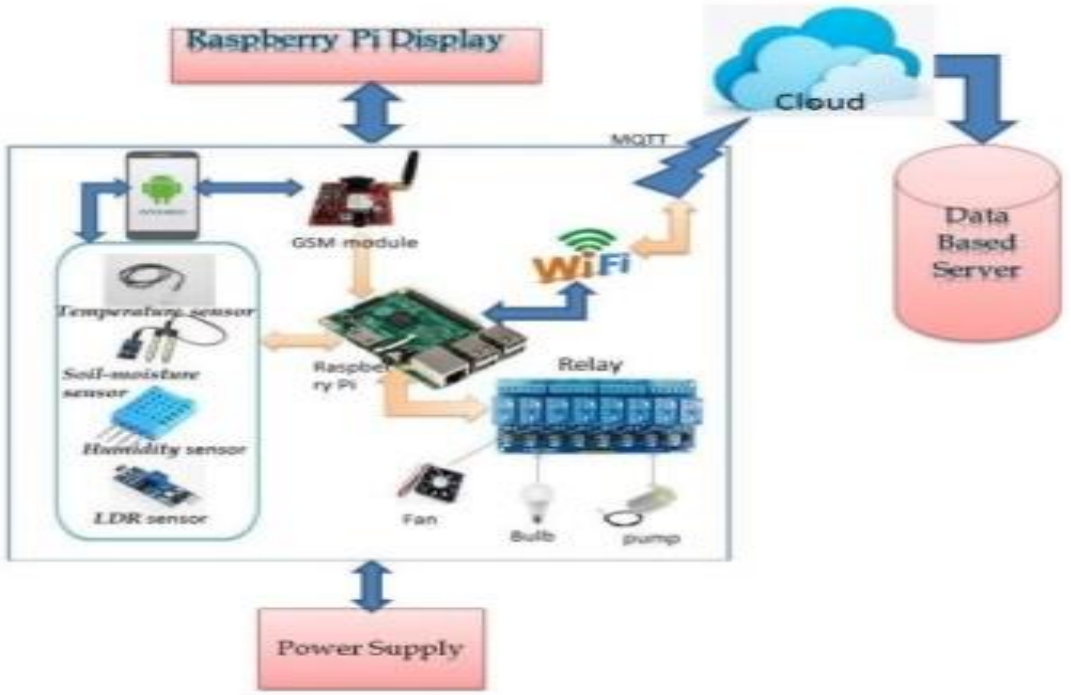

Fig-1: System Overview

2.4 DATASET COLLECTION
The suggested system is a web based application which suggests and advises the suitable crop required for the land. The front end of the system is developed using python. Both the admin and user can login through the dashboard. Admin can do the training of the data and view the user details whereas the user login has the prediction and advisory options. Many clients can be connected wirelessly to this device using the IP address. Three sensors namely DHT11, soil moisture sensor and soil PH sensor, water-pump, ldr- sensor,

warming light are interfaced with Raspberry Pi 3. Python language is used in the development of this system. The collected data is processed by the Raspberry Pi. The intelligence is given to the machine through cloud and saved in CAYENNE platform. The model is trained for over 30000 combinations thus increasing the accuracy. The data has to be preprocessed before training. Categorical values can't be recognized by the machine, thus converting it into numerical values. For example the predicted value rice can be labeled to '0' and maize can be labeled to '1'.

CONCLUSIONS

Agriculture is an important part of Indian economy. The IOT smart device as described and discussed in the paper plays a vital role in improving farmer life as well as increases the crop production efficiency. Educating farmers with visual alerts helps them to make better and efficient decisions. Different devices connected with each other help in evaluating the better data points and analysis which will help Indian government to make better policies for famers. Indian farmers are still unfamiliar with the properties a soil possesses and the best crop that can be grown in the respective fields. The IOT device will help them to easily know each detail of their soil, water level and fertilizer required for the field, thereby, providing sufficient knowledge as required for them to enhance the yields. Weather forecasting and theft protection with visual alerts in their own languages is added as on advantages to their understanding.

Fig-2:- LDR and Moisture Sensors output in cayenne

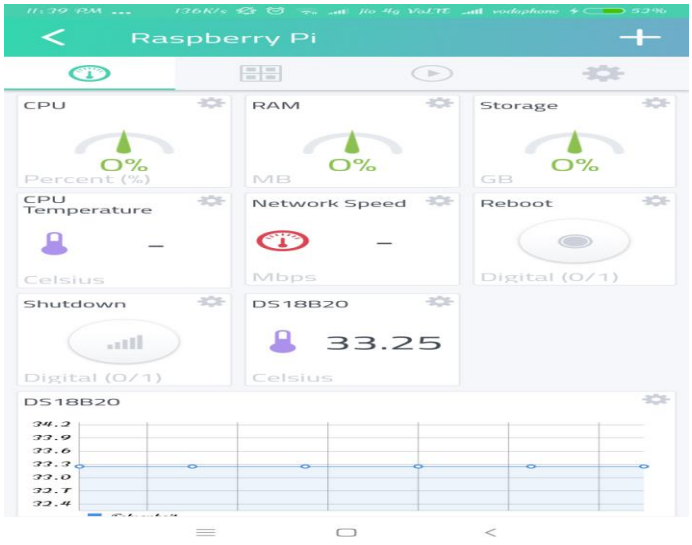

Fig-3:- Raspberry pi dashboard with DS18B20 sensor in cayenne

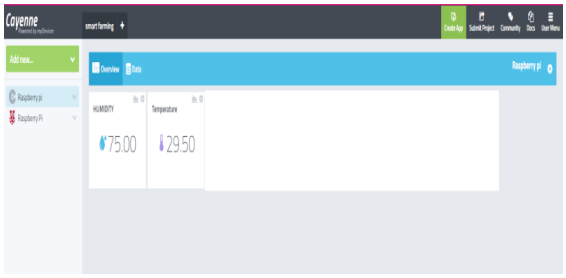

Fig- 4:- DHT11 Sensor output in cayenne

Fig-5:- Water-pump indication output in cayenne

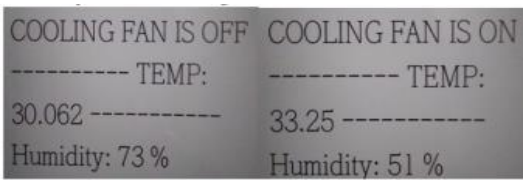

Fig-6:- SMS sent from GSM module

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