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Agriculture Based Crop Selection Using Machine Learning

A Report for the Evaluation 3 of Project 2

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report "**AGRICULTURE BASED CROP SELECTION USING MACHINE LEARNING**" is the bonafide work of "**VISHAL KUMAR(1613113015)**" who carried out the project work under my supervision.

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Abstract : **Agriculture planning plays a significant role in economic growth and food security of agro-based country. Selection of crop is an important issue for agriculture planning. It depends on various parameters such as prediction of weather, Soil pH, soil Moisture, Temperature and Humidity for agriculture planning using machine learning techniques like multiple regression and customized k-fold method and internet of things (IOT) for Remote Monitoring of the soil properties which consists of all the web enabled devices that collect, send and act on data they acquire from their surrounding environments with embedded sensors, processors and communication hardware. One of the reasons for the shortage of food across the country can be choice of unsuitable crop for cultivation. This paper proposed a method named Crop Selection Method to solve crop selection problem, and maximize net yield rate of crop**

KEYWORDS:

Agriculture, Soil Monitoring, IOT, Machine Learning, crop prediction, Sensors, climate, agricultural productivity

Introduction : In a country like India, agriculture is the most prominent sector where the country's major income depends on these fields. About 60% of the land in the country is used for the agriculture and more than 50% of population depends on agriculture. Agricultural Automation especially in developing countries can help on effective yield and reduce human intervention.

Now-a-days Internet of Things (IOT) was being used in various sectors. India being an agricultural country it needs some innovations in the field of agriculture. For Remote Monitoring of the soil properties we need an IOT based system. Internet of things sometimes referred to as the Internet Of Everything(IOE) which consists of all the web enabled devices that collect, send and act on data they acquire from their surrounding environments with embedded sensors, processors and communication hardware.

Various sensors are embedded in the farm to know the soil information. Basically the soil parameters are Soil pH, soil Moisture, Temperature and Humidity. These basic parameters of the soil will help in characterizing the soil and therefore in taking proper decisions. Machine Learning is an emerging technology which is a subfield of computer science and Artificial Intelligence that focuses on the design of systems that can learn from and make decisions and predictions based on the data. Based on the Machine Learning algorithms the crop has been predicted which gives the better yield. This paper is an attempt to study the various Machine Learning as well as IOT techniques applied to the agriculture sector to predict soil moisture, soil PH, and other factors affecting agriculture.

Agriculture helps to meet the basic needs of human being and their civilization by providing nutrient, clothing, shelters, medicine and recreation. Hence, agriculture is the most important enterprise in the world. It is a productive whole where the free gifts of nature namely land, light, air, temperature and rain water etc., are integrated into single primary unit indispensable for human beings. Secondary productive units namely animals including livestock, birds and insects, feed on these primary building block and provide concentrated products such as meat, milk, wool, eggs, honey, silk and lac. Therefore the term agriculture means cultivation of land. i.e.,the science and art of producing crops and livestock for economic purposes. It is also referred as the science of producing crops and livestock from the natural resources of the earth. The primary aim of agriculture is to cause the land to produce more abundantly, and at the same time , to protect it from deterioration and misuse. It is synonymous with farming–the production of food, fodder and other industrial materials. India is the largest producer and consumer of crops in the world, constituting 75% of world production and consuming 90 % of the world production. Other major countries are Myanmar, Kenya, Uganda and Malawi. Crop

accounts for about 20 percent of the total pulse production of the country . India annually imports 2-3 lakh tones of which 95% is from Myanmar. India annually produces about 2.0-2.5 million tonnes and the production has been stagnant in the past 10 years. The shift in cultivation from pulses to commercial crops and lack of technological innovations to increase yields has hindered the rise in output. The major producing states are Maharashtra , Uttar Pradesh, Orissa and Karnataka. Among these, Maharashtra is largest producer of crops which constitutes about 34% and these four states contribute nearly 70% of total output in the country.

Objective :

To observe the growth of the crop under varying real-world conditions (e.g., soil quality, environmental conditions, etc.), typical crop studies involve phenotyping to understand the key factors (e.g., the pH levels of soil, the rate of Nitrogen depletion) affecting growth. Such studies are conducted in natural outdoor environmental conditions and locations where plants are growing, by varying irrigation and the application of fertilizers. Internet of Things (IoT) technologies can lower the cost and increase the scale of such studies via the collection of related time series data from sensor networks. For example, IoT devices can help to capture the pH levels of soils and the rate of Nitrogen depletion as time-series data, and share it among interested researchers and growers for further analysis.

PROPOSED SYSTEM :

In our experimental setup we use Arduino Uno to collect the data and sensors to be used are:

- Temperature and Humidity Sensor (DHT11)
- Gas and Smoke Sensor (MQ2)
- Soil Moisture Sensor
- Light Intensity Sensor

The sensors mentioned above are added to the field for which the readings are needed to be calculated. The DHT11, MQ2, Soil Moisture Sensor, Light Intensity Sensor sends the readings in real time to the cloud server which in which the processing occurs.Machine Learning Algorithm(KNN) is used to calculate the crop which is best to grow in the particular field based on the values received at real time. A standardized dataset containing the minimum requirements for a particular crop is maintained and is used for the prediction of the crop.

HARDWARE COMPONENTS:

NodeMCU

NodeMCU is an open source IoT platform primarily used as a mode of Internet communication. It includes firmware which runs on the ESP8266 Wifi System on Chip, and hardware which is based on the ESP-12 module. The term "NodeMCU" is used to refer the firmware rather than the development kits. The firmware uses the Lua or Arduino scripting language. It is based on the eLua project, and built on the Non-OS SDK for ESP8266. It uses open source projects, such as lua-cjson, and spiffs.

Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software program. Arduino boards are able to read inputs - light on a sensor and turn it into an output - activating a motor, turning on an LED, publishing something online

DHT11

The DHT11 is a low-cost digital temperature and humidity sensor used with Arduino products. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and sends a digital signal on the data pin to the Arduino board. It is fairly simple to use, but requires careful timing to receive the data. The only downside of this sensor is that the user can only get new data once every 2 seconds, so when using library, sensor readings can be up to 2 seconds old.

MQ2

MQ2 gas sensor can be used to detect the presence of LPG, Propane and Hydrogen, also could be used to detect Methane and other combustible steam, with low cost and suitable for this said application. Sensor is sensitive to flammable gas and smoke. The smoke sensors requires 5V power. Smoke sensor indicates the content of air by voltage. More smoke meaning
more voltage. A potentiometer is provided to adjust the sensitivity. Sn02 sensor is used, which is of low conductivity, when the air is clean. But when smoke exists in air, an analog output is produced based on the concentration of smoke. The circuit also carries a heater. Power is given to heater by the VCC and is grounded by GND from power supply. The circuit has a variable resistor.

Soil Moisture Sensor

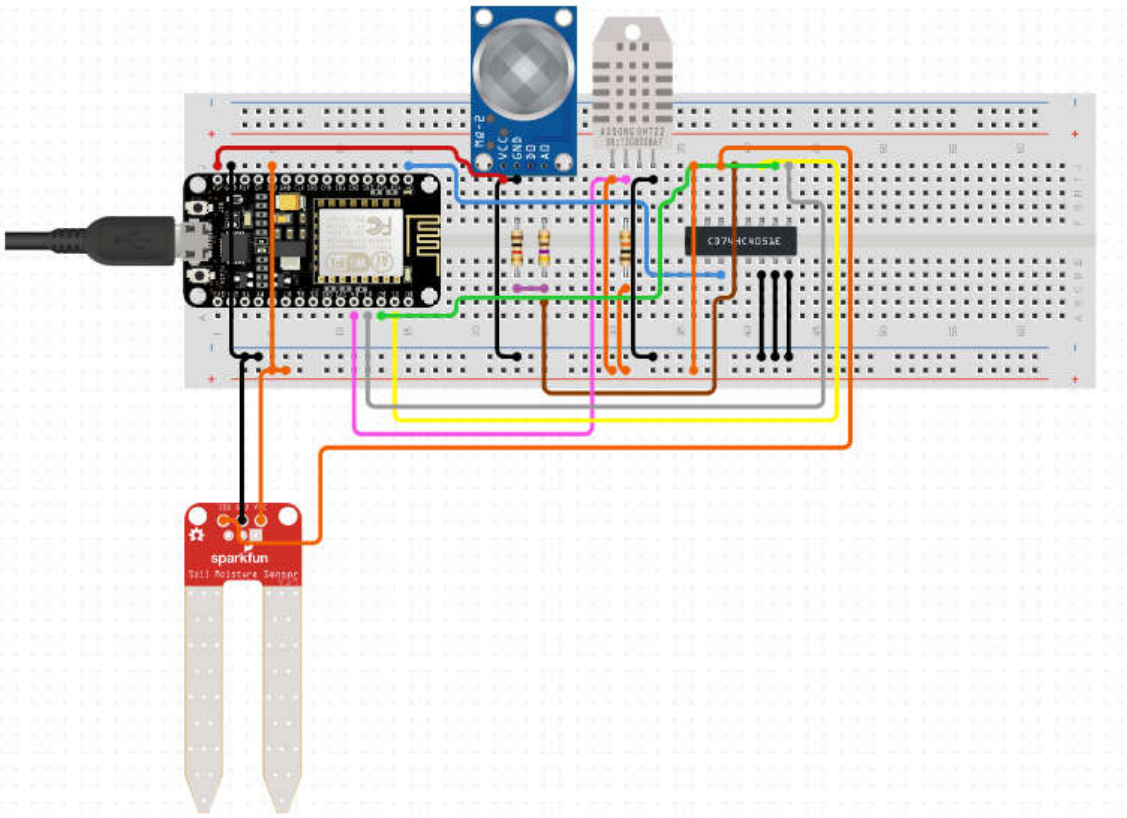
The Soil Moisture Sensor is a simple sensor for measuring the moisture in soil and similar plasmatic materials. The two large exposed pads connected to chip function as probe for the sensor, acting as a variable resistor. The more water means that is in the soil means the better the conductivity between the pads will be and will result in a lower resistance, and a higher signal value will be out.

Light Intensity Sensor

A light sensor is a device used for measuring the intensity or brightness of light. One of the most common that can be used when building a light sensor is a photoresistor. Photoresistors, which also called light detecting resistors are made from cadmium sulfide cells that are sensitive to visible and near infrared light. The resistance of a cadmium sulfide cell varies
inversely with the amount of light incident upon it i.e, bright light causes a low resistance between the two leads of the cell and low light creates a higher resistance. This module is mainly adjusted to calculate the intensity of the light from sun falling on the field

METHODOLOGY :

The main aim of the suggested system is to take various sensor readings from the soil and predict the type of crop that is the most suitable to grow for that particular type of soil. The project has three main components:
i) The Front End- A Prebuilt android app, which is used to access the Dashboard displaying the values from the sensor, the Visualization of the data that is accumulated and the Crop Prediction, where the user is suggested with the suitable crop by the given parameters.
ii) Firebase Cloud- The data taken from the sensors are sent and stored in the Firebase cloud interface from which the data is read and analyzed.
iii) The Hardware- The different sensors which are used to collect various data from the soil and its environment are connected to the NodeMCU module which sends the data to the Firebase cloud. The data is sent at fixed intervals to avoid overloading the cloud.
Thus, the data is collected from the sensors and stored in the Firebase cloud. This data is accessed using a website, where data can be analyzed using Visualizations and also crop suitables for that particular soil can be predicted. The real time readings can also be viewed along with the average reading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