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Agrotech: Soil Classification and Crop Recommendation

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***Abstract*: This project implements a system that can classify the soil and predict the type of crop that will be best suited for the given soil. The type of soil is classified using three attributes taken into consideration. The three attributes are nitrogen, methane and soil moisture. The values of the attributes are obtained using an IoT based system. To the Arduino board we connect gas sensor, moisture sensor, methane sensor to extract the data. The data is then preprocessed to get the clean data. Using these data, we classify any soil given. We have developed an application using html, php pages. Whenever the user logs into the application the user is able to visualize the crop recommendation for their soil. All the data are stored in the database. So the implemented project classifies a given soil and then predicts the crop, the user end to visualize is an application.**

***Keywords*: Crop, IoT, Data, Soil.**

1. Introduction

India is a country which is still practicing agriculture. More than 50 percent of population depends on agriculture. Agriculture plays a major role in Indian economy. This forms the main source of income. Agriculture sector accounts for 23 percent of India's Gross Domestic Product(GDP) and gives employment to the 59 percent of the countries workforce [2].

India is the world's second-largest producer of fruits and vegetables. India has emerged as the second-largest producer of rice, pulses, wheat, spices and spice products in the world. The production of food grains for the year 2013-2014 is 264 million tons which is increased when compared to 20122013(257 million tons) according to the data provided by the Department of Economics and Statics(DES). The agriculture sector is termed as the backbone of Indian economy. Agriculture sector employs the majority of the labor force [5].

The problems faced by agriculture sector are environmental changes, floods, sporadic precipitation, draft etc. To overcome these issues, we have to develop a mechanical arrangement. The profit of agriculture is also depending on the inputs given to the framework. Type of soil, crops, weather conditions, location, availability of water and type of fertilizers are the inputs given to the framework. The crop selected by the farmers may not be suitable for the soil, Sometimes farmer's misguided decisions may lead to low production. To overcome such problems IoT and applications using html, php can be used [4].

Agriculture is the important economic sector of most of the developing countries. Due to lack of getting broad technologies the Indian agricultural methods have continued in undeveloped ways. A farmer must reduce the overuse of fertilizers, reduce the risk of crop failure, minimize the operating costs and maximize per acre yield to be successful. The key to achieve this success is the effective management of input resources like seed quality, fertilizers, water etc. Most of the farmers in developing countries are still following conventional farming methods and facing the issues like low yield, high crop losses etc. Conventional practices like soil analysis and crop investigation are very time consuming. By using IoT and some kind of applications using html, php pages a farmer can make huge profit and use their land more efficiently [7].

2. Problem Definition

Agriculture sector plays an important role in the economy and it is a major contributor to the Indian economy. The majority of Indian population relies either implicitly or explicitly on agriculture for their livelihood. The major reasons that effect the crop production are not knowing the suitable soil, climate for crops, climatic disasters and infectious diseases. This project identifies the soil and recommends the most suitable crop for that soil through a smarter technology. A farmer's decision about which crop to grow is generally clouded by his intuition and other irrelevant factors like making instant profits, lack of awareness about market demand, overestimating a soil's potential to support a particular crop, and so on. A very misguided decision on the part of the farmer could place a significant strain on his family's financial condition. Perchance this could be one of the many reasons contributing to the countless suicide cases of farmers that we hear from media on a daily basis. The most common problem existing among the Indian farmers are they don't choose the suitable crop based on their soil requirements, they just choose based on their intuition. Due to this they face a serious problem in the productivity of the crops. Precision agriculture can be

used to solve this problems of the farmers in the Indian society. It is a modern agriculture technique that utilizes soil characteristics, soil types, crop yield data collection and recommends the farmers the suitable crop based on their site specific parameters. This decrease the wrong choice on a crop and increase profit.

3. Existing Work

Farmers grow crops based on their intuition or they just follow the ancestral pattern. Which may not be always accurate, which in turn may lead to less production of crops. Less production will automatically effect the farmers livelihood and the country. As the most suited crop is not selected for growing the less production problem arises. So it is very important to select the best suited crop for the soil. Now a days farmers take their soil sample to soil testing centers to find the contents of the soil. Many farmers does the soil testing rarely as soil testing centres may be far from their land. As agriculture and production of crops are very important to the country this existing method can't be relied upon. So our project makes it more automatic and easy to classify soil and predict the crop suited.

4. Proposed System

Our proposed application is named AgroTech. It recommends the suitable crop for the particular soil. There are different types of soil and only few crops suits for one particular soil based on the characteristics of that soil. Here we are considering four types of soil named as red soil, black soil, clay and laterite soil. With the help of an IoT system we collect the dataset of various soils. It consists of three attributes like nitrogen, methane and soil moisture. Database is used to store all the datas. We classify the soils by using preprocessed data. Then the application using html and php predicts the crops suited for the given soil. The crops that matches the soil and the contents of the soil can be viewed by the farmers.

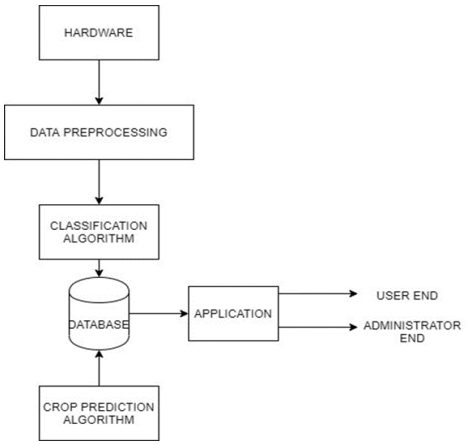

Fig. 1.

The proposed system can be classified into 2 as hardware part and the software.

A. *Hardware*

The hardware part of the implemented system consists of,

1) Arduino Uno

2) Soil moisture sensor

The Soil Moisture Sensor measures soil moisture grace to the changes in electrical conductivity of the earth, soil resistance increases with drought. The electrical resistance is measured between the two electrodes of the sensor. A comparator activates a digital output when an adjustable threshold is exceeded.

3) MQ4 gas sensor

MQ-4 gas sensor has high sensitivity to Methane, also to Propane and Butane. The sensor could be used to detect different combustible gas, especially Methane, it is with low cost and suitable for different application.

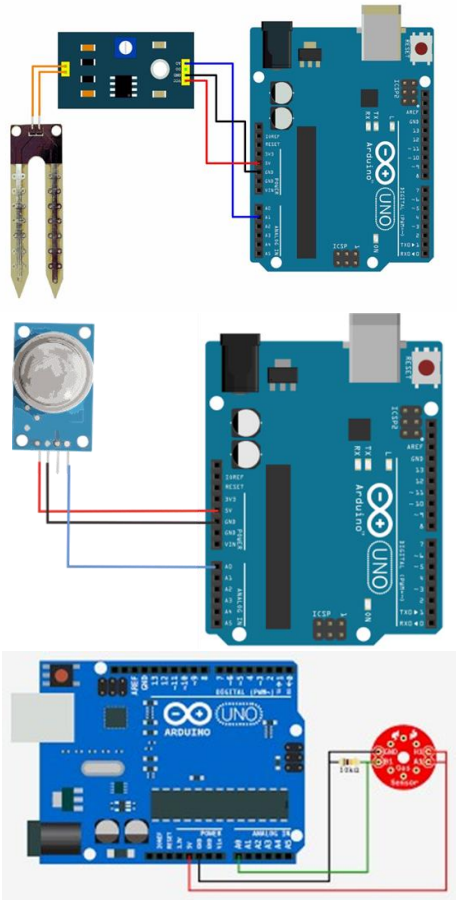

Fig. 2.

4) MQ3 gas sensor

MQ-3 sensor senses the nitrogen content. Nitrogen is a very important characteristic of soil.

Three attributes are considered here for classifying the soil. They are soil moisture, methane, nitrogen vale. All these are obtained using the hardware. We insert the sensors into different samples of soil we have. Then using the Arduino code, we get the value to the serial monitor.

As these values need to be recorded we used a software

named cool term to record the values to our device as text files. We have taken into consideration 4 samples of soil. Black soil, red soil, clay soil and laterite soil. For each of the above mentioned soil we collected the data. A large set of data was collected. Then we did data preprocessing on the collected data using python. We used the platform google colab for the same. Then the data was cleaned and we made an analysis on the data. Based on the analysis we found out the range in which a particular soil will belong to. Finally, we wrote a program to classify the soil.

B. Software

This section shows the output to the user. Here we create the web pages and connect them to the database.

1) Administrator

A login page is created for the administrator so that administrator enters the attribute value to the database. The login page is created using php, html and css. After the successful logging another page displayed which shows to enter the location and the attribute values. So the values entered by the administrator will be stored in the database.

2) User

Whenever a user logs in user.html page is loaded which will insist the user to select the location and a submit button is given in that user page. When submitted web page will be displayed which will show the type of soil and also the crop that will be suitable for the soil.

3) Database

Two different database are created one for user and another for the administrator. The database is triggered each time the administrator enters a new data to the database. So that the crop for that particular soil can be displayed.

5. Specifications

The experiment was conducted with the environment with the following specification,

Processor: Intel(R) Core(TM) i3-6006s CPU @2.00GHz 2.00 GHz

Installed memory(RAM): 4.00GB (3.89 GB usable)

System type: 64-bit Operating System, x64-based processor

6. Result

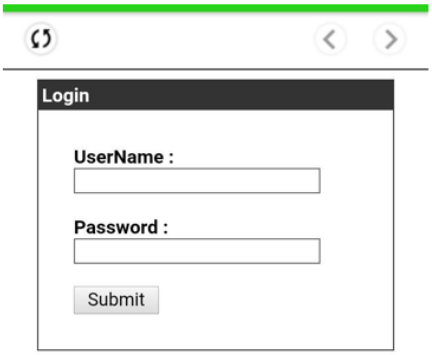

Fig. 3. Login page for administrator

Fig. 4. Laterite soil

Fig. 5. Red soil

Fig. 6. Clay

Fig. 7. Black soil

7. Conclusion and Future Work

India is a nation in which agriculture plays a major role. In prosperity of the farmers, prospers the nation. Thus our work would help farmers in sowing the suitable seed based on soil requirements to increase productivity and obtain profit out of such a technique. The main stream Indian population depends on agriculture for their livelihood. The major reasons that effect the crop production are not knowing the suitable soil, climate for crops, climatic-disasters and infectious diseases. This project identifies the soil and recommends the most suitable

crop for that soil through a smart technology.

The proposed system assures that crop yield produced will be maximum by classifying soils based on their features and thus recommending the best crop suited to the farmers.

In future we can add climate as a parameter to the project to find the suitable crops. Soil quality can be checked using the agrotech application. So that the application will be useful for not only farmers but also civil engineers. Before construction of a building it is important to identify the quality of the soil. We have a plan to add on the feature to our application.

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