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Soil Fertigation System for Desired Crop Using IoT and Machine Learning

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***Abstract*—India is a nation of agriculture , its prime importance is to focus on farming and improving the method use for farming. In India agriculture with its allied sectors, is the largest source of livelihoods in india.The agricultural process like irrigation or testing the nutrients content of the soil in terms of fertility taken care of, this is called precision farming. The fertility of the soil is measured by the amount of nutrients present in the soil. There will be two types of nutrients present in the soil are macro and micro nutrients, also water, pH etc.**

In India most of the farmers use the manual technique to use the fertilizers in their agricultural land. Addition of the fertilizers in the right amount is of great importance as excess addition of the fertilizers can harm the plant life and reduce the chance of great yield. Main objective of this project is Soil fertigation system for desired crops using IoT and machine learning. In the proposed system using different sensors measure macronutrients of the soil and transmit the data to the cloud. The user can view the soil fertility at their mobile website. The software system has the intelligence to recommend the fertilisers that are required to be used to suit the needs of the desired crop, thus improving the quality of the soil and in turn, increasing the yield. Overall, the proposed system helps farmers to gather real-time information about various soils, their fertility level, suggest crops and fertilisers at the convenience of the websites.Finally, this project effort will help farmers to make the right decision, gain better yield and economic advantage.

***Keywords*—Smart farming, Irrigation and Fertilization control, Internet of Things, irrigation system.**

1. INTRODUCTION

For farmers soil analysis is the important thing. Soil has a great supply of nutrients. Plants need a controlled environment for healthy growth. Soils are used to continue the growing process so all the nutrients present in the soil get removed whenever the crop is harvested. Low nutrients may contain the deficiency in the crop as well as low production. For healthy crop growth nutrients need to be restored in the soil. When a great amount of the nutrients are present in the soil the plant growth is healthy. So framers need to add the perfect and great amount of nutrients in the soil for healthy crop growth. Organic fertilizers are more important for healthy growth. The nutrients which cannot be replaced by any other elements are called essential nutrients. Which is necessary for crop growth. In nutrients Nitrogen(N), phosphorus (P), potassium(K) are the Main nutrients are in the soil. If we know the right amount of N, P, K needed for the soil. It will help to produce healthy crop growth. With the help of nutrients the plant grows in good conditions The aim of the project is using different wireless sensors to measure the amount of nutrients needed for the soil.

2. LITERATURE SURVEY

[1]. Detection of Nitrogen ,Phosphorus and Potassium nutrients of soil using optical transducer, Marianah Masrie , Mohamad Syamim Aizuddin Rosman, Rosidah Sam and Zuriati Janin ,IEEE 2017.

In this paper [1], optical transducer is used to measure the amount of (N, P, K) content of soil.Optical Transducer makes use of light detection system and provide LCD display control functions ,First uses three LED"s with different wavelength .LED and photodiode was placed in same length .Light is reflected and detected by the photodiode to detect the length of transducer. Difference in light intensity level will be calculated,absorption rate was calculated and determined the deficiency of nutrient content in soil in three levels high , low,medium, .Here the displayed values of nutrients are compared with threshold values and then decide the level of nutrients.

[2]. Automated fertigation system for efficient utilization of fertilizer and water, Cyril Joseph, I Thirunavukkarasu, Aadesh Bhaskar, Anish

Penujuru,IEEE 2017

This paper[2] gives an implementation of a system consisting of four step soil moisture monitoring and control ,fertilizer mixing and delivery ,Wifi module (ESP826) connection and configurations and user interface. A timer is set for detecting moisture of a soil twice a day.It detects the moisture content and if it is less then it gives the message for supply of water. Water soluble fertilizers are used .After calculating the amount of nutrients required it sets the timer for delivery of fertilizer according to the requirement. The Wifi module is connected to the arduino board for creating the communication. Act as a client that can access the internet by connecting to a router.

[3]IoT Enabled Plant Soil Moisture Monitoring Using Wireless Sensor Networks A.M.Ezhilazhahi1 and P.T.V.Bhuvaneswari,IEEE 2017.

In this paper[3], implementation of the system is done by creating a greenhouse automatic control system based on a wireless sensor network to monitor the indoor conditions. Based on the information collected,
the indoor conditions are controlled and monitoring of the crops is carried out which secure the crop from blight and harmful insects. The data gathered is stored either in a database or in a server which is monitored by the user remotely. They monitored the growth of sweet potatoes under a controlled and exposed soil environment. According to limitations in parameter value, greenhouse setup is monitored via relay switches connected to Arduino based embedded units. They have created a temperature and humidity sensor that is placed on plant species. The data from these sensors are gathered continuously and stored in atos pc software which is open source. Then it is uploaded to the server through pc server for remote monitoring.

[4]. Soil Analysis and Crop Fertility Prediction, Komal Abhang Surabhi Chaughule, Pranali Chavan, Shraddha Ganjave, 2018.

In this paper[4], it uses a pH meter to detect the pH content of soil this value is used to estimate the N,P,K values , then this value is used to determine the fertility of the soil.For this testing of various soils was done . This value is inserted into the software then the comparison is done with the database using the classification algorithm.Based on the classification it will give the list of suitable crops for that particular soil.

3. SYSTEM ARCHITECTURE

A system architecture is an abstract architecture,to define a solution based on the concepts. Its main focus is to achieve a life cycle. It helps to describe the entire system.

3.1 Block Diagram

The block diagram is given in Figure 1. Each block is described in this following Section.

Fig. 1 Block Diagram of Proposed System

A. DESCRIPTION:

In the Project using different sensors through which content of nutrients will be detected and then compared with a dataset through machine learning using classification algorithm which will then give output to the user which will tell the need of fertilizer required for the crop.

Sensor Circuit: This module includes two different types of sensors: pH sensor and moisture sensor. All these sensors are placed inside the pot in such a manner that all the information related to plants such as the moisture content of the soil and the pH can be taken accurately.

pH Meter: The simple method of measuring soil pH by soil meter. Soil pH helps the farmers to get the right value of the pH soil using a pH meter. This tool helps the farmers to get the perfect value of the soil pH. Though the knowledge of the soil acidity is very helpful for the purpose of agriculture.

Moisture Sensor: Moisture sensor helps to sense the moisture of the soil.with this tool the farmers easily get the value of soil moisture.

Flask Application: It is a User Interface Design. used this application to create a website.

Logic Regression: Logistic regression is a supervised classification algorithm used to anticipate the probability of a target variable. It is the simplest ML algorithm that can be used for various classification problems such as spam detection, diabetes detection etc.

Support Vector Machine: In (SVM) support vector machines are supervised learning algorithm models with associated learning algorithms that examine data for classification and regression analysis.

Naive Bayes: Naive bayes is an easy machine learning algorithm based on the bayes theorem, used in a wide variety of classification tasks.It is not a single algorithm but a family of algorithms where all can share a common principle.

Decision Tree: Decision tree algorithm is a member of the family of supervised learning algorithms. The motive of using a decision tree is to generate a training model that can be used to anticipate the class or value of the target variable by learning simple decision rules inferred from training data. It is an illustration representation for getting all the possible solutions to problems and decisions based on given conditions.

Random Forest: Random forest is a machine learning algorithm which helps to solve the both classification and regression problems. It predicts data with high accuracy.

Ada Boost: Ada boost technique follows a decision tree model with a depth equal to one. Ada boost is nothing but the forest of stumps rather than trees. Ada boost algorithm is developed to solve both classification and regression problems.

Neural Networks: A neural network is an algorithm that attempts to identify underlying relationships in a set of data through a process that copies the way the human brain operates.It helps to understand the impact of increasing and decreasing the dataset vertically or horizontally on a computational line.

Graphical Representation:

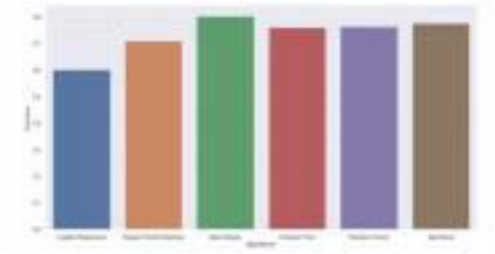

Fig2. Precision Graph

Fig 2.Shows the precision quantifies the number of class predictions that actually belong to the positive class.precision also called positive predictive value.The ratio of correct positive prediction to the total predicted positives.

Precision =TP/TP+FP

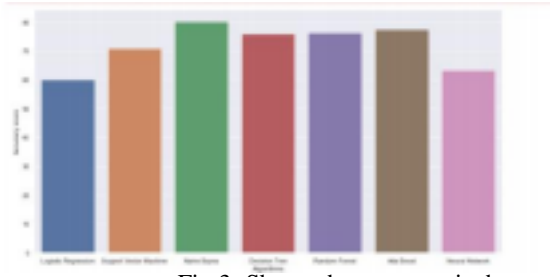

Fig 3. Accuracy Graph Fig 3. Shows the accuracy is the most intuitive performance measure and it is simply ratio of correctly predicted observations to the total observation.

Accuracy =TP+TN/TP+FP+FN+TN

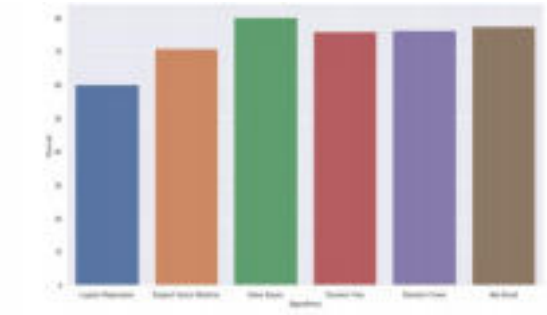

Fig 4. Recall Graph

Fig 4. Shows recall is calculated as the number of true positive and false negative.

Recall = TP/ TP+FN

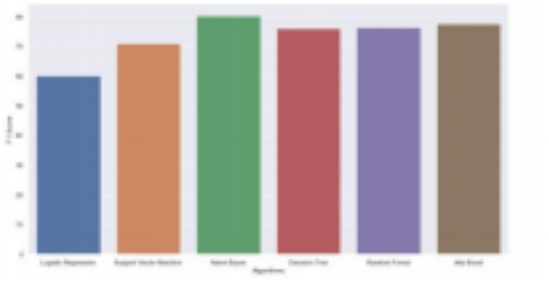

Fig 5. F1 Score Graph

Fig.5 shows F1 score conveys balance between precision and recall.

F1 Score = 2*(Recall* Precision)/(Recall+Precision)

Website Display: Fig 6.Website is to display the values of pH and moisture as well as the N, P, K Values. Data stored in the cloud that can be read on the website display. Website is help to display the output.

Fig 6. Display of Website

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