

A SMART AGRICULTURE 2019

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Abstract- Agriculture is the main source of income for Indian Economy. The Indian agricultural sector accounts for almost 18% of India's gross domestic product (GDP) and it also promises employment to half of the country's workforce. The main goal is to provide facts on soil testing and irrigation to minimize the manual nursing of the field and help the farmers to rise the agricultural production. The soil is being tested using several sensors and using that farmers can cultivate the suitable crop that suits the soil based on the Data received. Detection of plant's diseases can be done using image processing technique. And it also includes pest detection and its control by using Acoustic sensor and ultrasonic sound emitter helps to retain the pests away from the farm. It alerts farmers through a message. All the information is sent to IBM Bluemix Cloud by ZigBee protocol. A direct communication link is set up between farmers and the consumers without the involvement of any middleman via mobile app.

Keywords—*pH sensor, NPK sensor, Temperature sensor, Humidity sensor, moisture sensor, Irrigation system, MATLAB*

I. INTRODUCTION

Agriculture is the elementary support and the backbone of Indian economy. In the earlier decade, it is witnessed that there is very less advance in agricultural sector. Food prices are reaching great heights day by day because good and healthy crop production level is being declined[1].

Even though many advancements has taken place in field of agriculture, the farmer is unable to get profitable yield due to the lack of knowledge on the nutrient's required and also on the parameter's like PH, temperature, humidity, moisture etc. The nutrient's like Nitrogen, Phosphorus, and Potassium (NPK) play an important role in plant growth. Low nutrition level has many bad impacts on plants which leads to multiple disorders in plants which further leads to low yield. The quality of recommended macro nutrient's like NPK is purely reliant on the kind of crop and on plant progress status. The main idea behind this is to measure the real time values of PH, humidity, moisture, NPK etc. by using sensor nodes which is sent to cloud by ZigBee protocol. The data is analysed by datamining technique for a specific crop which can be obtained via mobile application. Infection on plants shows the major reason for reduction in both the quality and quantity of farming foodstuffs. The

analyses of plant infection refer to the readings of visually evident outlines on the plants. Checking of strength and infection on plant shows a main part in fruitful farming of crops in the farm. In opening days, the observation, scrutiny of plant ailments were done physically by the proficiency person in the field which needs incredible quantity of work which leads to excessive handling time. For plant disease recognition image processing technique can be used. In utmost cases ailment indications are observed on different parts of the plants. To avoid the yields from vermin and their linked diseases is a tough job for agriculturalists. The vermin's can damage crops, diminish the yield and also effect negatively on crop quality. Farmers use variety of methods to destroy the vermin. Identification of plant disease is essential before dealing with it. Without proper identification, the use of insecticides grounds many adverse consequences such as vermin's can cultivate resistance to pesticides leading to changed results and it also kills many supportive pests leading to an growth in the insect population. To control the pests in the field ultrasonic field emitters are used thus avoiding the crops from getting destroyed and also alerts the farmers over message. There has to be straight relationship between the growers and consumers. With the world becoming more technical oriented, smart phones has become easily available for people even in the countryside. A mobile app will affluence this problem. All the particulars of the necessities needed for the functionality such as Specifics of products from farmers and consumers, Skilled analysis, Cost approximation and value check can be known easily within less duration.

II. LITERATURE SURVEY

The study in farming area is boosted in numerous parts to advance the class and measure of yield of agriculture.[1] The authors major goal is to gather real time data of farming that delivers easy access for farming facilities such as signals through SMS and gives instructions on weather conditions by the combine approach of IOT and wireless communication .[2] In this paper the soil is verified by means of several sensors such as pH sensor, temperature sensor, and humidity sensor. The crop that suits the soil is advised based on the sensor's reading. [4] This targets at restoring the levels of Nitrogen, phosphorous, potassium in the earth by estimating the volume of nutrients present. [5] The analyse of nutrients in the soil that is measuring Nitrogen (N), Phosphorous (P), Potassium (K) values is done by by

means of sensors. Subsequently, sensors are used to send the data to the cloud through ZigBee protocol. [6] This system receives the data from the sensors and sends it to the cloud which can be accessed through mobile application. [8] This system consist of various sensor across the field which will automatically irrigate the field using the valves. It also includes pest control using an ultra sonic emitter and protects the crop from the field. [9] wireless sensor network helps in monitoring and detection of pest and plant diseases. [10] In this plant leaves are used for the detection of plant diseases. This also includes techniques like segmentation and feature extraction in the plant disease detection. [12] Image processing using MATLAB is implemented to `detect the weed areas in an image we took from the fields. [13] the demand of the wholesaler and retailers are matched with the production of the farmers through electronic exchange and a direct communication link is set between them. [14] This provides a platform for the farmers to sell their crops directly to the consumers through the mobile application without the interference of any middleman. The crops are tested and graded based on the quality and later it is bought to marketing.

III. PROPOSED METHODOLOGY

In figure 1, A system is developed to maximize the agriculture yield by nutrient analysis like pH, moisture, temperature, humidity and NPK using sensors and the data Analysis Is done through the datamining technique and assessment for specific crop is made via mobile application. In further stages the plant diseases are detected through image processing using a tool developed through MATLAB, also pest is detected through WSN, which is controlled through Ultrasonic sound emitters and also alters the farmers through message. This system also proposes of automated irrigation based on soil moisture. Finally, the direct communication is set between the farmers and the buyers which helps in avoiding the involvement of middle man.

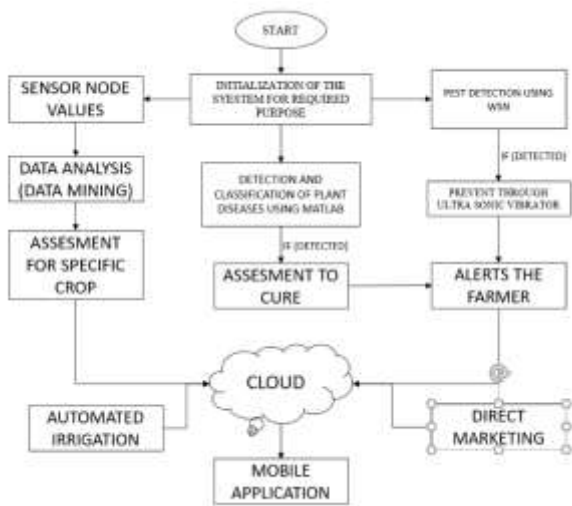


Fig (1) Proposed system

I. Soil testing

The system consists of many sensors to measure the pH, moisture, humidity, temperature and also soil nutrients like Nitrogen, Phosphorus, and Potassium (NPK).



Fig (2) sensors block diagram

- **Temperature sensor**

LM35 is an Integrated temperature sensor specially designed for measuring the surrounding temperature. the main advantage of this is the output is directly proportional to the surrounding temperature hence its accuracy is more compare to the thermistor. Its self heating is about 0.1 °C hence power consumed will be less.

- **Soil moisture Sensor**

Soil moisture sensor is mainly used to do the volumetric analysis of the water content present in the soil. Which helps in the suitable irrigation of plants. It increases the quality and yield of the crop, by providing the required amount of water using relays through microcontroller.

- **pH sensor**

A pH sensor consist of electrodes which measures the concentration of hydrogen ions, which indicates

whether the soil is acidic or alkalinity. Here pH sensor used is a analogy pH meter. The output is obtained by connecting BNC connector and PH2.0 sensor interface to microcontroller.

- **Humidity sensor**

A humidity sensor measures moisture content present in the air. The amount of moisture present depends on the air temperature. The humidity changes with change in air temperature Which is important factor to increase the yield by looking into other surrounding parameters.

- **NPK sensor**

The NPK sensor detects the amount of nutrients present in the soil. Where NPK are the major nutrients for the growth of the plant. based on the NPK value received from the sensor which is sent to cloud through ZigBee and analysed through datamining technique. Thus, the suitable crop is suggested to farmer via mobile application.

- **MSP430**

MSP430 is a microcontroller which operates at low power.it is very effective for the low power applications where the batteries cannot be replaced repeatedly. A 9V battery is enough to operate the microcontroller over a period of 10 months.

The sensors are connected to the MSP430 via I2C bidirectional bus to process the data received from each of the sensors. The I2C bidirectional bus provides a direct communication link between integrated circuits. The program of the sensor collects the temperature, pH, soil moisture, humidity, NPK values and analysis for specific crop is done through datamining technique. The collected data is processed and extracted parameters are transmitted to the cloud through the ZigBee protocol. A mobile application Is developed that delivers results to concerned person. The information delivered by the app helps the farmers to increase the yield and can minimize the crop production cost.

	SENSOR	OUTPUT VOLTAGE	OUTPUT CURRENT	TEMPERATURE	ACCURACY
TEMPERATURE SENSOR	LM 35	4V-30V	60uA	-55 to +150°C	±3/4°C
MOISTURE SENSOR	YL-69	3.3-5V	35mA	-	-
PH SENSOR	PH SENSOR	5V	-	0-60 °C	±0.1PH
HUMIDITY SENSOR	DHT11	3V-5.5V	100uA	0-50 °C	±5% RH

Fig(3) sensor specifications

ii. Automated irrigation

This proposed system consists of sensors like soil moisture sensor, humidity sensor and temperature sensor. These sensors collect the present soil moisture, humidity and temperature of the surrounding. This data is taken by microcontroller and sent to cloud through ZigBee protocol. This data analyses the water required for the proper irrigation of the plants. We also gather the moisture requirement for various crops in different climatic conditions. This helps the system to start the irrigation on its own by analysing the data. The moisture sensor measures the moisture content present in the soil for the specific time interval. If the moisture content is lesser than the threshold value the system commands the microcontroller to open the valves using the relays and allows the required amount of water to the field. When the values are reached to its threshold the valves are automatically closed. By this technique we can improve the crop yield and also avoid the wastage of water.

iii. pest detection and prevention

a) pest detection

Pest detection and prevention plays a major role in improving the crop yield. Here Pests are detected using WSN, here we make use of acoustic sensor which is nontoxic, remotely operated and very efficient in the detection of hidden infestation.

This sensor is the best for detection of pest with more efficiency and less cost. This system is designed in such a way that it monitors the crops by monitoring the sound level of the Pest. When the sound crosses the threshold, it alerts the farmers of the specific area from where the infestation is taking place.

b) pest control

Pests are one of the main reasons for the reduction of crop yield. Hence prevention of the pest using proper pesticides in proper quantity is necessary. Unnecessary usage of pesticides leads to loss of crop yield. Hence in this proposed system we use an alternative technique i.e. we use an ultrasonic sound emitter which is placed in different places of the field. They emit high frequency, short wavelength sound waves which are about 20KHz, which is too high hence that cannot be heard by human ears. This sound wave varies from 50KHz to 240KHz which is scientifically proven to get rid of pests. It affects the pest's nervous system by causing irritation and keeps the pest away from the farm. By using ultrasonic sound emitter we can avoid the pest which is cost effective and also helps the plants to grow healthy and reduces the usage of pesticides in fields.

iv. Plant Diseases

The elementary steps for detection and classification of plant disease by image processing using MATLAB tool.

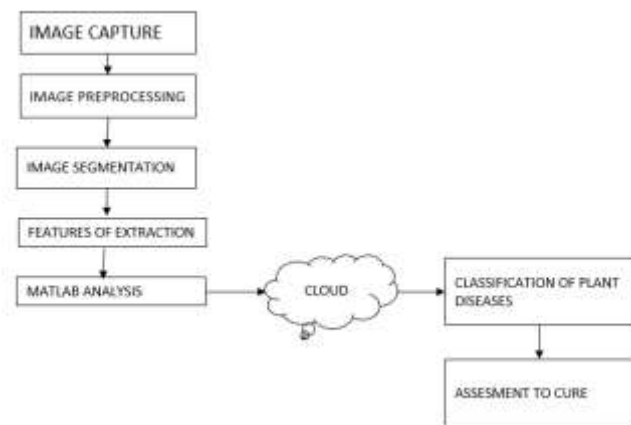


Fig (4) disease detection and prevention

A) Image capture

The plant leaf images are taken through camera. This image is classified into Red, Green and Blue form.

B) Image Pre-processing

The image processing technique is used to remove noise and other unwanted objects present in image by different image pre-processing techniques. The leaf images are cropped to get the required image region. The smoothing filter is used to smooth the image. The RGB images are converted into grey images for further processing.

C) Image Segmentation

In this the images are divided into many parts of having similarity. The separation of images can be done through various methods k-means clustering, and by converting RGB image into HIS model etc.

D) Feature Extraction

Feature extraction plays an important role in the identification of an object. The feature of extraction is used in many applications of image processing. Colour, texture, morphology and edges are the main features which are used in detection of plant diseases.

E) MATLAB analysis

After feature extraction is done, the special tool is developed through MATLAB which detects and plants diseases. Which is sent to cloud through ZigBee protocol and suggests the farmers to cure via mobile application.

Finally, the crops are rated based on the quality (high, medium, low). This makes the farm products easily accessible. Hence it provides freedom to access crops of our choice. This will help the farmers to make the selling decisions based on their convenience. Farmers can connect socially and form cooperatives (like amul, more, reliance) through mobile application.

RESULT ANALYSIS

The proposed system is implemented and tested. The sensor nodes functionality is verified and tested by requesting, receiving and evaluating the sensors data, transmitted from sensing nodes to the base station. The data transmission is realised via the wireless ZigBee protocol. Later the working of this proposed system is tested by sending data to and receiving data from the platform. Then it measures humidity, temperature and other parameters. And this crop details are logged at the CPU and is saved; it is logged on cloud by the MATLAB. This data in cloud can be obtained by mobile application. The cloud-based log gives the users the opportunity to obtain this information from anyplace and any time.



Fig (5) crop recommendation's



Fig (6) Diseases detection

CONCLUSION

The proposed technology helps in determining the nature of soil by extracting the contents of the soil using variety of sensor nodes. This particular system helps the farmers in finding the suitable crop for their field. It provides the suggestion about the suitable crop that can be grown by analysing the sensor values. In the cloud the comparison of sensor values with the threshold values takes place. The images of the crops are taken and monitored in such a way that they can protect the crops from pests and insects. Detection of diseases of plants is also done using MATLAB processing in order to protect plants and produce good quality plants. This helps to monitor the crops anytime

from any place using the developed app. The main purpose of this system is to increase the agricultural yield and reduce the investment of the farmer.

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