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Prevention of Crop Disease in plants (Groundnut) using IoT and Machine Learning Models

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Abstract - *Plant disease is one of the most vital among the crops which annoys the farmers. In order to help the farmers, it is a vital role to prevent the crop disease. If not done then huge amount of loss will happen to them. To address this problem a naïve model is designed for the monitoring of crop disease with help of the sensors. Internet of things (IoT) is a promising technology which provides efficient and relevant solutions towards the modernization of agricultural domains. Humidity and Temperature sensor is deployed to verify the humidity and the atmospheric temperature of the plant. Similarly soil moisture sensor is deployed and to get status of the soil. Sensors, webcam, GSM and Controllers are used for receiving the data from the groundnut farm. The received data is analyzed using machine learning models (XG boost) and so the prediction of crop disease is done. Thus a novel approach for preventing the crop disease (Groundnut Crop) is proposed and the prediction is intimated to farmers through SMS/E-mail.*

Key Words: **Plant disease, Crop monitoring, XG Boost, Sensors, IoT.**

1. INTRODUCTION

IoT is an integration of multiple devices which can communicate sense and interact with their internal and external state models. IoT has become the best performance for next generation technology which can impact the whole spectrum with extended benefits which are advanced connectivity of end devices, system and services. IoT offers appropriate solutions for multiple applications such as IoT-cloud enabled CMM index for smart agriculture monitoring system, using cloud IoT for disease prevention of in precision agriculture, IoT based smart agriculture: Towards making the fields Talk. A significant amount of work has been done regarding IoT technology in agricultural area to develop smart farming solution. IoT has brought a great revolution in agriculture environment by examining multiple complications and challenges in farming [1].

Now a days with the advanced technology it has been expected that by using IoT agriculture and technologies are finding out the solution of those problems which farmer are facing such as diseases for plants, cost management and productivity issues. The IoT technologies have detected all these issues and provide solutions to increase productivity while lowering the cost [2]. Efforts made on wireless sensors networks enable use to collect the data from sensor devices and send it to the main servers Data collected through sensors gives information about different environment condition to monitor the whole system properly. Monitoring the environment conditions or crop productivity is not only the factor for the evaluation of crop but there are many other factors which effect the crop monitoring movement of an unwanted object, sudden dry of water and attack of disease etc. Moreover, IoT provides a well-organized scheduling of restricted resources which makes sure that the best use of IoT enhances the productivity.

2. RELATED WORK

Several Plant diseases seriously affect the normal growth of plants, the yield and quality of groundnut plant work using IoT. Detection of diseases in groundnut plant is utmost need for farmers and agricultural experts. The main aim is to detect plant diseases using IoT. In most of the plants the disease will takes place on plant leaves. Hence, in the proposed work we have considered detection of plant disease present on ground nut plant leaves. The discrimination of normal and affected plant leaf can be measured based on variation in temperature, humidity and color [4].

This methodology of image is analyzed extensively applied to agriculture science to maximum protection to plants which can ultimately lead to be better crop management and farming. We have presented design and development of soil, humidity, atmosphere and color monitoring system for implementing crop disease in plant using IoT [5]. India's most of

the farmer grow groundnut but did not get yielding due to bugs in groundnut. In this proposed design system used Arduino for monitoring the soil and temperature. We have presented Arduino microcontroller based on soil moisture control and temperature and humidity sensor using real time monitoring sensors. This method is to develop automatic performing operation of dispensing pest control agents, self-guidance on the crop without any user interference and create an environment for the optimum growth of the crops in a real time monitoring. We have presented a color monitoring sensor (web camera) and suitable evaluation algorithm (XG Boost) for plant recognition [6]. The system developed is based on programmable color sensors for real-time recognition and identification of crop plants using XG Boost algorithm. A color transformation structural for the input RGB (Red, Green and Blue) image was designed firstly and then RGB model was converted to HSI (Hue, Saturation and Intensity), YUV and gray models [7]. The background was removed and then the disease spot image was segmented with region growing algorithm (RGA).In earlier, many traditional machine learning algorithms have been used to implement this process. Recently, several researchers have studied plant leaf disease detection and classified with neural network algorithms and image processing. Also, the research studies showed that convolutional neural network have been used majorly for many plant diseases recognition and showed good results [14]. Finally, the diseases were recognized and data was analyzed sent E-mail/SMS to crop owner. We have presented implementation of IoT with image processing sensors in plant growth monitoring system. This work combines image processing and IoT to monitor the plant and to collect the environmental factors such as humidity and temperature.

3. SYSTEM DESIGN

The different sensors used are temperature and humidity sensor and soil moisture sensor. The information collected by the sensors is sent to the Arduino microcontroller. Crop monitoring is done through web camera are used to collect information by capturing images and sent to Arduino microcontroller.

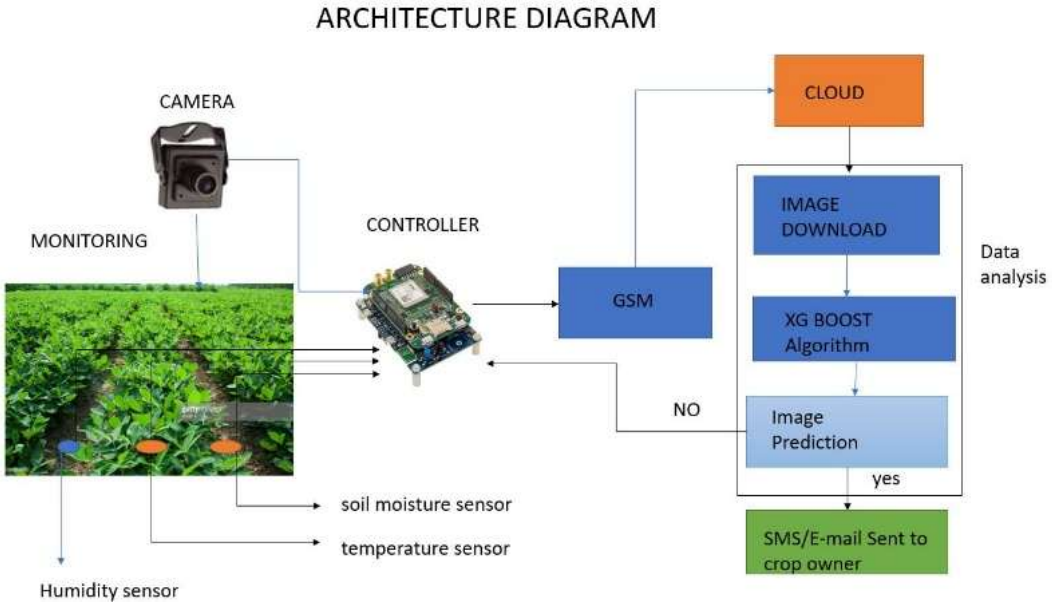


Figure (1)

The collected information can be displayed in an LCD display. A web camera is fixed to monitor. This is finished with the assistance of GSM module. In programmed mode the microcontroller gets turned ON and OFF consequently while data is analyzing. Now the crop information collected by the sensors is updated periodically through controller. A GSM module is connected with the microcontroller through which the SMS /E-Mail about the farm condition is sent to the crop owner. Crop monitoring is done where sensors are used to collect information in the ground nut plant.

4. PROPOSED MODEL

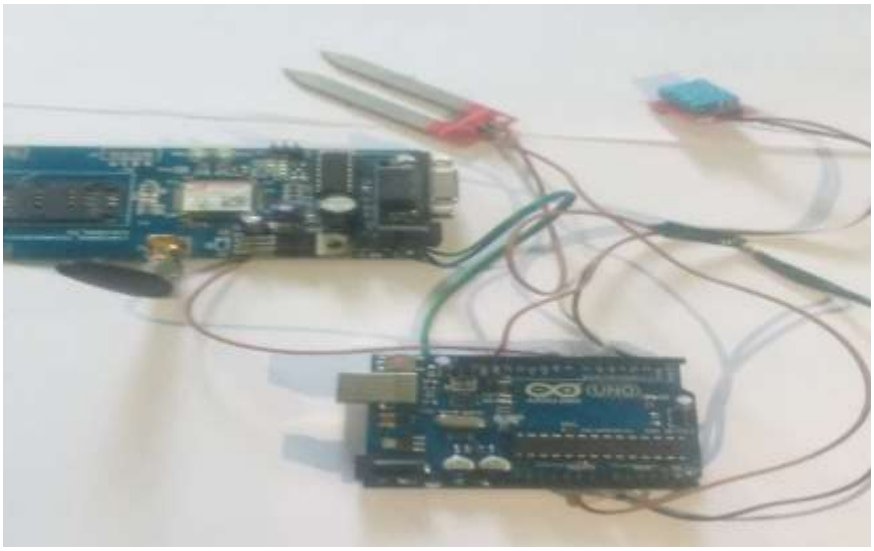
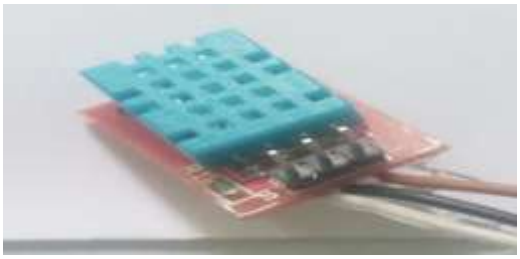


Figure (2)

In our application the collected information from the sensors are tested and analyzed. For measurements, we deployed two sensors, one web camera for monitoring the crop, Arduino microcontroller and GSM module. From temperature and humidity sensors data is passed to Arduino microcontroller, then Web camera is to monitor the crop disease. From Arduino microcontroller the information is sent to GSM module using the web camera the image is captured and data is analyzed. A GSM module is connected with the microcontroller through which the SMS /E-Mail about the farm condition is sent to the crop owner.

Fig(3).Soil Moisture Sensor



Fig(4). Temperature and Humidity Sensor

Fig(5).Web Camera

4.1 Soil Moisture Sensor

The soil moisture sensor is used to detect the humidity of the soil. The sensor is set up by two pieces: the probe with two pads that detects the water content. The sensor has a built-in soil for sensitivity adjustment of the digital output (D0), a power LED and a digital output LED. The voltage that the sensor outputs changes are accordingly to the water content in the soil.

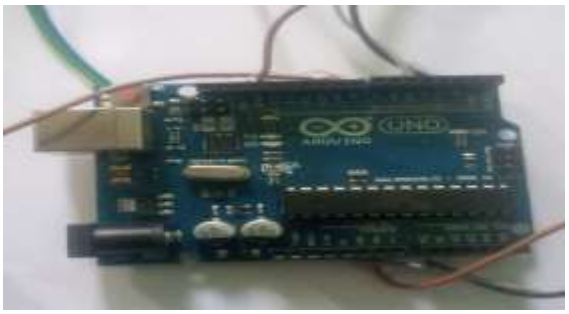
4.2 Temperature and Humidity Sensor

This sensor is a basic, ultra-low-cost digital temperature and humidity sensor also it consists of positive and negative pins. It uses a humidity sensor and a temperature sensor to measure the surrounding air, and the digital signal on the data bar. It does not need any analog input pin to pass the information.

4.3 Web Camera

The camera capable sensor nodes capture the images of the leaves and the diseased part is progressed. The camera will capture the image randomly, when the color change on leaf is detected thereby reducing the energy consumption. In some cases, the images are captured periodically. The image is pre-processed before the segmentation process is to enhance the quality of the image.

Fig(6).GSM Module



Fig(7). Arduino Microcontroller

4.4 GSM Module

GSM module designed for the global market. It works on frequencies GSM 850MHz, EGSM 900MHz, PCS 1900MHz. It provides all hardware interfaces between the module and customer boards. GSM integrates TCP/IP protocol and extended TCP/IP AT commands which are very useful for data transfer applications.

4.5 Arduino Microcontroller

The Arduino microcontroller is a board based on positive and negative controls. It has digital input/output pins. The plans of the Arduino boards are used to control the operations in crop monitoring system. The circuit designers can make their own version of the module, 6 Analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, a reset button and run on windows. It contains everything needed to support the Arduino microcontroller, simply connect it to the computer with a USB cable or battery to get start.

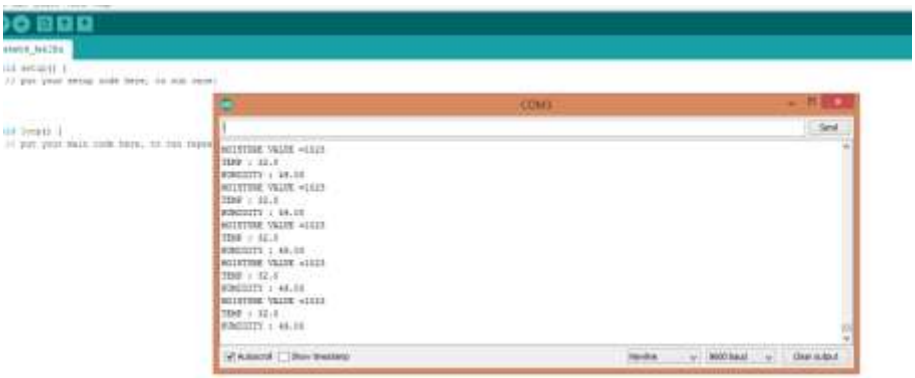
5. IMPLEMENTATION & RESULT

An easy implementation of IoT used for crop disease in plants conditions by means of low-price sensing system is achieved here with success.

Sensing Ranges for Ground nut plant				
	Normal	Acceptable	Sample Output	Category
Soil moisture sensor	6.0 to 6.5	5.5 to 7.0	6.2	Good
Temperature sensor	30□	35□ need more than 21□	27□	Good
Humidity sensor	10□	7□	6.5□	Poor
Web camera (image capture)	Pale yellow(Disease occurred)		Green	

The optimum soil moisture, temperature for Groundnut plant is good. The humidity sensor climate is poor as data analyzed using sensors, so the information is sent to farmer via SMS/E-Mail. We have proposed a method for crop monitoring in plant to increase the efficiency of the crop productivity by using the IOT technology and to avoid the damage

in crops by preventing from the diseases which can be monitored by using the sensors and web camera for ground nut plant. This paper is limited only for crop monitoring and thus it may also extend for automated water supply but not yet included in our implementation. Hence in future this system can be enhanced with more plant disease detection with XG Boost algorithm. XG Boost is an implementation of gradient boosted decision trees designed for speed and performance in crop monitoring of plant using machine learning models. The outline regarding the smart farming system and fixing soil moisture sensors, Temperature and humidity sensor and web camera to pass the information to Arduino microcontroller via LCD display as SMS/E-Mail. Therefore, in future it can be automated for farming using IoT



6. CONCLUSION AND FUTURE WORK

In this paper, we made use of IoT is most advanced and simplest method of efficient crop monitoring for agricultural field. It observes soil condition and monitors the crop diseases. This application monitors groundnut plant through web camera using IOT. The data is to be stored and retrieved from anywhere. In this proposed work, the sensor part is limited only for monitoring of crop. Hence in future the automatic system can be used for irrigation purpose.

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