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Sensor Based Quality and Safety Ensured Agriculture Followed by Neural Network Based Plant Disease Management

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Abstract- Agriculture is the essential source of raw materials required by various manufacturing industries like cotton, sugar, jute and oil industries. Agriculture being science and art of growing plants attracts the researchers to work towards attaining substantial agriculture. When agriculture gets degraded in quality of its yields then it will reflect severely on the financial development of our country. To increase the agricultural outcome and to improve the efficiency of the harvests, smart agriculture based on IoT technology is adopted. To prevent the crops from cattle intervention smart techniques based on sensors for monitoring and ensuring safety is required. Despite of environmental conditions, animal intervention crop handling is still a challenging task. The proposed system is comprised of sensor module to handle the challenge of monitoring cattle intervention in the field as well as moisture level of soil so as to avoid the draught condition and over drain of water in the farm as well. Controlling those parameters are through any remote device or internet services and the operations are completed by means of interfacing sensors, with microcontroller. This work also includes the implementation of artificial neural networks in predicting the plant disease so overcome the loss in crop yield.

I. INTRODUCTION

Smart agriculture system is a platform to improve the yield of harvest as well as to address the issue of plant disease management. The problem of efficient plant disease protection is often related to the problems of sustainable agriculture and climate change one of the major challenge in agriculture is plant disease management. If not the plant disease management and crop prevention from cattle intervention is taken care properly it leads to high rate of pathogen development and huge loss of crop yield. This will result in worst case of rapid spread of diseases all over the form resulting in severe loss of agricultural yield. Crop protection is essential in today's world as it has great impact on human's life. Food is the basic need of human and they met with satisfaction only when they are provided with quality ensured crops. Crop protection is kind of science that deals with managing plant diseases. The crop protection is violated by weeds and other pests. The Pesticides are the cause of destroy of various agricultural crops. The destroy of crops is a serious issue that backfires the economy. The crop plants are prone to damage by some other elements like bacteria, birds and other insects.

II. PROPOSED METHODOLOGY

The proposed methodology is equipped with arduino uno microcontroller, PIR Sensor, humidity sensor, temperature sensor and Bluetooth module. The main aim of our project is to protect the crops from damage caused by animal, early prediction of plant disease and frequent monitoring of farm to assure quality and safety.

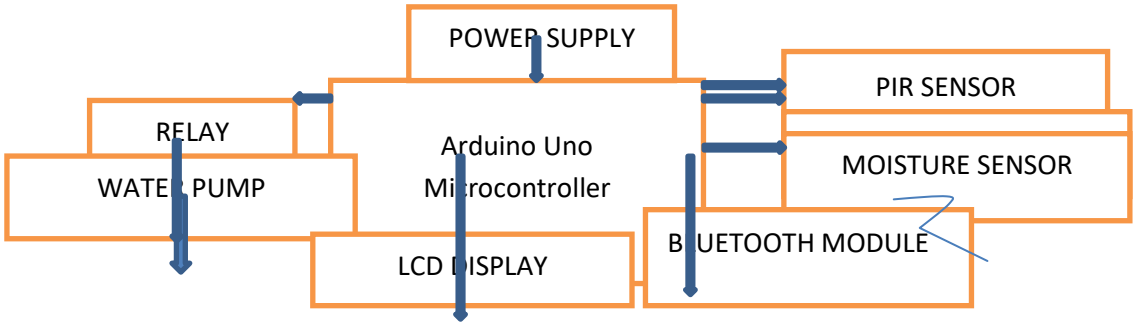

Figure 1: Block Diagram

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2.1. PIR SENSOR TRANSMITTER

Passive infrared (PIR) sensors use a pair of pyroelectric sensors to detect heat energy in the surrounding environment. These two sensors are used serially, and when the signal differential between the two sensors changes the sensor will engage indicating the presence of someone. This is notified by an alarm, by authorities, or maybe turns on a alert. IR radiation focuses on each of the two pyroelectric sensors using a series of lenses constructed as the sensor's housing. These lenses widen the device's sensing area. While the lens setup and sensor electronics are sophisticated technology, these units are easy to use in a practical application. It is required to have power and ground for the sensor to produce a discreet output that's strong enough for a microcontroller to use.

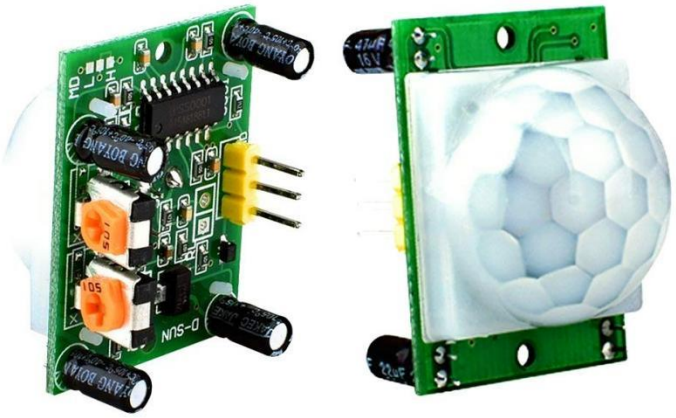

Figure 2. PIR Sensor

2.2. SOIL MOISTURE SENSOR

Soil moisture sensor is a sensor which senses the moisture content of the soil. The sensor has both the analog and the digital output. The digital output is fixed and the analog output threshold can be varied. It works on the principle of open and short circuit. The output is high or low indicated by the LED. When the soil is dry, the current will not pass through it and so it will act as open circuit. Hence the output is said to be maximum. When the soil is wet, the current will pass from one terminal to the other and the circuit is said to be short and the output will be zero. The sensor is platinum coated to make the efficiency high. The range of sensing is also high. It is anti-rust and so the long has sensor life which will be afford the farmer at a minimum cost

Figure 3 Moisture Sensor

2.4. TEMPERATURE / HUMIDITY SENSOR

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The DHT11 sensor is highly used because its output voltage is linear with the Celsius scaling of temperature. It does not provide any external trimming. It has a wide operating range. The maximum output is 5V. The output will increase 10mV for every one degree rise in temperature. The range is from -55 degrees to +150 degrees. There are three terminals as Vcc, Ground and the analog sensor. It consumes minimum amount of electricity. Thus, it is energy efficient. It is very efficient in horticulture. It is user friendly to use.

Figure 4 Humidity Sensor

2.5. A LIQUID-CRYSTAL DISPLAY (LCD)

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels , while other display have larger elements .

Figure 5 LCD Display

2.6.BLUETOOTH MODULE

The **HC-05** is Bluetooth module which is full-duplex wireless functionality facilitates dual communication simultaneously. This module is preferred to communicate between two microcontrollers like Arduino or communicate with any device with Bluetooth functionality like a Phone or Laptop. This kind of Bluetooth module is compatible with many android applications that are already available and thus making communication smarter.. The module communicates with the help of USART at 9600 baud rate hence it is easy to interface with any microcontroller that supports USART. The module can also configure the default values by using the command mode. This method looks for a Wireless module that is capable of transferring data from your computer or mobile phone to microcontroller or vice versa then this module might be the right choice for smart agriculture.

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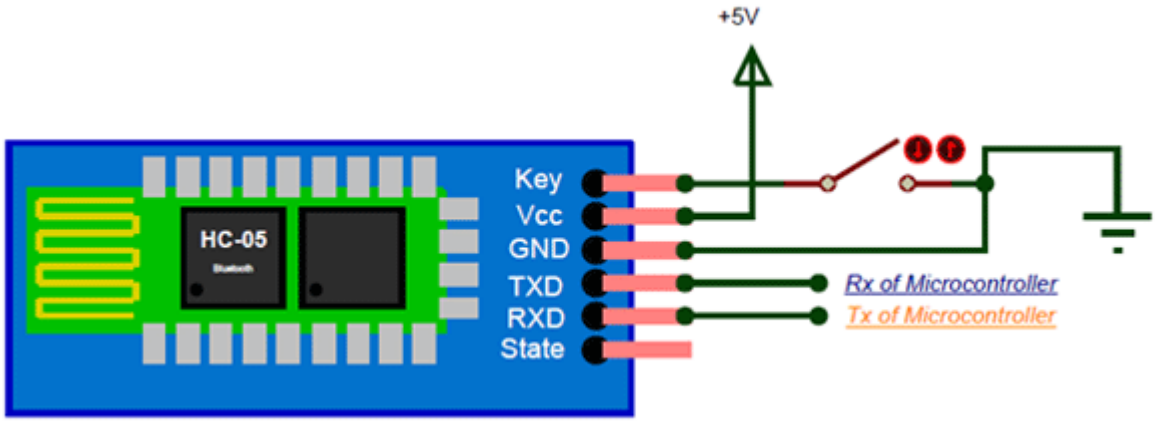

FIGURE 6 BLUETOOTH HC-05

The basic idea beyond using IOT in agriculture is to protect the crops during different seasons. As the many techniques are applied in agricultural sector greenhouse technique is also one of them. As of controlling and monitoring of greenhouse using IOT and some other technologies are implemented.

III. PLANT DIEASE PREDICTION USING NEURAL NETWORK

A plant disease is a inevitable abnormality. The plant diseases are always accompanied with certain symptoms. The symptoms are the explicit changes seen in the physical appearance that are induced and gradually developed and can be witnessed by naked eyes. The worst case is that it can be spread rapidly. Illustrations of symptoms are wilt leaf spots, rots, cankers and many more. The image based classification and detection of disease will be more appropriate in plant disease management. Here convolutional neural network is used to detect and classify the disease.

3.1. Faster Region-based Convolutional Neural Network (Faster-RCNN)

Using Faster RCNN architecture, object detection is being done at two different stages. First stage is region proposal network (RPN) stage, where the images are processed to generate region proposals directly through feature extractors rather than using an external algorithm such as Edge Boxes. Using these features the forecasting of class-specific proposals is carried out for each intermediate convolutional layer. Now, the generated anchor boxes are the inputs at the second step of detecting the characteristics of the same immediate layer of an image.

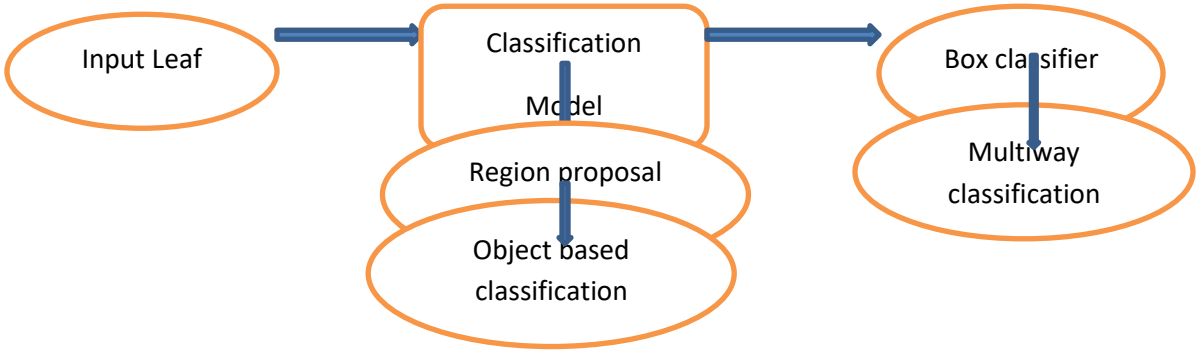

Figure 7 Predictive Model

IV. RESULTS AND CONCLUSION

Substantial agriculture is not an easy task and it results in better prevention of crops from cattle intervention by implementation of series of PIR sensors in the fence of farm land. To improve the harvest yield various monitoring sensors are used to monitor the environmental conditions and based on that the water supply is regulated so that draught condition as well as over drain condition is also avoided. Most important among all is plant disease

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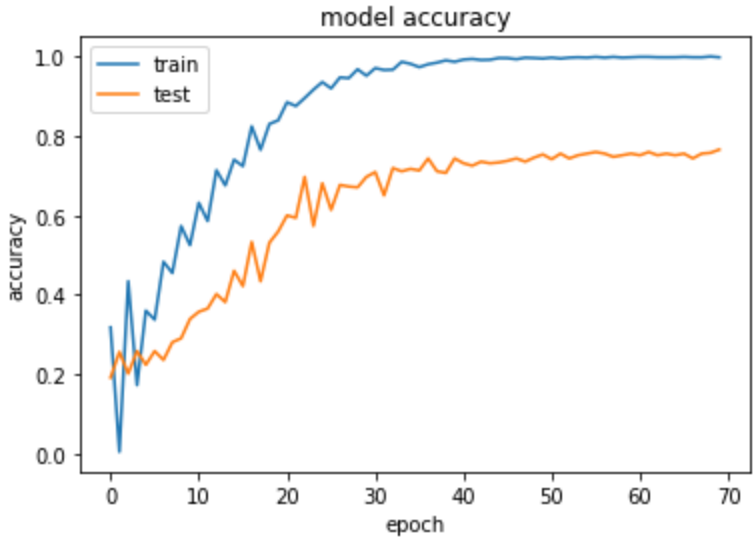
management, which is tested by using fast convolutional neural network in predicting the plant disease at the earliest so the loss of crop yield can be avoided and this improves the level of agriculture.



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