Design and Implementation of Smart Farming System

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Abstract: - Agriculture is one of the important aspects to feed ever growing population and is the source of the world's food supply. Monitoring and disease detection plays an important role in the successful cultivation of crops on the farmland. The proposed system is a Smart farming system that can able to monitor the farmland parameters like temperature and humidity, soil moisture content, and detect the plant diseases using Machine Learning Techniques. The system uses Raspberry Pi for both automation and disease detection systems. The sensor data can be viewed by the farmers using a Web page. After detecting any diseases in the plants, the information is automatically sent to the farmer via mail.

Key Words: ***Smart Farming system, Machine Learning Technique, Temperature, and Humidity monitoring, Soil moisture monitoring, Leaf disease detection.***

I. INTRODUCTION

Agriculture, the backbone of India contributes a major role in the economic development. In India, about 70% of the population depends on agriculture. Due to rapid population and urbanization, there emerges need to find new methods of cultivation in agriculture. In agriculture, automation is always being a great challenge for farmers. And also the production of fewer amounts of crops of good quality is due to disease. Climate changes also have a significant impact on agriculture by increasing water demand and limiting crop productivity in areas where irrigation is most needed. In order to use water efficiently a smart system has to be designed. In the system, farmers need not make the water flow into fields manually, but the system automatically does that efficiently. Plant dieses have made larger problems as it causes a significant reduction in both quality and quantity of agricultural products.

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Also, the spread of diseases has increased due to environmental pollution and many other causes. [1] It shows the survey about smart agriculture to increase the quantity and quality of crops and overall farm. With the use of IoT and sensors, monitoring of farms can be done. One can find the condition of the farm from their house or any place and also the farmer gets notifications via SMS. This system gives real-time environmental parameters which can be used in deciding whether the crop is suitable for growing. [2] It describes the methodology used for detecting plant disease using Image Processing. The various steps like loading an image; pre-processing, segmentation, extraction and classification are involving illness detection. The leaves pictures are used for detecting plant diseases. [3] This system uses an Arduino UNO microcontroller and few sensors to monitor the farmland spontaneously. [4] This system was focused on the detection of leaf diseases using IoT which includes collecting sensor data, processing and detecting leaf disease using Image Processing. [5] It describes the Smart farming system with various sensors to monitor the farmland and update the status of the farmland via a customized web service. [6] It describes the Smart farming system using IoT with various sensors like temperature and humidity sensor, PIR sensor, and soil moisture sensor to monitor the farmland with the help of Arduino and update the status of the farmland via message to the farmland using GSM module. [8] It shows the survey about smart agriculture.

Using IoT and sensors, monitoring of the farmland can be done. The farmer gets notification on the web page. This system uses few sensors which give real-time environmental parameters which can be used in deciding whether the crop is suitable for growing.

II. PROPOSED SMART FARMING SYSTEM

The proposed system was developed using Raspberry Pi (microcontroller). The proposed system has been divided into two phases namely,

- Phase I (Sensor Node)
- Phase II (Detection Node)

The Sensor node consists of few sensors like temperature and humidity sensor module (DHT 11), soil moisture sensor (FC 28), relay and a submersible water pump motor. The temperature and Humidity sensor is used to measure the temperature and humidity in the farmland since the crop is dependent on temperature and humidity for its efficient growth. The submersible motor is connected to a water pump which pumps water to the crops when the soil moisture sensor senses the moisture level in the soil and if the soil moisture level is below the threshold value, then the relay will be triggered and then the pump will be in ON condition for the automatic irrigation system, otherwise It will be in OFF condition. The collected sensor data can be viewed by the farmers via web page and can control the pump remotely.

The Detection node consists of pi camera interfaced with the raspberry pi which is used to capture the real-time images of the plant in the farmland. Plant disease detection can be done using Machine Learning techniques. It uses convolutional neural network algorithm for identifying plant diseases. Convolutional means the same calculations are performed at each location in the image. This model can classify images across 1000 categories. In Convolutional neural network, the image passes through a series of layers. The image is then passed through the convolutional layer. The image is converted as a matrix with pixel values. Tensor flow is a free, open-source software library for dataflow and differential programming across a range of tasks. It is a symbolic math library and is also used for Machine Learning applications such as Neural Networks. After a plant disease is detected, the mail is sent to the farmer. The block diagram of the proposed system is given in the below figure.

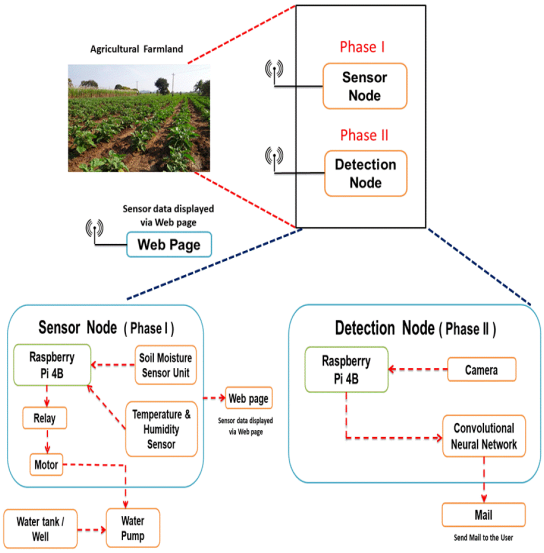

Fig.1. Block diagram of the Smart Farming System

III. HARDWARE USED

This project is aided by many hardware components. The proposed technology uses

- Raspberry Pi,
- Temperature and Humidity sensor,
- Soil Moisture sensor,
- Pi Camera,
- Relay and
- A submersible water motor pump.

The flow of the sensor node and detection node in the Smart farming system is given in the below figure.

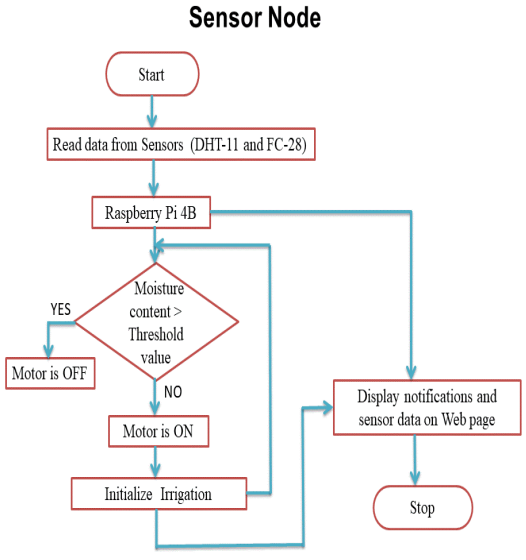

Fig.2. Flowchart of the Sensor Node (Phase I)

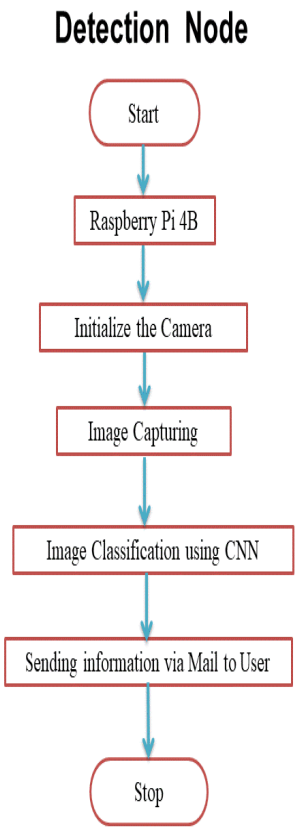

Fig.3. Flowchart of the Detection Node (Phase II)

IV. RESULTS AND DISCUSSION

Our proposed system works as follows; Sensor Node: firstly, few sensors like DHT11, FC28 are used to measure the temperature and humidity and soil moisture content in the farmland. The submersible water pump pumps the water to the crops based on the moisture level in the soil. If the soil moisture level is below the threshold, then the motor will be in ON condition and the automatic irrigation system will be activated otherwise the motor will be in OFF condition. The farmers can monitor the farmland via web page showing the sensor data and can able to control the irrigation system. Detection Node: secondly, the pi camera is interfaced with the Raspberry pi to capture the images from the farmland. Plant disease detection can be done using Machine Learning Technique. Convolutional Neural Network algorithm is used to identify plant diseases. Tensor flow is used here. First, a set of healthy and unhealthy plant images is used to train the model. After training, the captured image is then compared with the trained image and it produces the output. When the plant is infected, mail is sent to the farmers regarding the status of the plant in the farmland.

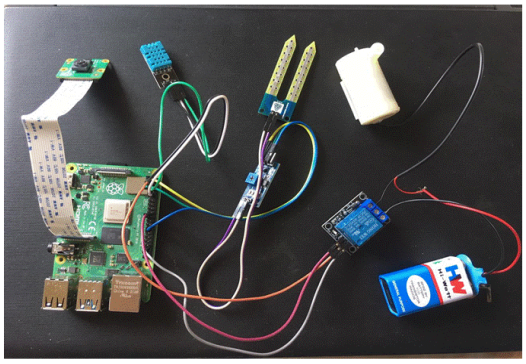

Fig.4. System Architecture of Smart Farming System

The proposed system produces remote monitoring system that is used for small areas which can replace the human power in the farmland. It greatly improves productivity in terms of both the quality and quantity of the crop. This system effectively uses the available water. It can also be used as a preventive measure for plant disease detection. The proposed system is a fully automated farm with the ability to predict the yield and control plant diseases in the farmlands. The proposed system will monitor and control all the activities like irrigation system, monitoring the environmental conditions, and plant disease detection system efficiently. Thus, farmers farm owners save manpower, water to improve productivity and ultimately increase profit.

V. CONCLUSION

In the proposed system, we have implemented a remote farming system that would assist the farmer in controlling the plant diseases and also monitoring the farmland remotely. The system could be used in small areas that will enable the farmers to automate their farmland, thus reducing the workload of the farmers.

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