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# IoT Based Farming with Live Monitoring of Temperature, Soil Moisture, Weather Conditions through Image Processing Techniques

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**Abstract—** The Internet of Things (IoT) is a technology where in a mobile device can be used to monitor the function of a device. IOT is a shared Network of objects where these objects interact through Internet. One of the important applications of IOT is Smart farming. Smart Agriculture reduces wastage of water, fertilizers and increases the plant quality using the identifying plant growth and plant disease. Identification of plant diseases and plant growth are the key to preventing the losses in the yield and quantity of the agricultural product. This project combines Image Processing and IoT to monitor the plant and to collect the environmental factors such as humidity, temperature, soil moisture and the motor status in farm. In this project, we propose an Android application that helps farmers for identifying disease by uploading leaf image to the system. Input image given by the user undergoes several processing steps to detect the disease and results are returned back to the user via android application. This system also shows the live weather status.

**Keywords—**Internet of Things (IoT), Humidity and Temperature Sensor(DHT11), Smart Farming, Soil Moisture Sensor, Fertilizers, Water Monitoring, plant health, Internet, Raspberry Pi.

## I. INTRODUCTION

Internet of Things (IoT), these days is playing a crucial role of transforming "Traditional Technology". Agriculture is the main backbone of Indian economic growth. The most important barrier that arises in traditional farming is climate change. The number of effects of climate change includes heavy rainfall most intense storm and heat waves, less rainfall etc. due to these the productivity decrease to the major extent. To overcome climate problem our project shows the live climate status. In biological studies, plant growth and plant disease are still evaluated manually by human observations, which are time consuming and destructive. Because of this there is an increasing demand for objectivity and efficiency. Thus, automatic image processing technique has become a useful tool in biological researches. To overcome this, Digital Processing Techniques can be used to detect the diseases of the plants and plant growth. This paper gives the introduction to image processing techniques used for plant disease detection and plant growth. Building an IoT application requires the right selection and combination of sensors, networks and communication modules. The above setup is then collaborated with concepts of image processing.

## II. PROPOSED ALGORITHM

The main idea is to combine the concepts of Image processing techniques and Internet of things to get the required results. The proposed system consists of the fertilizers information with respected to plant, live weather information by entering city name, plant health as plant growth and plant disease and the farm status that includes the sensors and motor status of farm field. The following figure shows the block diagram of system:

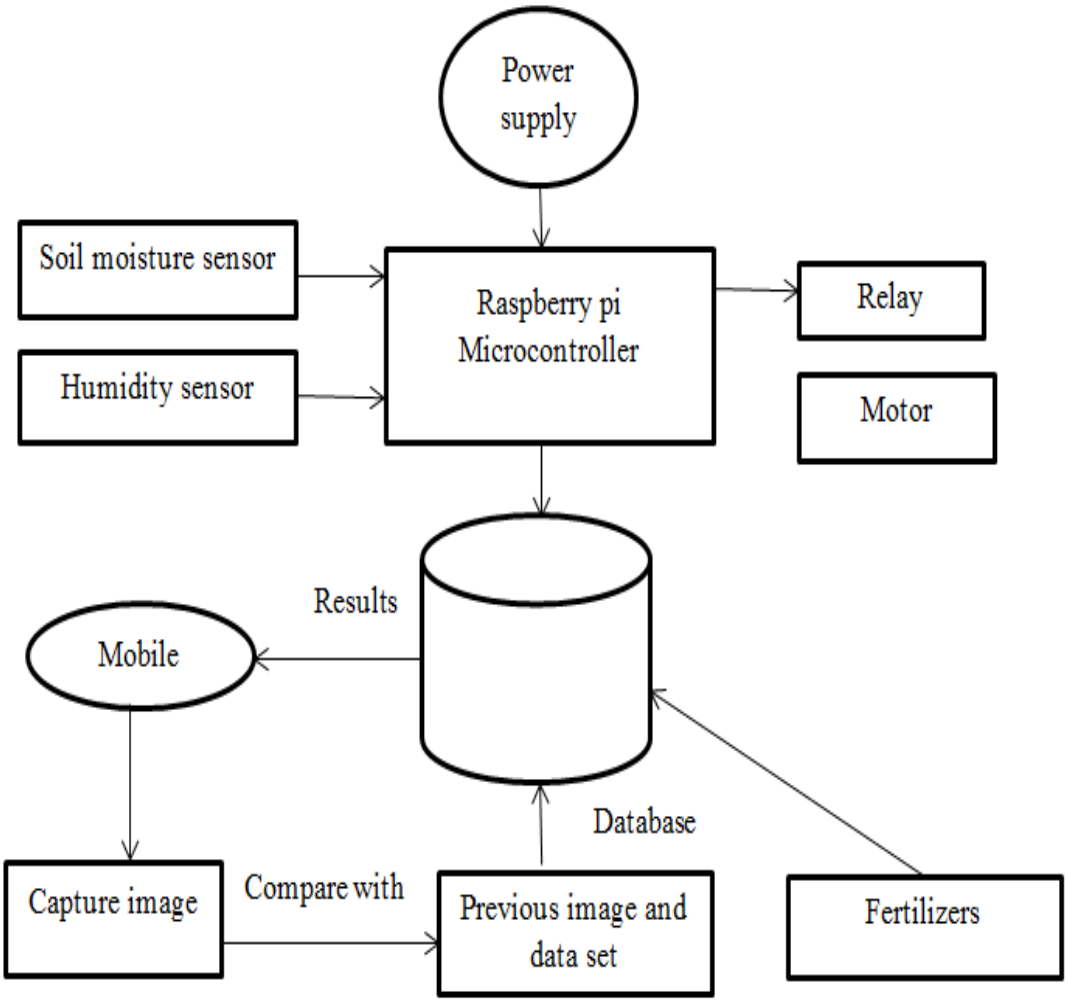



*Fig (a): Block Diagram*

The above figure shows that main block diagram of smart farming system. In that main model is Raspberry pi model, Relays, Sensors. In this control system three sensors are such as soil moisture sensor, temperature sensor, humidity sensors are connected to the raspberry pi model. The connection of raspberry pi is given to the relay given to the motor respectively. The plant health checked by using the comparing the saved images in database and the latest captured image. The result is shown on app. The fertilizers also displayed with respect to plant. Fertilizer information is store in database. Capture the image plant Disease and store the database we mach the image find the disease.

**Working Steps:**

**1. Sensing Values From Sensors:**

The sensors read values from farm and those values are reads after some time delay. This sensed values and motor status are sending to the database.

**2. Store Information In Database:**

The sensing or reading values are sending to the database. Database also stores the set of images that are used to compare with captured data for view the plant health. These values are display on users mobile app whenever wants. The system also stores the information of fertilizers of specified plants or crops on weekly and monthly basis.

**3. User Upload Captured Image:**

User uploads images to check plant health as plant growth and plant disease. After uploading the image in database it compare with all images which are saved in the database for plant disease. Plant growth is done by comparing the previous captured image of plant to latest captured images. Plant health is identified and then displays message on farmer's android app.

**4. Weather Data :**

The system also shows the live weather information by entering city name. The current data is displayed on the mobile app. check the weather status on https://openweathermap.org/city.The number of effects of weather change includes heavy rainfall most intense storm and heat waves, less rainfall etc. The live weather status shows the live temperature, live clouds data that is sky is clear or not the android application display live weather information app tempature,cloud is clear or not and by using click on button weather link.by entering city name we check the weather information on website**.** This system reduces wastage of water, fertilizers and increases the plant quality using the identifying plant growth and plant disease live weather.

## III. TECHNOLOGY USED

### 3.1 Sensors:

There are two sensors are used first DHT11 Humidity Temperature sensor, and second Soil Moisture sensor. Sensors are the device which converts the physical parameter into the electric signal. The output of sensor is analog signal; the signal is converted into digital signal and then fed to the processor. The sensor checks the moisture in soil or air and temperature in air. The moisture sensor is used to measure the moisture content of the soil.

### 3.1.1 DHT11 Humidity Temperature Sensor Module:

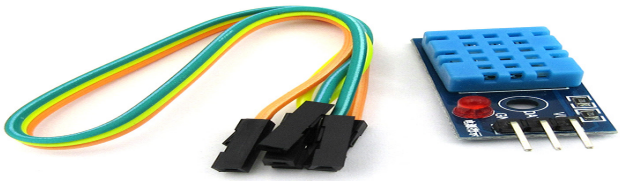
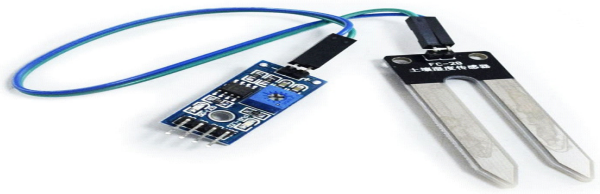


*Fig (b): DHT11 Humidity Temperature Sensor Module*

The DHT11 is a basic, low-cost digital temperature and humidity sensor. The sensor checks the moisture in soil or air and temperature in air. A DHT 11 sensor consists of three pins voltage, ground and the data pin. It gives out digital value and hence we can give its output directly to data pin. It has a capacitive sensor for measuring humidity and temperature in real time. The sensed data is controlled by the raspberry pi and then send to the android application through internet.

### 3.1.2 Soil Moisture Sensor:



*Fig(c): Soil Moisture Sensor*

The moisture sensor is used to measure the moisture content of the soil. It is connected to raspberry pi and the copper electrodes are in the soil. Copper electrodes are used to sense the moisture content of soil. The conductivity between the electrodes helps to measure the moisture content level. It is used to sense the moisture in field and transfer it to raspberry pi in order to take controlling action of switching water pump ON/OFF.

### 3.2 Raspberry Pi :

The Raspberry Pi is small pocket size computer used to do small computing and networking operations. It is the main element in the field of internet of things. It provides access to the internet and hence the connection of automation system with remote location controlling device becomes possible. Raspberry pi is used to connect the hardware devices like motor, soil moisture sensor, humidity sensor and the temperature sensor using the bread board. The sensors sense the values and those data are send to farmer's application using the raspberry pi microcontroller. It uses the python language for the implementation. It sends data though internet or the Bluetooth device. The power supply is given to raspberry pi using the USB port.

### 3.3 HC05 Bluetooth Module:

The Bluetooth module HC-05 is a master/slave module. It is connected to raspberry pi. The data collected by the moisture sensor is transferred to the android application in the smart phone using the raspberry pi and Bluetooth module. It works on serial communication.

### 3.5 Receiving Section:

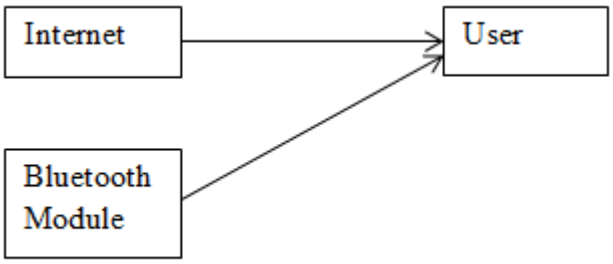



*Fig (g): Receiving Section*

Above figure shows that receiving section of the main module that is Monitoring unit by the farmer on their android application. In that three sections are present those are internet, Bluetooth module and user. This connection again given to the raspberry pi module to send data. Farmer

monitors the fertilizers, plant growth, plant disease, live weather, humidity and temperature, soil moisture and the motor status.

## IV. IMPLEMENTATION DETAILS

### 4.1 Plant Health:

#### 4.1.1 Plant Growth:

The factors to be considered are temperature and humidity that leads to delicate the changes in the health of the plant. The factors to be considered are temperature and humidity that leads to delicate the changes in the health of the plant. The Changes that a plant undergoes are captured by the camera and analyzed with the image processing. The process of capturing image and the required environmental factors are done with the IoT network. A storage device can be used to store all the required data's for the analysis .In Image processing section, initially the image is captured from the camera and further the image is processed using the size, color and shape of the image. It is compared with the previous image and check the size, color and shape of plant through image processing and then shows result of plant growth in farmers application as plant growth is increased or not.

#### 4.1.2 Plant Disease:

Changes in the color of plant tissue are a common symptom of plant disease. Often these color changes are brought about by the yellowing of normal green tissue .The color sensor senses the color of the leaf under consideration which is another parameter that is being used to determine whether the leaf is either diseased or healthy. The sensor records values for, "RED", "Green" and "Blue" value of the leaf. The disease images of respective crops are saved in database. The humidity and temperature values are also affected on the plant diseases when these values are increased and decreased. The color values that are recorded for the leaf are then sent to the database for analysis. Later the obtained values of RGB, shape and size are compared with the threshold value in dataset to determine whether the leaf is healthy or diseased by using image processing.

#### 4.1.3 Live Weather:

The most important barrier that arises in traditional farming is weather change. check the weather status on https://openweathermap.org/city.The number of effects of weather change includes heavy rainfall most intense storm and heat waves, less rainfall etc. due to these the productivity decrease to the major extent. To overcome weather problem our project shows the live weather status. To check the weather, click on the weather link that shows the web page to display the weather status by entering the city name. The live weather status shows the live temperature, live clouds data that is sky is clear or not. This system reduces wastage of water, fertilizers and increases the plant quality using the identifying plant growth and plant disease live weather.

#### 4.1.4 Fertilizers:

It shows the fertilizers for the respective crops and plants. These fertilizers are stored in database. Fertilizers and watering messages are displayed on farmer's android app after fifteen days or after one month depend on the crop type and crop duration. The message is automatically displayed week wise or month wise. Due to this the wastage of fertilizers are reduced.

| **Corn** (Fifteen days basis) | | | | | | |
|---|---|---|---|---|---|---|
| 1-15 days | 15-30 days | 30-45days | 45-60 days | 60-75 days | 75-90 days | 90-105 days |
| Sowing of corn and watering | Urea and watering | Urea and watering | Only watering | Only watering | Only watering | Only watering |
| **Sugar Cane** (Monthly basis) | | | | | | |
| 1 Month | 2 Month | 3 Month | 14Month | 5 Month | 6,7,8,9,10,11 | 12 Month |
| planting of sugar cane | RFC urea and watering | 10:26:26 RCO + urea and watering | 12:23 urea + super Powder and watering | DAP + MOP and watering | DAP + MOP and watering | DAP + MOP and watering |

***Table: Fertilizers for specific crop***

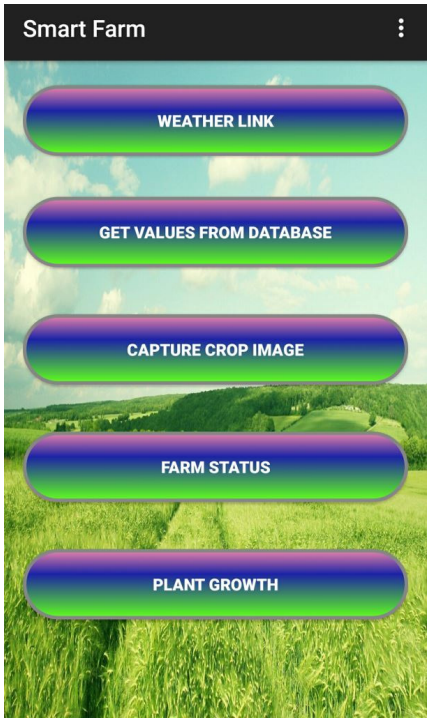
Above figure shows the fertilizer data stored in database. When the farmer selects the crop type and stated the sowing the weekly and monthly basis message is displayed on farmer's android application.

## V. BENEFITS OF PROPOSED SYSTEM

Smart farming with the help of automation and sensor technology, benefits the society in the following ways:

- Conservation of water
- Optimization of energy resources.
- Better crop yield
- Better plant quality
- Time consuming
- Reduce work of farmer

## VI. RESULT




***Screenshot: Android app view***

In above figure, the app shows the farm status, plant growth, plant disease, live weather and motor status. The app shows the smart farming using Internet of things.

## VII. CONCLUSION

In this Paper, Smart Farming Enabled: IoT Based Farming for Live Monitoring of Temperature, Soil Moisture, climate status and motor status has been proposed using Raspberry Pi and database technology. The sensors have high efficiency and accuracy in fetching the live data of Humidity, temperature and soil moisture.

This paper presents, smart farming system which is capable to send and receive the data from the sensors and also get the updated and precious data from the database. The role of image monitoring systems to evaluate plant growth and plant disease were reviewed. Various image analysis systems were used to assess the plant growth and health in literature with various degrees of success. Some feature variables like size, shape and color were used to detect the object in the plant image and to assess the growth and health by image processing. Image processing methods will have an increasingly important role in growth and health of plants assessment in the future. This system reduces the wastage of water and reduces the time consuming.

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