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PLANT HEALTH MONITORING SYSTEM

Apurva Mahendra Patil[*1], Haiqa Waseem Khan[*2], Reshma Milind Khare[*3], Prof. Vedika Avhad[*4]

[*1,2,3,4]Department of Information Technology Vasantdada Patil Pratishthan's College of Engineering & Visual Arts. Mumbai, India.

ABSTRACT

Plants are an essential type of organism that can be found all over the earth. Plants benefit the environment and human existence on the planet in a variety of ways, including supplying food for humans and wildlife. As a result, it is critical to maintain the health of the plants. Plants that are healthy lead to a country's profitability. Production of agricultural products The Internet of Things (IOT) has played a critical role in plant health monitoring. It is beneficial for farmers to increase productivity as a result of plant monitoring. The proposed system is based on the following principles:-sensors for the purpose of monitoring, soil moisture, pH, temperature, and air quality can all be determined. With the help of a microcontroller, certain sensors can be used. The data is gathered from the sensors. The internet of things (IoT) in combination with environmental sensing and image processing devices has ushered in a new era of plant health monitoring. The early detection of plant illnesses using image processing and analysis of environmental sensing data not only aids farmers in growing healthy plants, but also helps them maximize production. IoT is required to monitor and classify plant diseases by sending photos and providing comments. In this research, a Raspberry Pi-based IoT device is presented that sends photos of plants to classify diseases and continuously updates environmental information such as air temperature, humidity, soil moisture, and pH in a MySQL database.

Keywords: Plants Health, Farmers, Agriculture, Internet Of Things, Sensors, Microcontroller.

I. INTRODUCTION

Agriculture is one of our country's most vital industries, and plants play an important role in it. Plants are one of our primary food sources and also provide us with oxygen. Some plants are used for medicinal purposes. As a result, people rely heavily on plants for survival. Water, sunlight, air, and critical nutrients are all required for a healthy plant. Fertilizers also supply numerous nutrients to plants, resulting in the plant's healthy growth. India has over 40000 plant species and accounts for roughly 12% of global plant diversity. For a plant's growth to be successful, it requires adequate land and water resources. The idea involves using IoT to monitor plant health (Internet of Things).

IoT is used in everyday life and plays an important part in human life. To determine the plant's soil moisture level, temperature, pH level, and air quality level in order to ensure good quality and efficient output. Sensors are used to collect data from the environment. It's also used to store data. The automatic system can be used in any field of agriculture. The Internet of Things (IoT) is a network of physical objects that use the Internet to control equipment. The Internet of Things (IoT) is a network that connects a variety of technological devices. With the help of electronic components, it is possible to access any information. The proposed solution primarily involves connecting the Internet to the primary system in the plant field, as well as using smartphones to monitor the results. The internet is connected to the device via a smartphone that works as a Wi-Fi hotspot so that other devices may watch and see the findings. Plant disease detection is an important task in agriculture, as plant diseases are so common. On the other hand, proper measures are not taken into account, which hinders the harvest of and the quality, quantity, or efficiency of the crop, which has a real impact on the crop. Detection of plant infections by programmed procedures is useful as it reduces significant observation work in large production plants. We have proposed a system for image processing methods that are automatically used for programmed locating and characterization of plant leaf diseases. In addition, it contains study on various disease characterization methods that can be used to identify plant leaf diseases. Together with measuring the infection, this model also compares the soil quality with plant health via image processing, which is a vital viewpoint for infection location in plant leaf disease.

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II. EXISTING SYSTEM

Using image processing technology for degree plant disease classification eliminates the subjectivity of artificial error methods and traditional classification. Classification and detection of diseases in crops are very important for successful crop cultivation, which can be done using image processing. The basic steps for disease detection using image processing include image pretreatment, image acquisition, feature extraction, detection, and plant disease classification. The enhanced image has sharpness and higher quality than the original image. Detecting crop diseases with automated technology is advantageous because it reduces the effort to monitor crops on large farms and detects the symptoms of diseases at a very early stage. They outlined various classification methods. Detection and classification of plant diseases is very important for successful crop cultivation. This can be done by digital image processing. In this project, both validation and preparation for treatment will be achieved. In this study, a system was developed to determine leaf quality. Image processing technology that recognizes the types of diseases that affect leaf and classifies various diseases among the leaves of here you can build an automated system that will help you in large-scale production, help you detect diseases early, and help your customers improve their performance and increase their yields.

III. PROPOSED SYSTEM

Improving the agricultural sector requires great care and the use of digital concepts. Agriculture is the main source of income for citizens in countries like India, but because they use old traditional methods, their income is reduced and their families' financial problems cannot be solved. Some equipment cannot be repaired due to the huge quantity. To overcome these problems, this system needs to be developed and economical for the user. The Internet of Things refers to any device that has built-in sensors and the ability to acquire and transmit data across a network without the need for manual intervention. The integrated technology within the product enables them to interact with internal states and, as a result, exterior settings, which aids in the selecting process. IoT is a concept that connects all of your devices to the internet and allows them to communicate with one another. IoT is a huge network of interconnected devices that all gather and share information on how they're utilized and the surroundings in which they're used. By doing so, each of your gadgets, like humans, is learning from the expertise of other devices.

IV. MODEL

(a) Moisture Sensing

Two YL-69 soil moisture sensors and two LM393 comparator modules were placed in various soil conditions for investigation. The YL-69 sensor is made up of two electrodes. It detects the moisture content in the air around it. A current is transmitted through the soil between the electrodes, and the resistance to the current in the soil determines the soil moisture. If the soil has more water, the resistance will be low, allowing more current to travel through.

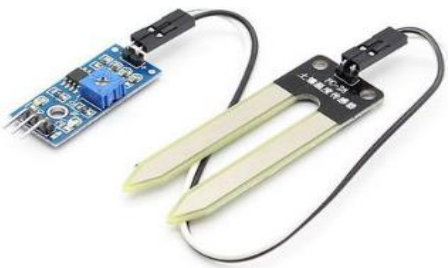

Fig: Soil Moisture Sensor

(b) Humidity Sensor

A humidity sensor is a device that detects, measures, and reports the relative humidity (RH) of air or determines the amount of water vapor present in a gas mixture (air) or pure gas. Humidity sensing is linked to the adsorption and desorption of water. Humidity sensors are used to monitor both industrial and agricultural products. Humidity sensors are utilized in equipment such as incubators, sterilizers, and pharmaceutical manufacturing equipment.

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Fig: Humidity Sensor

(c) Temperature Sensor

A temperature sensor is a device that detects and measures temperature and turns it into an electrical signal. Temperature sensors operate by sending electrical signals that provide readings. Sensors are made up of two metals that produce an electrical voltage or resistance when the temperature changes by measuring the voltage across the diode terminals. When the voltage rises, so does the temperature.

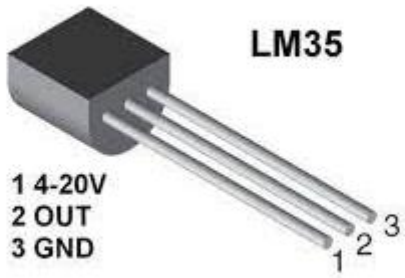

Fig: Temperature Sensor

(d) IR Sensor

Active infrared sensors use radar technology to emit and receive infrared radiation. This radiation strikes nearby objects and bounces back to the device's receiver. This technology allows the sensor to detect not just movement in an environment, but also how distant the object is from the device.

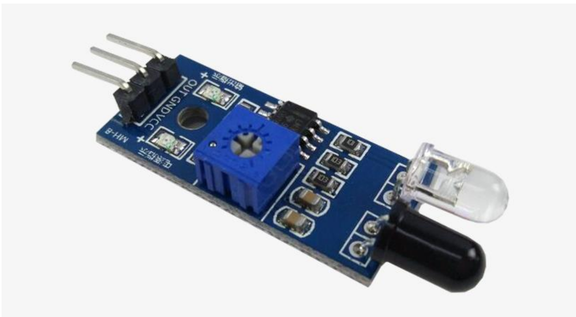

Fig: IR Sensor

(e) Monitor

An experimentation setup is created in order to test the functionality of the designed system. The results have ensured that the designed system works properly. The storage of the desired crop field parameters in the cloud enables remote users to access this data on smartphones via the Thing View application. It enables immediate contact and treatment of the affected crop fields, resulting in a higher crop output. As a result, it will have a good impact on the farming socioeconomic system. The use of event-driven data capture in sensing nodes, as well as sending on delta-based wireless interface implementation between sensing nodes and base station, would increase system efficiency in terms of resource use and power consumption.

(f) Web based application

When constructing an IoT system based on sensors, the dev board transmits data to the cloud platform. These platforms save data and use it to create graphs. An Ubidots IoT cloud platform is similar to a PaaS (Platform as a service) in that it provides some services that are beneficial in the IoT ecosystem. These services allow

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devboards to communicate with remote services or other service providers. Connecting Arduino to a distant service would be costly. These platforms do the hard lifting. Based on the incoming events from Arduino sensors, they run a set of custom rules. These events cause an external action, such as sending a short message.

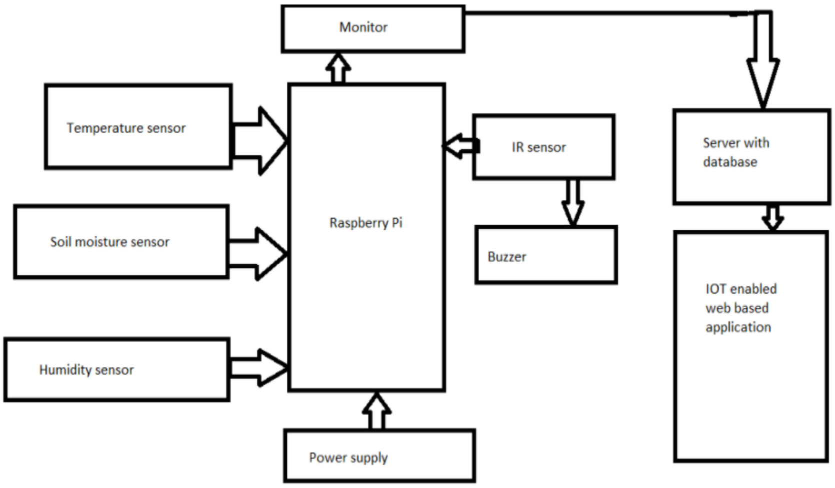

Fig: Block Diagram

Fig: Visual Variables

Fig: Graphical view of temperature values

Fig: Graphical view of humidity values

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Fig: Graphical view of soil moisture

(g) NDVI Image Sensing

The NDVI readings of each pixel are collected, and the average NDVI (table1) is calculated. This figure will aid in determining the state of the plant's health and is thus classed as healthy, unhealthy, or dead. The NDVI score of 0.96 is greater than the minimal range of healthy plants, which is 0.5. Similarly, 0.42 is in the unhealthy plant range. The NDVI value of a dead plant is -0.02, which fits the criteria.

TYPE OF PLANT	AVERAGE NDVI VALUE
Healthy	0.96
Unhealthy	0.42
Dead	-0.02

V. CONCLUSION

Our technology incorporates all metrics in order to monitor the plant's health. Meanwhile, farmers and landowners should see the potential of IOT in the market right now. If we employ IOT technology properly, demand will rise rapidly. We can reduce water waste and electricity consumption by pumps so that they can be saved for future use. This strategy delivers total sensor observation action in fields that are quite simple to manage the sector. It contains factors such as determining moisture content, temperature, pH, and air quality. It has a high transmission rate. Using Wi-Fi increases security. The sensors and microcontroller have been successfully connected to the cloud. The data was successfully saved and can be accessed remotely. All observations and experimental setup demonstrate that this is a complete method for monitoring a plant's health. Through the wireless method of the plant health monitoring system, a model based on the calculation of NDVI values of healthy and unhealthy plants is offered. It uses a control system based on a Raspberry Pi and a NoIR camera to operate.

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