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Predictive Analytics Precision Farming Using Internet Of Things (IoT)

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ABSTRACT

As agricultural sector plays a vital role in our country and acts as a backbone, new technology implementation in this sector will improve the agricultural sector as well the health and economy of a nation. In this regard, this work describes the use of various wireless sensors to monitor and data is collected from the field of agriculture and enhance its growth through its proper implementation. Initial stage of this system can be start from the collected data. This project demonstrates the use of a wireless sensor network to collect data on various sensors installed in various locations in an agricultural field and transmitted via a wireless protocol. The collected data provides information on a variety of environmental factors. The project's goal is to create an IOT-based super-intend prototype model. Using a moisture sensor, it delivers timely information such as water requirements. Image processing can be used to alert farmers of pest attacks. PIR is used to monitor and prevent animal invasion in the field. In agriculture, water is the most important resource. Concerns have been expressed about low-purity water. This has a negative impact on the soil and plant. Farmers suffer enormous losses as a result of it. As a result, this study proposed a project in which sensors would be used to detect and predict moisture and pH levels. The alarm system is activated when the sensor is triggered, and the registered user is notified via email and SMS. In this study, the details of building a gadget capable of exhibiting water readings and conversing with the registered user are described. A monthly report will also be generated, and the user would be informed by email and SMS.

Keywords— IoT, Agriculture, Farmers, Sensors, Image processing.

I. INTRODUCTION

Mutable environmental monitoring is not a complete way of strategy to increase agricultural productivity. There are number of additional substances that have a high impact on production. As a result, automation [2] in agriculture must be used to address these issues. To address all of these issues, an integrated system should be developed that considers all aspects of productivity at each level. However, due to various challenges, complete automation of agriculture is not possible. Despite the fact that it is used at the research level, it is not distributed to farmers as a product for their benefit. [4] As a result, this article focuses on smart agricultural construction using IoT and distributes it to farmers. [1]. The term "Smart" refers to the environmental surroundings and controlled communication using microcontroller such as smart home, smart agriculture, smart energy, smart grid, smart city, smart industry etc.

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Further include cloud-based data, sensors, and diversity [5] Intelligent agriculture is to provide benefits for farmers with support to sustainable agricultural techniques such as weeding, hearing, intimidation, storage, monitoring, weed control, humidity, bird, animals, etc. [3]. System identification and collaboration and support system. The good agricultural system requires good care, knowledge, and guidance. In this project, we aim to automate Storage, Pesticide and Insect Control, Water Management, and Plant Monitoring. [6] Monitor the field and prevent animal invasion in the field using PIR. Effective cost and power are the key to develop any IoT network which is useful, acceptable and beneficial to farmers. To monitor soil moisture, we have developed an improved indoor sensor. [7-8]. They reduce the use of satellites in monitoring and photographing agriculture by providing better control, nutrients, micronutrients, and pesticides. [9-10]. In this project, we have developed an inexpensive IoT network for intelligent agriculture.

A. Conventional Systems

In the current system, one should visit the field regularly and check the entire body features to take additional action. It can turn on and off the engine. It cannot detect the presence of animals and prevent injuries caused by animals. It says nothing about insect attacks. This method can only complete one task at a time. Data from IoT devices requires more storage than the standard web application can provide. Cloud-based data storage and end-to-end IoT forums are key features of an intelligent agricultural system [10]. These programs will likely play an important role in promoting better performance. Section II describes the proposed system followed by a section.

II. PROPOSED SYSTEM

The goal of this project is to exhibit the microcontroller's skills in detecting moisture levels, pests, and animals in the field. The construction of a smart agriculture system using sensors and a microprocessor as part of an IoT system is discussed. We must keep an eye on two different fields. They have a wireless connection to the main server. The presence of any animal in the fields is detected by a PIR sensor in this system.

The LDR is used to provide light when the light intensity is low. If the moisture level exceeds the threshold, the motor will turn on; otherwise, it will remain off. It entails knowing the status of the field and utilizing image processing to detect defective seeds. It has the ability to perform multiple tasks such as data transfer, monitoring, and control. The use of an automated system aids farmers in boosting crop yields.

As a result, it has numerous advantages. Irrigation that is automated can reduce resource usage and human intervention. The outputs of a smart agricultural system are more accurate and efficient. Water use is reduced, which saves electricity consumption and costs. Plants are given controlled amounts of water at regular intervals. The field's status is detected.

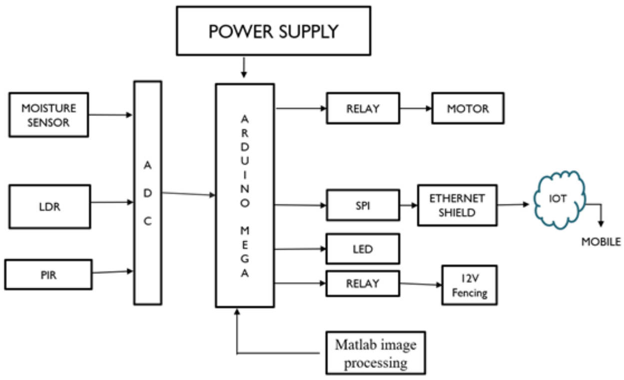

Fig: 1 block diagram

fig:1 depicts the project's entire operation. Sensors, ADC, Arduino Mega, relays, LDR, motor, and LED are all included. The ADC takes analog inputs from the moisture sensor, LDR, and PIR and converts them to digital signals that are sent to the Arduino Mega. The status of the field is determined by MATLAB image processing and sent to the Arduino. The Ethernet shield is linked to the Arduino and communicates via SPI. It also turns on the LED, activates relays to automate the motor, and supplies voltage to the fencing. The Ethernet shield transfers the data to the IoT cloud, which notifies the mobile device.

Section III describes the hardware description followed by a section.

III. HARDWARE DESCRIPTION

A. Soil Moisture Sensor

Soil moisture sensors measure groundwater level of agriculture field. Many soil moisture sensors are attached to the probe. This Sensor is used to monitor soil moisture or to detect the presence of water nearby, allowing plants in the garden

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to seek human help. Adjust the sensitivity of this module by placing it on the ground and adjusting the inner potentiometer. If the humidity level is higher or lower than the threshold established by the potentiometer.

Fig: 2 Soil Moisture Sensor

The sensor output logic will be HIGH/LOW. It will be possible to have the plant remind you: Hey, I'm thirsty now, please give me some water with the help of this sensor.

B. PIR Sensor

Fig: 3 PIR Sensor

This Pyroelectric PIR (Passive Infrared) Sensor detects motion by sensing changes in the infrared (heat) levels radiated by nearby objects. Check for a quick shift in the surrounding IR patterns to detect this move. When motion is detected, PIR sends a signal to the output pin. This logic signal will be read by the microcontroller, or it can be used to operate a transistor to switch a higher current load. HC-SR501 is an automatic control module which works on the principles of infrared technology that uses a Germany-imported LHI778 probe design with high sensitivity, high reliability, and ultralow-voltage operation. The application of PIR are used in auto-sensing electrical equipment, particularly battery-powered automatic controlled products.

C. Soil Moisture Sensor

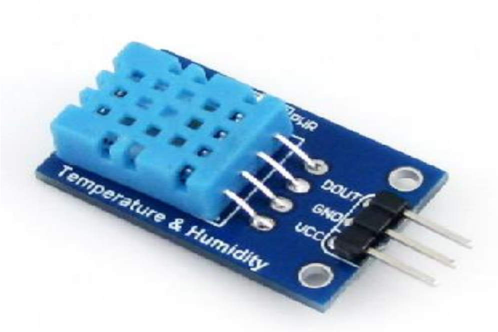

Fig*:* 4 Soil Temperature and Humidity Sensor

The Soil temperature and humidity sensor shown in Fig.4 gives details about the amount of vapor or gases present in the air. The digital signal collection technology and humidity technology used in DHT22 produces a limited digital signal, which ensures its reliability and stability. The sensors are connected to an 8-bit single-chip computer. Each sensor in this module is based upon the temperature, and measurements are made in the measuring chamber. When the sensor detects, it will quote the measurement coefficient in the OTP memory of the designer. Due to its compact size, less power consumption, and extended transmission distance, DHT22 can be used in a variety of challenging systems (20m). Because of the single-line packing with four pins, the connection is easy.

Section IV describes the Software description followed by a section.

IV. SOFTWARE DESCRIPTION

Proteus 8 is a program that allows user to simulate microcontrollers, to create schematics, and electronic prints for manufacturing Printed Circuit Boards (PCBs). This software was created by Lab Center Electronics company. Proteus 8 Professional software is a complete offline installation package. Proteus 8.6 Professional is a 32-bit and 64-bit version of Proteus. Finally, Proteus is a hybrid application that combines the virtual system modeling with circuit simulation. The simulation of full microcontroller-based designs can be made easier by combining the mixed-mode SPICE circuit simulation, animated components, and microprocessor models.

Section V describes the Simulation Results followed by a section.

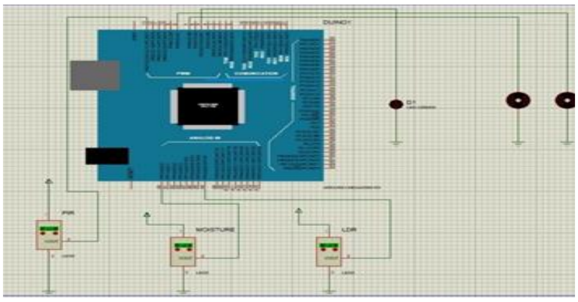

Fig: 5 Proteus Simulation of the prototype

V. SIMULATION RESULTS

Fig: 6 Pesticide is activated

Fig: 7 Healthy mango leaf

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Fig: 8 Mango fruit is not ready to cultivate

Fig: 9 Mango fruit is ready to cultivate

Section VI describes the Hardware Results followed by a section.

VI. HARDWARE RESULTS

The hardware results are shown below. If the light intensity is less, the LED is turned ON which is shown in the Fig:11. When the moisture level is less than the threshold level, the Motor turns ON. If someone enters the field the motion is detected. If a pest is attacked in the field the pesticide motor is activated. All this information is sent to the farmers' smartphone as notifications. fig:12, fig:13, fig:14 and fig:15 is shown below.

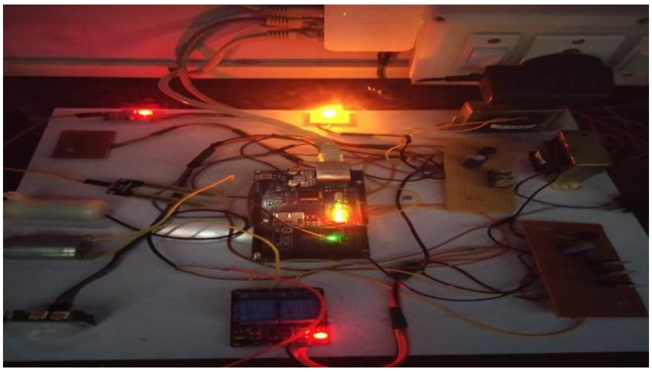

Fig: 10 Hardware Output

Fig: 11 The LED provides light to the field when the light intensity is low.

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Fig: 12 Low moisture level so, Motor ON

Fig: 13 Mortal life form enters the field, the motion is detected.

Fig: 14 Fruits, Crops ready to cultivate.

Fig: 15 If crops, fruits get affected by pests, it notifies.

Section VII describes the Conclusion followed by a section.

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VII. CONCLUSION

Everything in modern technology is dependent upon data processing and information technology. For sustainable agriculture, this prototype verifies to be useful for farmers, cost-effective, and efficient. This project uses Arduino Mega to provide a more efficient way to execute farm automation. The moisture level, light intensity level, pest assault, animal activity, and field status are all efficiently reported to the farmer through the use of a sensor.

Section VIII describes the Future Scope followed by a section.

VIII. FUTURE SCOPE

In future, Agriculture will be performed by precision method. Therefore, this system will be very useful. Because precision agriculture will become standard in future. This approach will be extremely beneficial to the farmers. In addition, the system can be used to monitor soil quality and crop growth in each soil. The sensors and microcontroller are successfully interfaced, and wireless communication between the nodes has been developed. All observations and reviews show that this project is the perfect solution for field work and irrigation issues. Applying such system in the field can undoubtedly help to increase crop yields and overall production.

Section IX describes the Reference followed by a section.

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