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IoT based Smart Farming System

Dr. S. Rathnamala[1], Dr. C. Parameswari[2], Sobana R.S[3], Veera Lakshmi.M[4]

[1]Associate Professor and Head/AI&DS, [2]Associate Professor/IT,
[1,2,3,4]Sethu Institute of Technology, Kariapatti, Virudhunagar-Dt, Tamil Nadu, India.

E-mail: rathnamala@sethu.ac.in[1], parameswaric@sethu.ac.in[2], sobanaramakrishnan04@gmail.com[3], veeralakshmi2404@gmail.com[4]

Abstract

The foundation of the economy and the most fundamental source of occupations is agriculture. Most people in the world depend on agriculture to sustain their daily existence. In India, crop production supports over 80% of the population. The majority of crop production needs to be handled by modern technologies because it can't be productive just through real-life activities. The initial approach is leveraging an novel water supply system with an innovative concept. This system is an expansion of the prior strategy that it highlights the characteristics that give a crop control over soil moisture, temperature, and a smart water system. These features also provide basic management in terms of precise continuous field information. A PC with Internet access keeps track of each of these activities to see whether they can be controlled.

Keywords: Temperature Sensor, Soil Moisture Sensor, PIR Sensor, GSM module.

1. INTRODUCTION

The income from agriculture is most important for the persons who depend on it. The agricultural business did not experience significant crop development in the past century, according to research. Food prices are rising because crop yields are declining. Water waste, low mud fecundity, misuse of nourishment, climate change, sicknesses, and other factors could all be to blame [2]. This can be caused by a multitude of factors, including water wastage, poor soil fertility, fertilizer overuse, climate change, sicknesses, and so on.

In agriculture, it is critical to be proactive, and the best solution is better management, routine maintenance, and crop inspection using Internet of Things (IoT) technologies combined

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with various networks, utilizing sensors toward measuring the factors and alerting the respective individuals via SMS attributes. It has the potential to shape agricultural evolution and contribute greatly to agricultural efficiency. Monitoring equipment are engaged to gather the details of the conditions prevailing in the farms, such as high temperature, stickiness, and bright strength, with the goal of increasing crop productivity.

Agricultural monitoring systems are one area where IoT technology is currently popular. In conventional farming, taking care of animals and crops requires manual labour, which frequently leads to inefficient resource use. The idea of "smart farming" can get around this problem by educating farmers on how to use the Internet of Things, giving them access to GPS, and teaching them information management techniques, so that they can increase the quantity and quality of their produce. Agriculture could be changed more easily by integrating wireless sensor networks with other technologies like the cloud and the IoT. It is a physical network of linked devices that can be accessed online. Its structure is composed of things, sensors, communication networks, processing, and computational units. The cloud server, a piece of computing and processing hardware, receives the data from the sensors and transmits it to it over the Internet.

In this research, a new farmland monitoring system that is wireless, has a solid design, and is very user-friendly, has been developed. Sensor input, an Arduino Uno interface, and a GSM connection as the user interface (Farmer's mobile) are all used to integrate the system. The system is simplified and is made easier to grasp for farmers to encourage them. The process is therefore more efficient than it was while using the farmers' manual and conventional tools.

1.1 Objectives

- To do smart farming with the help of IoT.
- To use water effectively in farming.
- To modernize the farming by IoT.
- To detect animal intrusion in the agricultural field.

2. LITERATURE SURVEY

Research in the field of agriculture is improved in a number of ways to increase agricultural productivity both qualitatively and quantitatively. The features of soil and varied climatic conditions have been the subject of several scientific projects. A few review papers examined the application of IoT and AI in agricultural surveillance. The researchers have emphasised the need of data-driven smart farming systems that reduce costs and promote environmentally friendly practices by gathering data and using it to make decisions.

For the identification and watering processes, investigation using a fuzzy logic system and applying a decision-making mechanism has been proposed. A system is built with the use of sensors, and the sprinkling method is computerized in response to a server's choice based on the detected information. Using wireless communication, the detected data is moved to a web server database. If the temperature and moisture levels fall beyond the required range, irrigation that is automatic will stop. The user can remotely monitor and control the system by using a programme with a web interface. The extensive real-time and historical environment is expected to support efficient resource management and utilisation. An IoT based smart farming using addons has been carried out in the work [1].

Components

The 2 main components used are:

1. Hardware Component
2. Software Component

2.1 Hardware Components

Arduino Uno: The atmega328p is used in the proposed work [3]

PIR Sensors: The PIR sensors are used to detect whether people or animals have entered or exited the sensor's detection range. They are lightweight, affordable, low-power, simple to operate, and durable. The sensor detects motion inside its field of view using infrared photons. The range of sensitivity is up to 7 metres. 5V input voltage is used for the power supply. As a result, it is often referred to as a passive infrared sensor or pyroelectric sensor.

Temperature Sensor: A precession integrated circuit temperature sensor called a "Temperature Sensor", changes its output voltage in response to the ambient temperature.

It is an inexpensive IC that can sense temperatures between -55°C and 150°C. Its output voltage is proportional to the instantaneous temperature. It is an analog sensor.

Soil Wetness Sensor: It measures the soil wetness level and reports to the controller [6].

LCD 16*2: The messages are displayed in the form of alphanumeric and special symbols.

GSM Module: Global System for Mobile Communication (GSM) is cellular wireless telecommunications. It is used to send the output messages to the registered mobile of farmer. It allows for transmission, sending and receiving voice calls. Its features are low -cost, long -range connectivity, and small in size. The supported frequencies are 850/950/1800/1900MHz [4]. The main network used is the GSM module.

Drip Irrigation Pump: When necessary, a drip irrigation pump is utilised to pump water from a tank to the agricultural area. It is also linked to the relay for high-current protection.

2.2 Software Components

All these hardware components are interlinked through network.

Working

A voltage regulator and a power supply adaptor are used to power the Arduino Uno. The Arduino sends the analogue output of the temperature sensor, which gauges the temperature of the nearby agricultural area, to the LCD. On the LCD, the pertinent temperature is shown. A digital signal is created and sent to an LCD coupled with an SMS to a registered mobile phone when a PIR sensor in an agricultural field detects an intruder. No SMS will be sent to the linked mobile phone if the sensor in the agricultural field detects no motion [8].

The moisture level of the soil is measured by a soil moisture sensor. No signal will be delivered to relay2 through Arduino if the detected soil moisture content exceeds the limit, and there will be a shutdown of the drip irrigation pump. Relay2 will receive the output signal if the observed soil moisture content is less than the set value [7]. The electromagnet activates Relay2 when it enters the ON state, turning on the switch and starting the drip irrigation pump. To the registered mobile phone number, an SMS will be sent.

An ultrasonic sensor is used to gauge the water level in the tank [9]. A signal is not sent to relay1 and Arduino relay1 is turned OFF if the water level rises above the predetermined level. An output signal is sent to realy1 via Arduino relay1, and the relay is activated if the

water level drops below a set level. Additionally, the tank pump will be activated. The registered mobile phone number will receive an SMS.

Relays are a particular kind of electrical switch that are magnetically powered. The magnetic pull, when activated, opens or closes an electrical circuit.

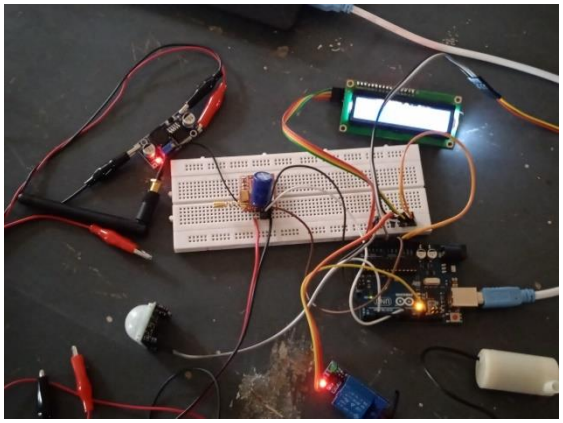

Figure 1. Representation of the working model

Advantages

- Improved and more extensive production.
- Effective utilization of water.
- Remote sensing.
- Smart irrigation control.
- Growers and farmers can use IoT technologies to reduce waste and increase output.

Applications

- System is applicable to different farmlands.
- System is applicable to farming in greenhouses.
- It is applicable to gardening.
- It is also applicable to Precision farming.

3. RESULTS

PIR sensors in the farm can detect motion, and when they do, the LCD displays the phrase "Intruder detected." Animals or people can be intruders. The temperature sensor concurrently displays the temperature value that was observed from farmland. The LCD displays the level of water in tank in inches, and this is done using ultra sonic sensor. The registered mobile number receives an SMS when the tank's water level is low, when the soil moisture level is low, and if an intruder is detected.

Fig. 2 represents the temperature value that was observed from the farmland. Fig. 3 shows the intruder detection that was observed by the PIR sensor and the detected moisture level by the soil moisture sensor. Fig. 4 shows the messages received through the GSM module.

Figure 2. Temperature value detection

Figure 3. LCD displaying soil moisture and intruder detection

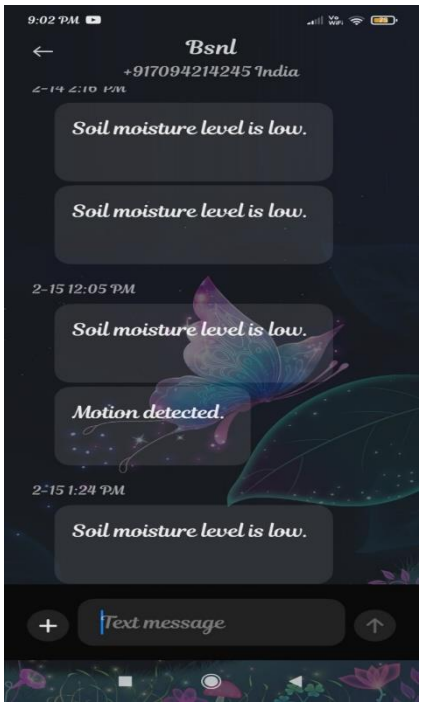

Figure 4. SMS to registered mobile number

4. FUTURE WORK

With the help of AI, IoT, machine learning, and cloud technology, a smart farming system may be built to make future changes to better analyse and increase crop yields in the agricultural sector. The field can be examined using machine learning to estimate the quantity and quality of the harvest. The farming harvest can be improved using AI, IoT, and cloud computing technologies [10]. The data can be collected, stored, and then subjected to machine learning analysis using cloud computing and technology. Agriculture could be improved to produce the maximum amount possible while reducing waste in order to fulfill the demands of the growing population with more research and technological breakthroughs. Additional sensors including NPK sensors, humidity sensors, and webcams can be used to boost research and development in the agricultural industry [13]. More data is required for potential future enhancement in order to perform training and testing on the data. In addition, the data can be validated using multiple subsets. The actual fuzzy systems will be changed so they may be used to many types of crops [15]. Numerous sensors, such as pH sensors, ambient carbon dioxide sensors, and light sensors, can be installed.

5. CONCLUSION

To decrease the need for human intervention in farming, a monitoring system for agriculture must be built. This process seeks to teach the farmer how to use an integrated technology system to monitor the farms in order to increase the quantity of crops produced. This system promotes water usage efficiency, and may potentially be applied to numerous agricultural areas. It can be applied to horticulture, greenhouse farming, and other fields. Since the PIR sensor used in this system can detect intruders, farmers no longer need to worry about crop theft and damage.

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