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IoT Based Greenhouse Monitoring Using Raspberry Pi

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Abstract

A greenhouse is a man-made environment in which plants can grow in a regulated atmosphere. Farmers experience unseasonal rainfall, low irrigation systems, and seasonal fluctuations in general, thus to minimize these issues, greenhouse monitoring utilizing IoT was established. It basically acts as a surveillance system. Controls the conditions that are necessary for the growth of plants. DHT-11, LDR, and Soil were used in this project. Light intensity, temperature, humidity, and soil moisture are all detected using moisture sensors. In this case, The Raspberry Pi is used to connect to these sensors and control all of them using inputs. given by the user, as well as sending data to the end-user via the gsm module attached to it. Throughout the year this technology allows the production and off-season crops.

Keywords

Raspberry pi, DHT-11 Sensor, LDR sensor, greenhouse monitoring, gsm module, and IoT.

1. Introduction

The Internet of Things (IoT) is a system that uses embedded sensors, software, and other hardware modules to connect and exchange data between devices through the internet. The Internet of Things (IoT) is currently found all over the world, and it is advancing in every facet of life on a daily basis. The Raspberry Pi is utilized in this study to connect with the equipment used in the greenhouse project. The Raspberry Pi is a small computer with no processor that runs Linux and handles GPIO. Agriculture accounts for a significant portion of India's economy. Agriculture must be expanded in order to ensure the economy's long-term viability. Greenhouse technology is one of the innovative approaches for improving or developing agriculture. By employing this innovative technique, Farmers will be able to grow imported plants and harvest the crop throughout the year. Previously, this type of technology existed in greenhouses, but it used microprocessors, microcontrollers, and sensors. They've also been proven to work, but when it comes to efficiency and response speed, current technology with IoT is the best. Everyone expects accuracy and efficiency in today's world. It can be done with the help of IoT. Previously, microprocessors and microcontrollers were employed as controlling devices; however, Arduino has since replaced them, and the Raspberry Pi has also emerged to replace Arduino. Aim for a real-time monitoring greenhouse system that uses the Raspberry Pi, which is a low-cost portable Linux computer with built-in wi-fi. Using this new greenhouse technology to improve field production while lowering labor costs and ensuring long-term resource sustainability for future generations.

2. Motivation

The impetus for this project stems from the growing population and food production crises, as well as the problems that our country is experiencing as a result of erratic rains and a lack of irrigation. The fundamental goal of this initiative is to expand resource production and use in a way that is sustainable for future generations.

3. METHODOLOGY

This model is prepared in the following manner as

By discussing the total connections between the components.

By keeping the main objective of the model which is useful for everyone

Explains the realization of the objective

4. CONTRIBUTION

*The contribution of "IoT-based Greenhouse Monitoring with Raspberry Pi" to society is that agriculture is the backbone of every country, thus improving agricultural technology and assisting farmers in producing more and earning more by lowering labor costs is important. We can create a lot of job opportunities to educate people by incorporating IoT technology into these projects. By utilizing automation in the greenhouse, the cost of labor is reduced, resulting in a rise in the government's economy. With this IoT-enabled automation greenhouse, we can take a step forward in our country's agriculture sector improvement quest.

*The project's key contribution is to boost yield output and better resource use through automation technologies, as well as to give a large number of job possibilities for educated individuals. [3].

*This project's main contribution is to improve sanitary conditions in public restrooms, which in turn reduces disease transmission. It is also utilized to conserve water and ensure resource sustainability[3].

5. REALIZATION AND REPRESENTATION OF OBJECTIVES

5.1 BLOCK DIAGRAM

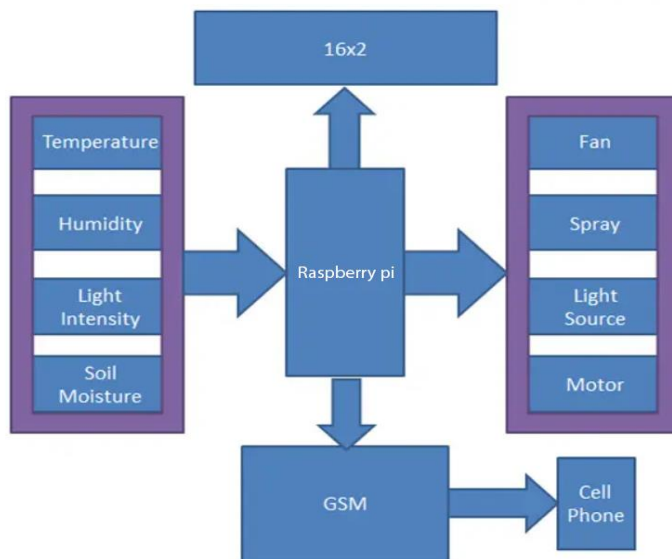
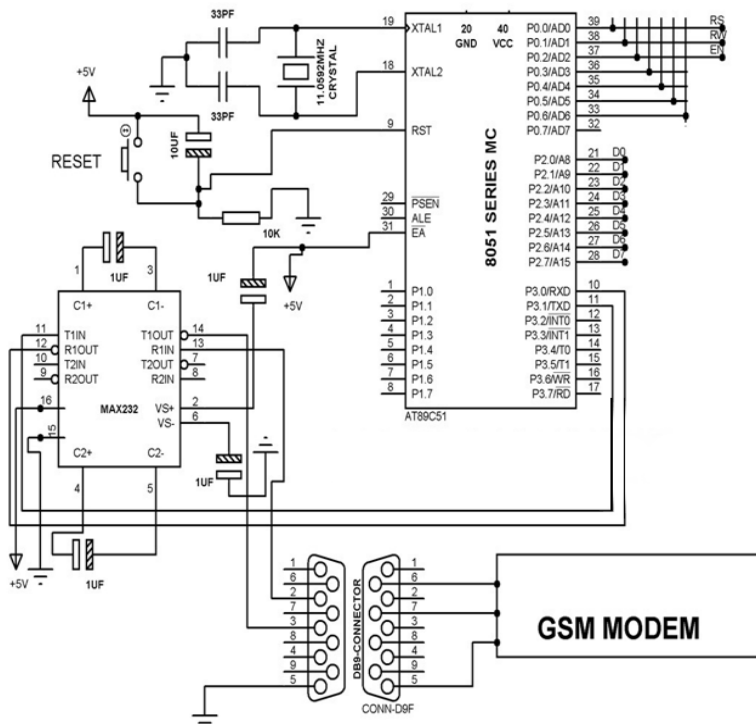


Fig 1: block diagram of the greenhouse monitoring module

Raspberry Pi is a chip card-sized mini-computer that runs on its own keyboard and mouse. It performs Linux and gpio operations. GSM stands for global system for mobile communication and it is a digital mobile network. This technique uses a combination of time and frequency division for multiple accesses. It is used to communicate and transfer data; it is the second generation of mobile networks. DHT-11 is an ultra-low-cost temperature and humidity sensor. It uses a capacitive resistor and thermistor to measure the surrounding air. It calculates relative humidity by measuring the electrical resistance between two electrodes. LDR sensor is also known as a photo-resistor. It works on the principle of photoconductivity and is used to measure the intensity of light. A soil moisture sensor is deployed in the soil to measure the moisture in the soil, if the moisture decreases in the soil, the raspberry pi triggers the tap on to release the water into

the soil. It is a low-cost and high-efficiency sensor; it has two metal rods held apart at a fixed distance with insulating material on it. 4-Channel Relay Module requires a 5v power supply to work, it can be connected with Raspberry pi, AVR, PIC, ARM, and MSP430. It consists of 4 relay modules with ‘NC’ meaning normally connected to COM and ‘NO’ meaning normally open to COM. It consists of 4 LEDs to show the relay status.

5.2 GSM MODULE:



6. Analysis

Climate factors, such as unseasonal rains, tropical weather, and, most notably, India's floods and droughts, which result in a bad irrigation system for farming, are all key concerns in the agricultural sector in India. To solve this problem, we devised a cutting-edge solution called greenhouse monitoring with Raspberry Pi, which operates automatically once set up.

This technique not only aids farmers in overcoming climactic challenges but also in lowering labor costs. In a developing country like India, where the population is steadily increasing while the number of individuals who can farm is decreasing, this is a problem. By utilizing this cutting-edge technology, we can overcome all of these obstacles and attain resource sustainability.

Advantages: We can overcome climate obstacles, reduce labor costs, use resources sustainably, and cultivate foreign plants using this method.

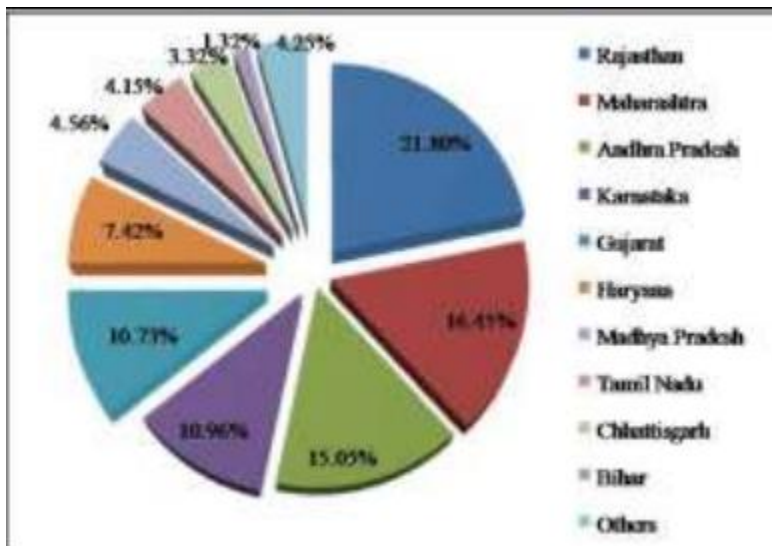


Fig.3: Irrigation system of different states



Fig.4: Greenhouse climatic conditions.

Disadvantages: The initial setup cost is significant, and machines wear out over time.

Using this strategy, we can create optimum circumstances in the greenhouse, as seen in the above figure. As can be seen in the above plot, the temperature, humidity, and light intensity are all at a moderate level, which is great for growing plants.

7. RESULT

This model is primarily concerned with resource use for future references. The Raspberry Pi is utilized in this model to operate the sensors that are attached to it utilizing IoT technology. Previously, an Arduino was utilized in this procedure, but due to its efficiency and precision, the Raspberry Pi has replaced it. The Raspberry Pi has a faster rate of speed or response time than the Arduino.

The workings of this model are as follows: a DHT-11 sensor is connected to a raspberry pi to detect the temperature in the surroundings; if it detects that the temperature is rising, it sends data to the raspberry pi to turn on the dc fan connected

to it; soil moisture is connected to raspberry pi and deployed in the soil to detect soil moisture; if it is decreasing, it sends data to the raspberry pi to turn on the dc fan connected to it; and soil moisture is connected to The raspberry pi will automatically turn on the motor supply to provide water, and an LDR sensor will be connected to detect light intensity and turn on the light if it is low. All of this is done using IoT technology, and a gsm module will be connected to the raspberry pi to send notifications to the user. Importing code to the Raspberry Pi is done using the Python platform. It continues the process as told by the user, eliminating the need for human input and lowering labor costs in comparison to traditional fields.

8. FUTURE SCOPE:

Agriculture is one of India's most important industries, accounting for 18% of the country's overall gross domestic product (GDP). The economy grows by 3% in this covid-19 outbreak as well. So, regardless of the circumstances, we can appreciate the value of agriculture in everyone's life.

When we consider resources like water and electricity, agricultural power use accounts for roughly 20% of total consumption in the country. As a result of the foregoing statistics, this technology can save energy resources by utilizing non-conventional resources such as solar and wind turbines. It is also possible to limit the consumption of water resources by adopting automatic resource control in greenhouses. Greenhouse technology will become a trend-setter in the agricultural sector in the future.

9. CONCLUSION

The advantages of a smart greenhouse over conventional crops are that it may be self-monitored by its own technology, resulting in higher yields, insect- and pest-free environments, reduced resource consumption, and lower labor costs. Some experts believe that by using greenhouses, increased production may be achieved year-round. Off-season crops and production are also possible. With this technology, it is possible to reduce any climatic conditions in the greenhouse, allowing it to grow foreign crops that are not ideal for our climate. The initial setup cost is more, but the lifespan is longer. It will be more efficient in the future if non-conventional energy sources like as solar and windmills are used. This initiative is thought to aid in the advancement of agricultural technologies and the growth of the country's economy.

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