International Journal of Modern Computation, Information, and Communication Technology
2022;5(1):27-32.
ISSN: 2581-5954

Wireless Sensor Network-based Greenhouse Effect Parameters Controlling System

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Abstract: There is currently no method in place to determine where irrigation is required. In this research, we created Zigbee wireless networks for analyzing moisture levels by installing humidity sensors around the field to identify areas with low relative humidity and other pollution monitoring metrics. We can preserve water and reduce the issue of waterlogged in the land using the methods described above. To determine the climate, we employed a moisture sensor. Farm owners may learn about the weather by doing so. If there is a prospect of rain, the farmer does not need to irrigate the agricultural field. As a result of not turning on the motors, we may save water and power. Fertilizer levels in crops are growing nowadays, which has an impact on humans. We obtain information about the soil and assess the acidity content in soil by utilizing pH monitors. This allows us to apply fertilizer only where it is needed and avoid over-fertilization of fields. Temperature is a variable factor in the irrigated agriculture ecosystem. The farmer receives information from temperature readings. We can record the status and feed the crop by employing temperature sensors.

Keywords: Wireless sensor networks, Cloud server, Greenhouse monitoring, Parameters controlling, Zigbee.

INTRODUCTION

A greenhouse, as the name suggests, is a structure where vegetation is cultivated. Greenhouses are frequently used to cultivate plants, veggies, berries, and nicotine plants. Exposure, soil moisture content, warmth, Carbon dioxide concentration, and other variables all influence plant development. These physical parameters are difficult to handle individually within a greenhouse, necessitating the requirement for controlled construction. Greenhouses are indeed very helpful as they provide an ideal temperature about crops, defend them from climate changes, eventually expand the growth cycle, enabling you to sow seedlings earlier and extract plants afterward, and allow important economic crops including such vegetables, cabbage, gourds, and indigenous tribes to crop more effectively [1].

The most important factor in your greenhouse's success is monitoring. We recommend checking the temperature and humidity levels every day to ensure plants are getting the care they need. We also recommend setting up a schedule to check the plants at the same time each day. This will make sure your plants are getting the optimal amount of light and exposure to CO2 [2]. Monitoring the greenhouse is one of the most important responsibilities for a cannabis grower. The state of the environment inside your grow room is the foundation for a successful crop. If you don't maintain a healthy environment for your plants, you'll struggle to produce the yields you want. That's why it's important to keep up with regular greenhouse monitoring, so you can identify and fix problems before they affect your yields [3].

Today, the greenhouse industry is facing a unique set of challenges. The climate is changing, causing weather patterns to become more unpredictable, and the rising cost of energy is making operating greenhouses more expensive than ever. But we've also seen an unprecedented amount of innovation in the industry — from the development of new technology to the implementation of new strategies and best practices. These changes have allowed the greenhouse industry to adapt and evolve to meet the needs of a changing climate [4]. When you hire a greenhouse monitoring service, they come to your greenhouse periodically to take readings and observations [5]. This allows them to monitor the temperature, humidity, and light levels so they can make corrections if necessary. They'll also note any changes—such as an increase or decrease in the number of pests or disease symptoms—that may indicate your plants need care. It's a great way to stay on top of your growing needs without having to be onsite all the time [6].

Received: 22.03.2022 Revised: 30.04.2022 Accepted: 13.05.2022

When greenhouse monitoring is performed regularly, it has the potential to improve crop health and yield. By closely monitoring your plants, you can detect when something isn't quite right. This might include detecting when the temperature, humidity, or light levels are off. If you catch a problem early, you can remedy it before it causes major damage to your plants [7].

Traditional computing is based on the idea of a central processing unit (CPU) that performs calculations, stores data, and responds to instructions from the software. This architecture is great for single tasks and programs, but it is limited for many applications that require computation to be performed in many ways, such as image and speech recognition, computer vision, and natural language processing [14]. Wireless sensor networks (WSNs) are computing architectures that are composed of many small, independent sensors that sense their environment and pass the data along to the processors in the network. Each of the sensors processes the data in a specific way and the network performs the function of a single, powerful processor [15].

The internet of things (IoT) technology is used in this study [8] to propose a monitoring system for environmental conditions in a greenhouse. Sensors are used to collect data on greenhouse ambient factors like as temperature, humidity, soil temperature, soil moisture, and light intensity. The sensor's data is subsequently transmitted to the gateway once per minute through an access point established in the greenhouse area. The information received by the gateway is then saved in the SQLite database [13]. In this paper [9], a hierarchical WSN is described for data collection of these parameters. The sensors, combined with all gathering features, processing, and wireless data transmission capabilities, labelled as sensor nodes, are at the lowest level in this configuration. In the middle level, router nodes are supplied to send data from sensor nodes to a controller known as the coordinator node.

The system consists of a regional appropriate information monitoring program and a radio frequency-based close communication platform. The system, when combined with global telecommunications based on GSM systems, enables large and micro greenhouses continuous assessment [10]. This research [11] proposes a type of vegetable greenhouse monitoring and management based on ZigBee and GPRS. The system incorporates wireless sensor network and GPRS technologies for data collecting, wireless transfer, wireless connectivity, and observation [12].

PROPOSED METHODOLOGY

This study describes the architecture of a sophisticated wireless sensor network (WSN) for an agro ecosystem. Observing farming surroundings for different aspects such as temperature and relative humidity, and other parameters, may be beneficial. The capacity to capture and detail modifications in factors of interest has grown in value. Studies for a Zigbee-based tracking system were carried out. These terminals electronically transmit data to a central server, which gathers data, saves it, and enables it to be analysed and presented as needed.

Using the strategies indicated above, we can conserve water and lessen the problem of water logging in the land. We used a moisture sensor to determine the climate. Farm owners may learn about the weather as a result of doing so. If rain is forecast, the farmer does not need to water the agricultural land [16-17]. We may conserve water and electricity by not turning on the engines. The monitoring system consists of temperature and humidity sensor, Ph sensor to monitor the global environment and upload the taken reading in a server.

Here we used serial communication interface module to communicate the observed data in the server o the pc or user mobile phone. The ability to communicate with other devices, systems, and people is one of the most basic functions of technology. Today, we take for granted that computers can talk to each other over the internet or through cables. We are also used to the idea that we can talk to computers using natural language. But long before the internet was invented, engineers found ways to allow computers to talk to each other over wires.

Wireless sensor networks (WSNs) are networks of sensors that are placed in the physical world to sense and collect data. WSNs are becoming an increasingly important part of our modern world and are being used for a wide variety of applications. One of the most exciting applications of WSNs is in the field of cyber-security. WSNs can be utilized to monitor and map the physical world to protect critical infrastructure and sensitive information. In the ZIGBEE wireless communication, the data packets are in the form of continuous waves. Each transmitting device continuously broadcasts its own packet of waves while listening out for packets from other devices.

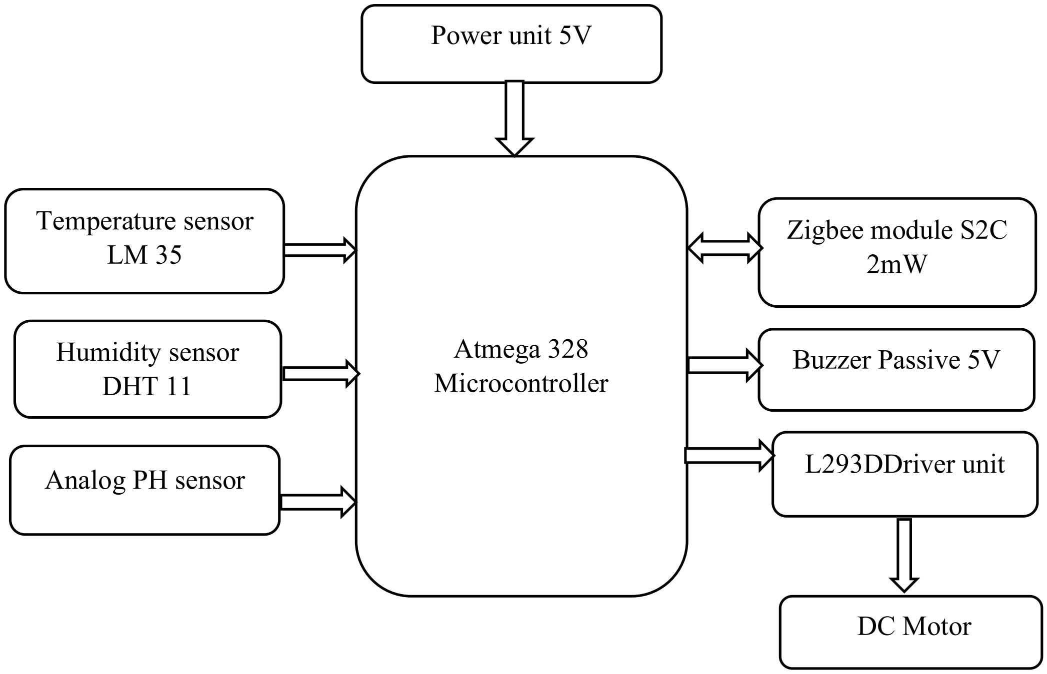

FIGURE 1. Monitoring Unit

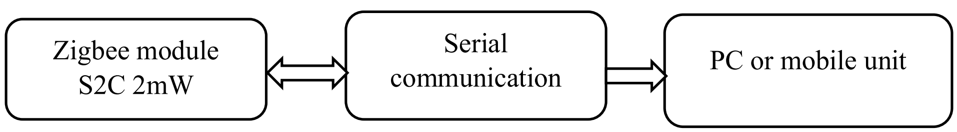

FIGURE 2. Control Unit

One of the most common sensors found in WSNs is the temperature and humidity sensor. These sensors are placed in areas of the physical world that are typically difficult to access, such as the inside of a building or under the ground. When a change in temperature or humidity is detected, the sensor sends a signal to the processor, which can be used to determine the location of the change. This can be used, for example, to keep an underground bunker at the proper temperature and humidity for optimal survival.

Ph sensors have found a wide range of uses in the modern world – from detecting harmful chemicals and pathogens in water to detecting key nutrients in soil. They are used in the medical field to detect the presence of infections, and they can also be used to detect and monitor the levels of key nutrients in plants and animals. The most known application of ph sensors is in the testing of household water to ensure that it is safe for human consumption. The range of uses for ph sensors is only going to increase in the future as our understanding of their functions and capabilities increases and we discover new uses for them.

RESULTS AND DISCUSSIONS

When you add greenhouse monitoring to your farming operation, you get regular updates on the status of your plants. You also get alerts if the environment inside the greenhouse isn't optimal for your plants. This lets you know when something needs to be corrected before it becomes a larger problem. This also helps you protect your investment.

When you invest in greenhouse monitoring, you're taking action to protect your investment. This service alerts you immediately if something isn't quite right with your greenhouse environment. You can then take the appropriate action to ensure your plants continue to thrive. This might include adjusting the light levels, temperature, or humidity levels.

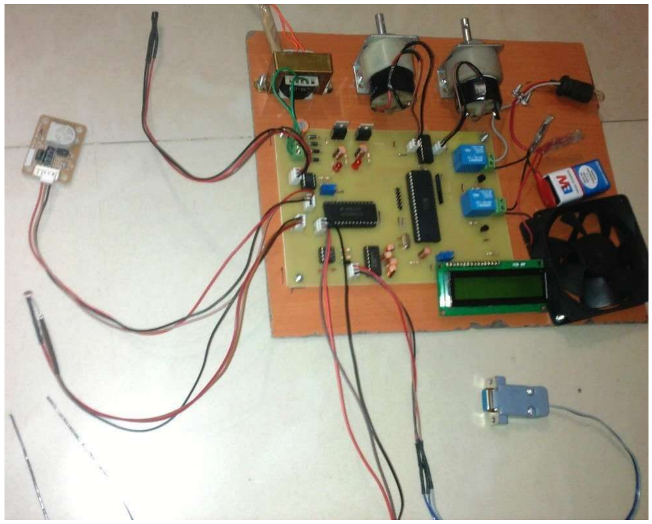

FIGURE 3. Hardware Implementation

Figure 4 shows the hardware implementation of the system. The ability to collect and detail changes in variables of interest has risen in value. There have been studies for a Zigbee-based tracking system. These terminals send data electronically to a central server, which collects it, stores it, and allows it to be analysed and displayed as needed.

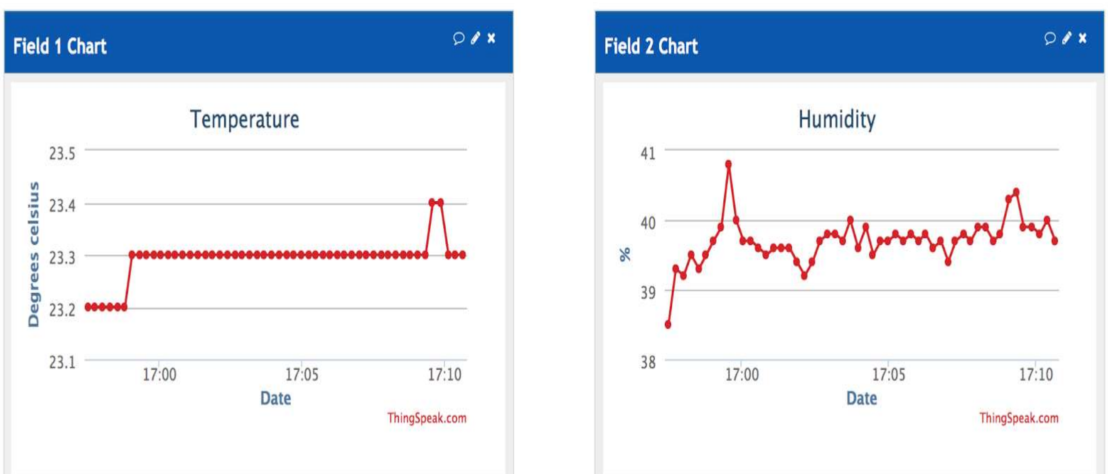

FIGURE 4. Cloud Graph for Temperature and Humidity Readings

We collect data on the temperature and humidity as shown in Figure 4, in the room to make sure that it's comfortable for our customers. This helps us to ensure that the data centre is staying within proper operating parameters and helps us to identify any changes in the environment so that we can act quickly. We also use the data to monitor our performance and adjust when necessary.

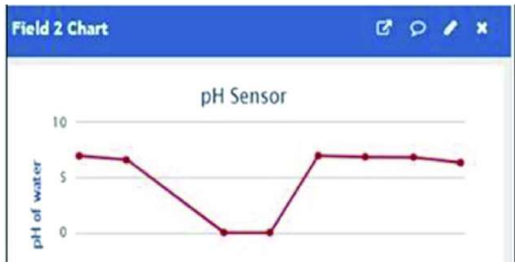

FIGURE 5. Cloud Graph for pH Sensor

Figure 5 shows the ph sensor readings. The world is becoming increasingly reliant on the internet and the services it provides. As a result, the internet is becoming increasingly centralized. This has several advantages, including the ability to provide better service and greater reliability. But because so much of our lives are dependent on the internet, the risk of an outage has never been greater.

CONCLUSION

This research focuses on greenhouse planning and evaluation, as well as low-cost data collecting of greenhouse activities. Agricultural regions are critical for digital control operations. The greenhouse operations variables under discussion here whose data temperatures, moisture should be obtained from the field, registered in a computer database, and the information is then utilized for continuous supervision. We may conserve water and electricity by not turning on the engines. Fertilizer levels in crops are increasing, which influences humans. Using pH monitors, we collect information about the soil and measure its acidity content. This enables us to apply fertilizer only where it is required, avoiding over-fertilization of crops. In the irrigated agricultural environment, temperature is a changeable factor. Temperature observations provide information for the farmer. Using temperature sensors, we can monitor the crop's progress and feed it. It was possible to create an autonomous dew condensation control system that works with a WSN and takes advantage of the dew point condition to stop the dew condensation phenomena on crop leaf surfaces, which is thought to play a key role in the spread of crop diseases. To test the effectiveness of the proposed system, a model resembling an actual greenhouse environment was created. The model was run and monitored using the automated dew condensation control system.

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