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Implementation of a Robot for Reducing Sensors in Greenhouse Monitoring

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ABSTRACT: The process through which the gases in the atmosphere retain solar radiation is known as the greenhouse effect. This causes the earth's temperature to rise above what it could have without an atmosphere, making life on Earth more comfortable. Specifically, flowers and vegetables are grown in the greenhouses. To monitor and control various parameters such as temperature, humidity, light intensity, soil moisture contentsand atmosphere, these greenhouses require monitoring mechanisms. In order to monitor a typical greenhouse, numerous sensors are used. There is a direct correlation between the number of sensors and the system's cost and complexity. In order to lower system costs and complexity as well as system design, installation, and monitoring, this system aims to decrease the number of sensors needed for greenhouse monitoring. A large number of sensors linked to a wired network are needed for greenhouse surveillance but the expense of installing and networking of sensors is a barrier to implementation of an automated greenhouse. Hence, we are making a robot that can navigate the greenhouse. We are using microcontroller herewhichgathers an information from various sensors, reads it, processes it and sends the data to a system. This robot will carry sensors required to monitor different greenhouse parameters. The greenhouse structure must be altered in order to accommodate the ease of operation of this monitoring robot during its development. The task can be completed by a basic line follower robot. Data points can be positioned at different locations from which the collection is to be carried out. It is necessary to decrease the number of sensors while preserving the monitoring process's efficacy and accuracy. Our goal in solving this problem is to create a robot-based system that uses fewer wireless sensors to monitor a greenhouse environment efficiently. This work includes Node MCU which will send the data to user for analysis purpose so that user will take action for better growth of plants.

KEYWORDS: Greenhouse, Wireless sensors, Line follower robot, Microcontroller, Node MCU.

I. INTRODUCTION

Nowadays farmers rely heavily on the greenhouses because they allow them to grow plants under climatic conditions that are controlled and maximize yield.A crucial component of every greenhouse that exists today is monitoring and management. The light intensity, air quality, temperature and humidity and soil moisture are the main sensors that make up an automated greenhouse monitoring system. These sensors gather data on light intensity, humidity, soil moisture content, temperature and quality of air which are subsequently transmitted to the controller, which compares the results to predetermined thresholds to regulate the course of action. The risk of a greenhouse not being maintained at all is thus eliminated by the greenhouse monitoring system. It is environmentally friendly and can lower labor costs and specific environmental conditions brought on by human error. The current research is primarily focused on developing a system for remotely monitoring a range of environmental and other conditions in a predetermined area. We are able to ascertain the conditions that exist at any given time by utilizing a range of sensors, and we can intervene if any parameter or condition surpasses or falls below a pre-established range. Additionally, by utilizing wireless technology, we are able to operate in a large area that would not have been possible with a conventional wire-based system.In this project, we are using a line-following robot with IR sensors in a greenhouse to monitor various greenhouse parameters. We are using controller here to monitor several parameters. After detecting the parameters by

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all sensors, it will send the information to the Arduino UNO and then to user. With the help of Node MCU the data will sent to user. Hence, it will help to monitor the all conditions in greenhouse as required.

II. OBJECTIVES

- To eliminate the need for large number of sensors.
- To reduce human error and labor cost.
- Can be used for continuous monitoring.
- Can be used for mix plants.

III. BLOCK DIAGRAM

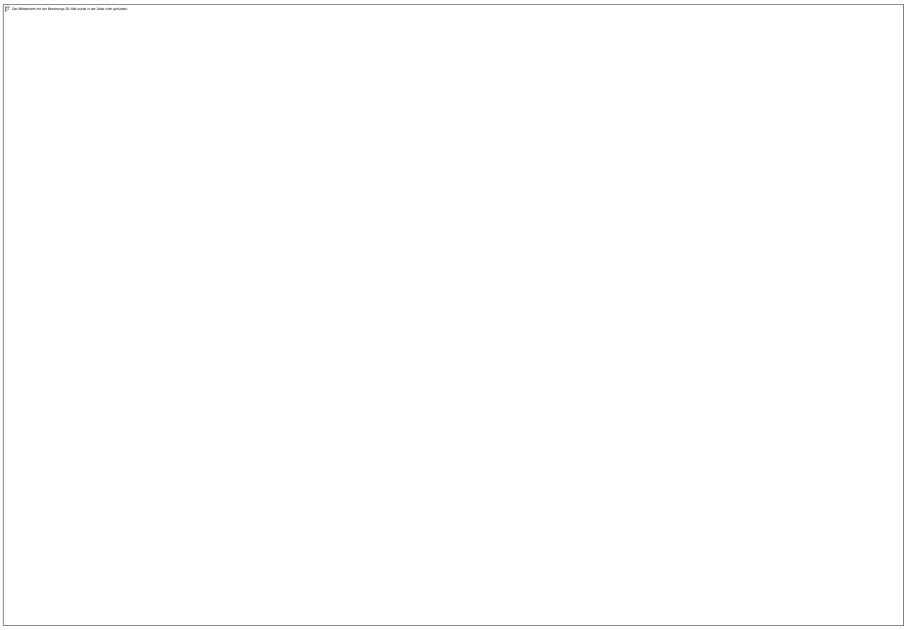

Fig.1. Block diagram for greenhouse monitoring using robot to reducesensors

The greenhouse monitoring robot's block diagram is displayed in the figure above. The data acquisition unit and the motor wheeling unit are the two components that make up this robot's functionality. The upper part consists of soil moisture sensor (capacitive type), temperature and humidity sensor (DHT11), air quality sensor (MQ135), light intensity sensor (BH1750), servo motor, and ESP8266 module which are all included in the data acquisition unit's configuration. When measurements are taken, the soil moisture sensor is inserted into soil via a servo mechanism that is attached to it. Through the ESP8266 module, the end user receives data from these sensors via SMS.

Lower part is the wheeling unit, which has a line-following architectural design. It follows a preset path to move the robot around the greenhouse. The robot is a line follower because of infrared sensors (IR obstacle sensors) are built into its structure, which helps it follow a line. Making a line path with strategically marked points beforehand is advised for the path where environmental parameter data is to be collected. Robot stops at each of these designated points, transmits the data from all of the sensors there, and then advances to collect the data at the next designated point. Because the robot's sensors only move during this movement, multiple sensors are no longer required for each plot in the greenhouse.

IV. METHODOLOGY

An automated greenhouse monitoring system robot is made up of multiple wireless sensors, including light, temperature, humidity, soil moisture and air quality sensors. These sensors send data to the controller based on a number of parameters they detect including temperature, light intensity, humidity, soil moisture content and quality of air.Wireless sensor networks employ Bluetooth or Wi-Fi technology to collect data from multiple locations. Complex wiring and messing are avoided with the wireless sensor network. It is suggested that a robot be used for greenhouse monitoring. The wheeling and sensing systems are the two components of this robot. The wheeling system uses infrared sensors (IR obstacle sensors) to help it follow a predefined path through the entire greenhouse like a line-following robot.

The unit of sensing records the temperature, light intensity, air quality, soil moisture content and humidity at each sensing point and transmits the data to the user via ESP8266 module. As a result, it permits the use of a single sensor for parameter monitoring at multiple nodes, hence lowering the total number of sensors.For this project, a line-following robot is being used in a greenhouse to monitor various greenhouse parameters.

V. SIMULATION OF WHEELING UNIT

Fig. 2. Simulation of wheeling unit

VI. HARDWARE

VII. RESULTS

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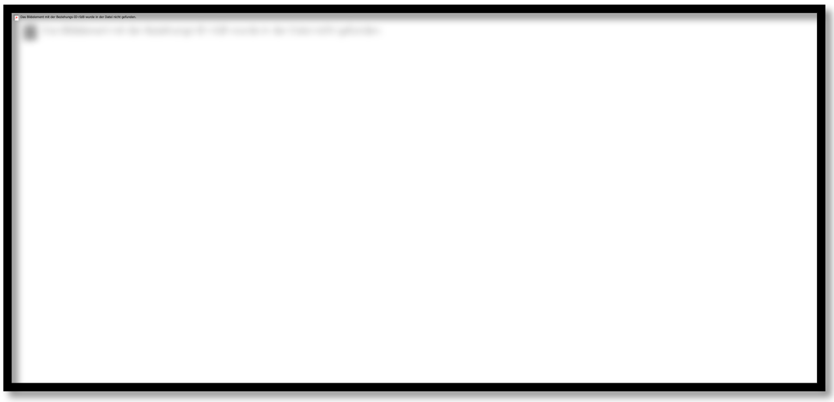

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VIII. CONCLUSION

Using a robot to reduce sensors in greenhouse monitoring gives a creative way to improve cultivation efficiency and support sustainable agriculture. Robotic integration into the monitoring system helps to improve data collection accuracy and efficiency while reducing the number of sensors needed. Analysis as well as real-time data collection made possible by using robots in greenhouse monitoring guarantees that growers can act quickly and decisively. Better crop yields, resource management, and general agricultural sustainability may result from this.

In conclusion, using a robot instead of more sensors for greenhouse monitoring is an exciting development in precision agriculture. It may not be able to reduce number of sensors entirely, but it can greatly improve greenhouse cultivation's sustainability and efficiency. We can anticipate more advancements and improvements as technology develops and as we work with these systems more, which will make this strategy even more beneficial for contemporary agriculture.

IX. FUTURE SCOPE

- Technology Developments
- Data Analytics and Predictive Insights

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- Autonomous Operations
- Scalability
- Energy Efficiency
- Market Growth

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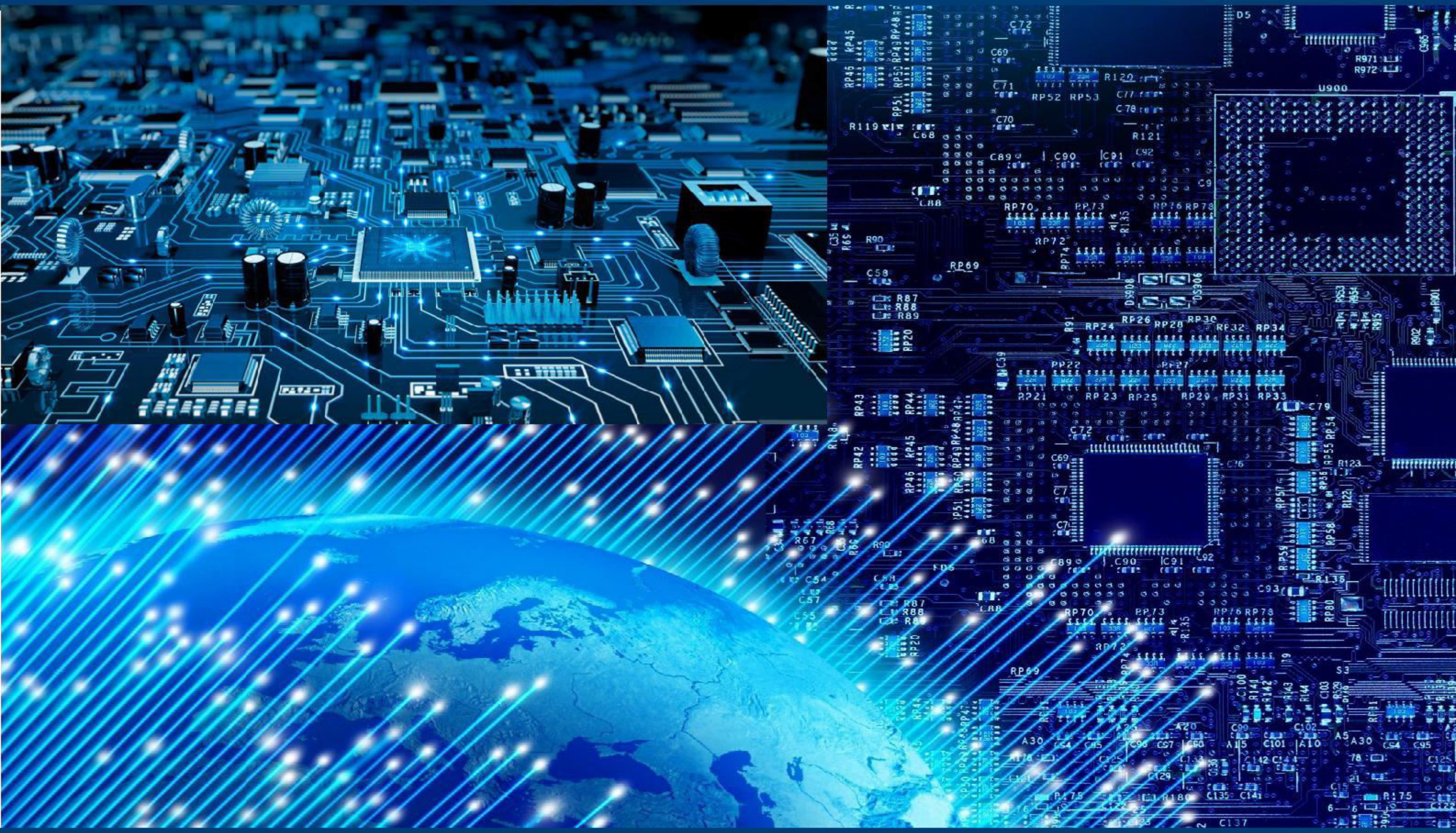

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