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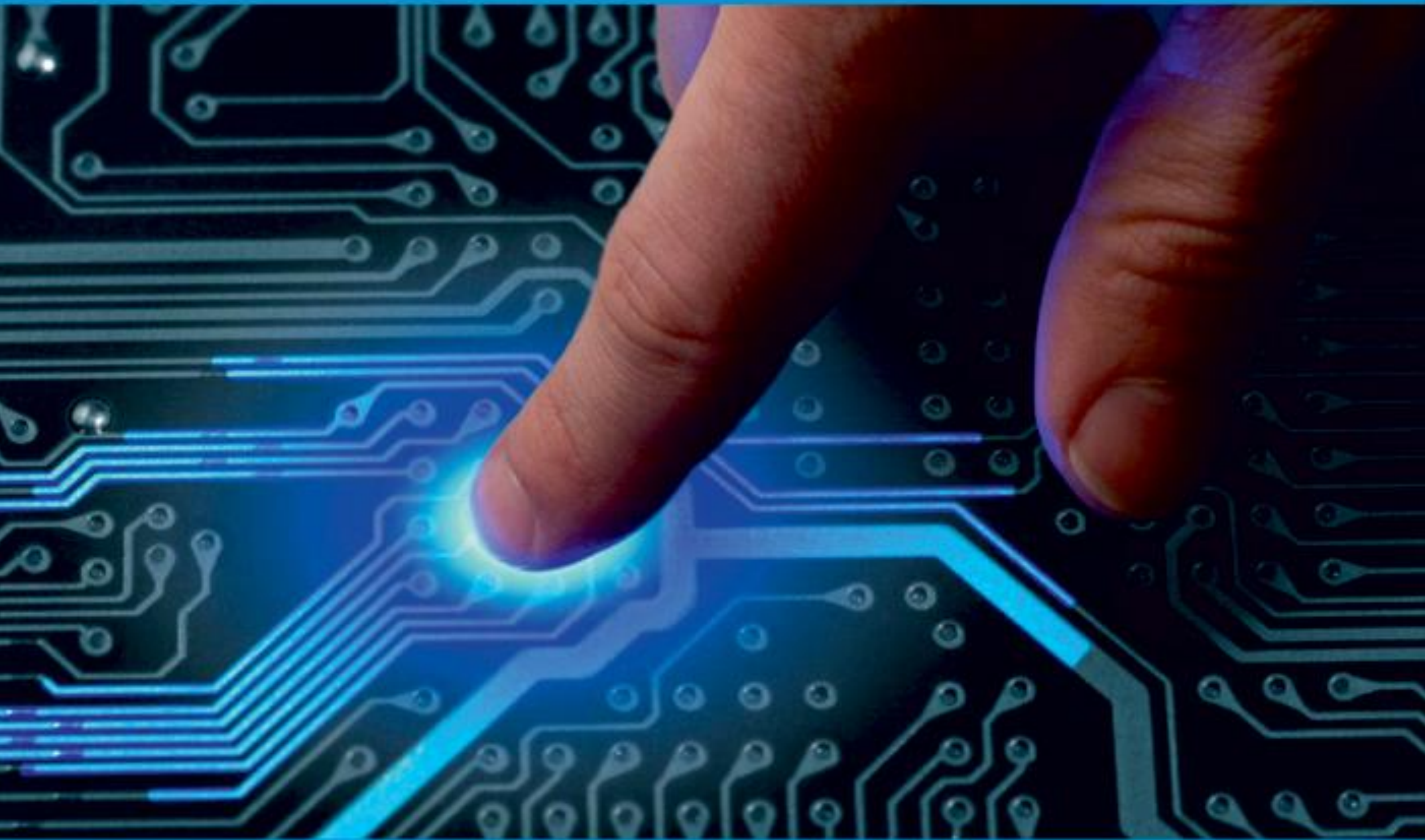

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Automatic Monitoring System for Greenhouse Agriculuture

Parameswari. A, Jeeva. B, Adithyan. S, Aravinth. S and Sohib Akthar.M

Assistant Professor, Department. Electronics and Communication Engineering, Adithya Institute of Technology, Coimbatore, Tamil Nadu, India

Students, Department. Electronics and Communication Engineering, Adithya Institute of Technology, Coimbatore, Tamil Nadu, India

ABSTRACT: Automatic Monitoring System For Greenhouse Agriculture have become increasingly popular due to their ability to optimize plant growth and improve crop yields. In this study, we developed a Smart Greenhouse Monitoring and Control System using a Esp 32, DHT11 sensor, soil moisture sensor, motor pump, and Blynk App . The system continuously monitored and controlled the environmental conditions within the greenhouse, including temperature, humidity, soil moisture through the Hanging Robot Setup and Control the Hanging Robot through the Blynk App.We evaluated the performance of the system in a greenhouse setting and found that it effectively maintained the desired environmental conditions for plant growth. The results demonstrate the potential of Smart Greenhouse Monitoring and Control Systems to improve the efficiency and productivity of greenhouse agriculture.

KEYWORDS: Esp32, DHT11 Sensor, Soil Moisture Sensor, Gas Sensor,Smart Greenhouse.

I. INTRODUCTION

Greenhouses have become essential in modern agriculture, enabling farmers to overcome the limitations imposed by natural climatic conditions and optimize crop production. However, maintaining the ideal environment within a greenhouse is crucial for achieving optimal plant growth and ensuring high-quality yields. To address this challenge, advanced monitoring and controlling systems are essential to provide real-time data and automated adjustments. In recent years, the emergence of low-cost microcontroller platforms, such as Esp 32, has revolutionized the field of automation and control. Esp 32 offers a versatile and user-friendly platform that enables the integration of sensors, actuators, and intelligent algorithms to create effective monitoring and controlling systems. This project aims to leverage the capabilities of Arduino in the context of greenhouse management. The goal of this project is to design a greenhouse monitoring and controlling system that utilizes Esp 32as the central control unit. By integrating various sensors, the system can collect data on critical environmental parameters within the greenhouse, including temperature, humidity, light intensity, and soil moisture. The Esp 32 microcontroller then processes and analyses this data to make informed decisions regarding the adjustment of greenhouse conditions through Hanging robot setup

II. LITERATURE SURVEY

A greenhouse is a structure covering ground frequently used for growth and development of plants that will return the owner's risk time and capital. The main purposes of the usage of greenhouses are to protect crops from extreme conditions and provide them better environment for efficient production. Unlike the conventional agriculture, where the conditions of the crops depend on the environment in the surrounding, greenhouse control the environments parameters such as temperature, humidity, water and light intensity to give the crops perfect conditions to grow. With a better environment, the quality of the crops will be much better and will increase the profit for the seller. However, to achieve the purposes stated and to have better control in horticulture development, a control system with monitoring features is being applied. Normally the temperature maintained during the daytime is different compared to temperature falls at night. Besides, it varies with the condition of the weather itself whether it is cloudy or sunny day. This assumes that the temperature at which the plants grow can actually be controlled. Even though the implementations of greenhouse protect the crops from unwanted elements, it still can cause several other problems such as fungus and excessive

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humidity. This is due to the structure of the greenhouse itself. Therefore, the application of control systems with constant monitoring is very crucial to the greenhouse to achieve the best productivity and quality. With better control, the cost of operations can be reduced with minimal workers needed and controlled usage of raw materials such as water, soil and fertilizer. The main elements involved in a greenhouse control system are temperature, humidity, light, water. While these elements feature separately in the environment, they are related and influence each other. The heating requirements of a greenhouse rely on the desired temperature for the plants grown, the location and construction of the greenhouse, and the total outside exposed area of the structure. As much as 25% of the daily heat requirement may come from the sun, but a lightly insulated greenhouse structure will need a great deal of heat on a cold winter night. The heating system must be sufficient to maintain the desired day or night temperature. Regularly the home heating system is not ample to heat a neighboring greenhouse.

III. PROPOSED SYSTEM

The proposed system offers several advantages over traditional manual greenhouse management. It provides real-time monitoring capabilities, allowing farmers to remotely access and monitor the greenhouse's environmental data. By visualizing this information through a user-friendly interface, they can gain insights into the current conditions and identify potential issues before they escalate. By implementing this Arduino-based greenhouse monitoring and controlling system, farmers can achieve better resource management, reduce labour requirements, and enhance overall crop yield and quality. The system's automation capabilities allow for timely Agriculture plays a major role in the development of the welfare of a country. Indoor farming has become a major crop growing method on large scale across different countries. A greenhouse is an effective and excellent way to implement indoor farming where different crops are grown in a closed environment. Automation and monitoring system can be implemented in the greenhouse, so that manual Labor is avoided. The proposed system saves time, money & human efforts. The traditional system for greenhouse monitoring is labour-intensive and time consuming. It provides a controlled environment for the plants to prevent and improves plant growth. All the sensor data will be updated to the concerned authority using an android application called Blynk through IOT.

IV. BLOCK DIAGRAM

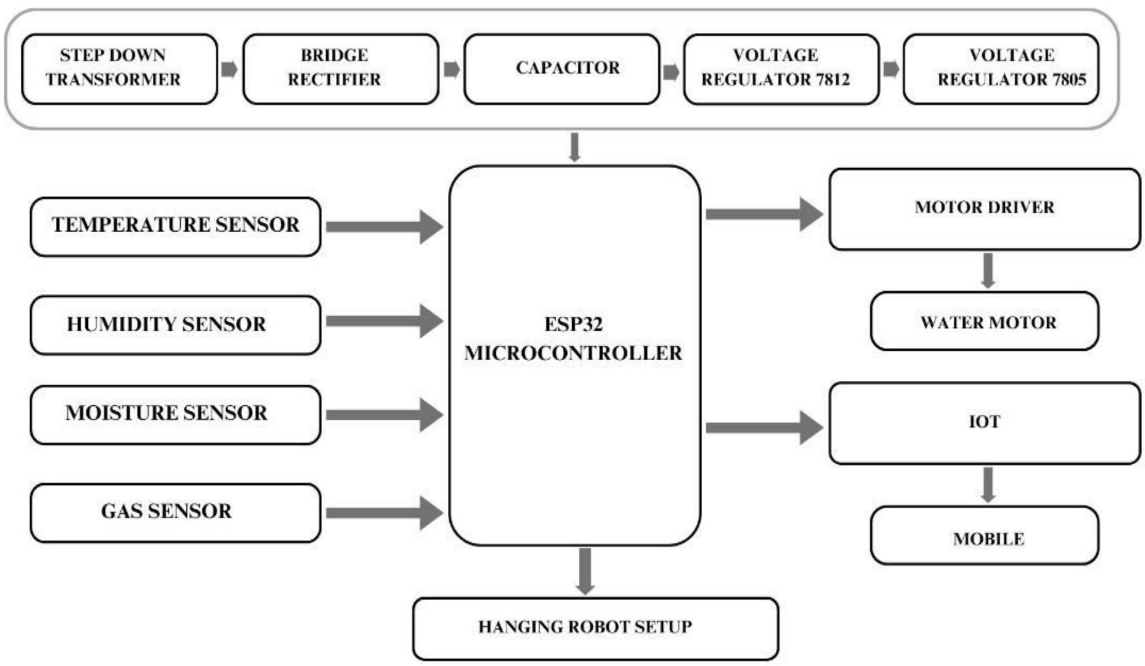

Figure 1: System Block diagram

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V. Flow Chart

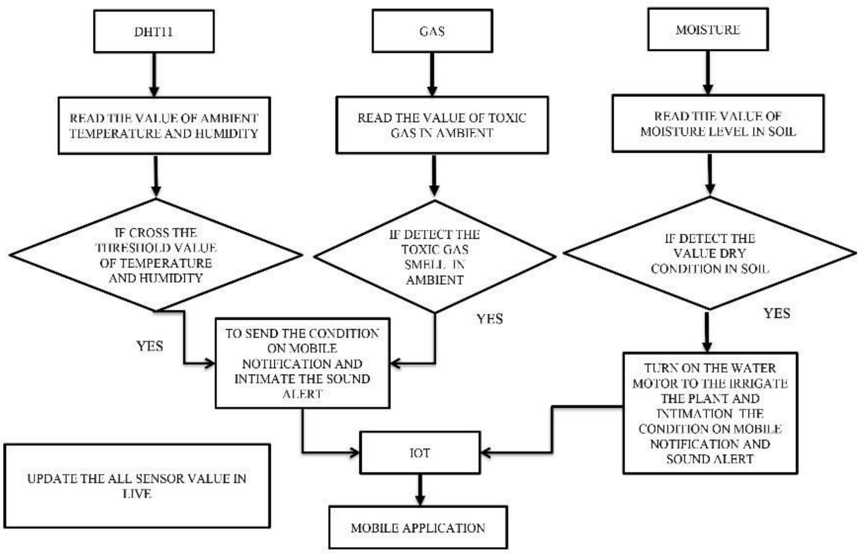

Figure 2: Project Implementation flow char

VI. Hardware Description

ESP 32
This serves as the main controller for the system and is responsible for collecting data from various sensors, processing the data, and controlling the various actuators in the greenhouse.

DHT11
Sensor This sensor measures temperature and humidity inside the greenhouse and sends the data to the Esp 32 for processing. DHT11 Sensor can measure a humidity value in the range of 20 – 90% of Relative Humidity (RH) and a temperature in the range of 0 – 500C

Moisture Sensor
This sensor measures the moisture level of the soil and sends the data to the Esp 32 for processing.Soil moisture sensor is invaluable tools in greenhouse agriculture, aiding growers in optimizing irrigation practices and ensuring that plants receive the right amount of water

MQ2 Sensor
MQ2 sensors are capable of detecting various gases such as methane, propane, butane, alcohol, smoke, and other flammable gases. Monitoring these gases is important for safety reasons as well as for ensuring the well-being of plants

Water Motor
Water motors are commonly used in greenhouse agriculture for various purposes such as irrigation, nutrient distribution, and climate control. These motors are essential components of greenhouse systems as they help automate and optimize water management, ensuring optimal growth conditions for crops.

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Motor Driver (L293)

the L293 could potentially be used to control the motors that open and close greenhouse vents to regulate temperature and humidity levels. It might also be used to control the movement of irrigation systems or shades within the greenhouse.

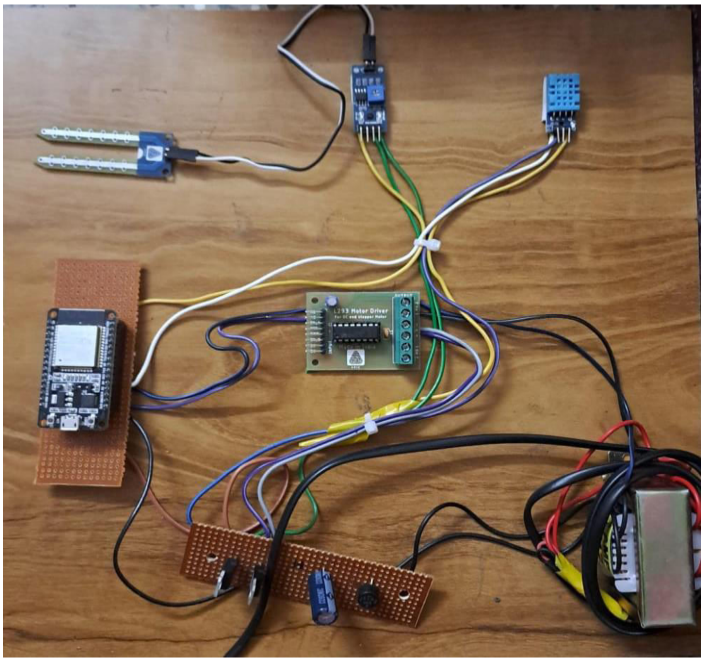

Figure 3: Project Hardware Implementation

VII. SOFTWARE DESCRIPTION

ARDUINO IDE

The **IDE** connects to the **Arduino hardware**, allowing you to upload programs and communicate with the boards Embedded C language is used to develop microcontroller-based applications. Embedded C is an extension to the C programming language including different features such as addressing I/O, fixed-point arithmetic, multiple-memory addressing, etc. In embedded C language, specific compilers are used

BLYNK APP

Blynk is a comprehensive software suite that enables the prototyping, deployment, and remote management of connected electronic devices at any scale. Whether it's personal IoT projects or commercial connected products in the millions, Blynk empowers users to connect their hardware to the cloud and create iOS, Android, and web applications, analyse real-time and historical data from devices, remotely control them from anywhere, receive important notifications, and much more.Access Controls/Permissions. Activity Dashboard. Activity Tracking. Asset Tracking. Configuration Management. Connectivity Management. Data Import/Export.

VIII. CONCLUSION

India is an agriculture– oriented country. For the quality and Productivity improvement of greenhouse and open field crops, it is necessary to measure and control several interacting physical variables. The proposed system saves time, money & human efforts. The traditional system for greenhouse monitoring is labor-intensive and time consuming. It provides a controlled environment for the plants to prevent and improves plant growth. This automation minimizes manual labor and reduces the risk of human error, leading to more consistent and reliable plant growth. The greenhouse monitoring and controlling system based on Arduino provides a wide range of advantages, such as increased crop yield, resource efficiency, remote accessibility, scalability, data-driven by using Blynk app IOT Technology one can get the updates of greenhouse environment in a remote place.

IX. FUTURE SCOPE

- Advanced Sensors: The creation and incorporation of more sophisticated sensors for the accurate measurement of environmental variables as temperature, humidity, light intensity, and gas concentrations.
- Integration of Internet of Things (IoT) technology to make it possible to gather, analyze, and remotely regulate greenhouse settings in real time.
- Automation: The use of automation technologies to streamline processes like irrigation, ventilation, and lighting management, resulting in higher efficiency and more effective resource use.
- Artificial intelligence (AI): The use of AI systems to evaluate sensor data and decide intelligently how best to manage crops and the environment.
- Cloud-based solutions: The use of cloud computing platforms to store and access greenhouse data in a safe manner, facilitating stakeholder collaboration and allowing for remote monitoring and management.
- Integration of sustainable practices into greenhouse monitoring and control systems, such as energy efficiency, water conservation, and the use of renewable energy sources.
- Application of precision agriculture concepts using real-time data for site-specific management, individualized care, and effective resource management.

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