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IOT BASED AEROPONIC CHAMBER TEMPERATURE MONITORING SYSTEM

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ABSTRACT
Urban farming lifestyle has gained traction in recent years as society started to pay more attention to the quality of the product being consumed. Aeroponic is one of the urban farming techniques which employs air as the growing medium. However, optimum aeroponic farming requires precise control of the cultivation environment. This work presents a design and implementation of a lab-scale aeroponic system that employs the Internet of Things (IoT) for online and automated monitoring capability. The temperature in this chamber was carefully monitored by using the DHT-11 sensor connected to the internet through the Wemos-D1-mini-integrated microprocessor and Wifi module. Actuators, i.e. a Peltier cell, fans, and mist makers were placed to control the temperature and to supply nutrients to the roots.
Keywords: Aeroponic Chamber, Temperature Monitoring System, Internet of Things (IoT)

1.INTRODUCTION
In an era where technological advancements revolutionize every aspect of human life, agriculture stands as no exception. The integration of Internet of Things (IoT) technology has sparked a transformative wave in traditional farming methodologies, promising unprecedented levels of efficiency, precision, and sustainability. N. Michaelidou and L. M. Hassan (2007) Among the myriad applications of IoT in agriculture, the development of Aeroponic Chamber Temperature Monitoring Systems M. Asif et al.2018 emerges as a beacon of innovation, poised to redefine the cultivation landscape. At its core, aeroponics represents a cutting-edge approach to plant cultivation, characterized by its soil-less methodology and efficient nutrient delivery system. By suspending plant roots in a nutrient-rich mist environment, aeroponics maximizes nutrient absorption while minimizing resource consumption—a paradigm shift in agricultural practices. However, the success of aeroponic cultivation hinges upon meticulous environmental control, particularly concerning temperature regulation. Fluctuations in temperature can profoundly impact plant growth, metabolism, and overall health, necessitating vigilant monitoring and management. M. Wier et al. (2008). This is where IoT-based Aeroponic Chamber Temperature Monitoring Systems emerge as indispensable tools for modern agriculturalists. By leveraging IoT technology, these systems offer real-time monitoring, analysis, and control of environmental parameters within aeroponic chambers. Equipped with an array of sensors,

actuators, and connectivity modules, IoT-enabled chambers provide a comprehensive view of temperature dynamics, empowering farmers to optimize growing conditions with unparalleled precision. I. Idris and M. I. Sani (2012). In conclusion, IoT-based Aeroponic Chamber Temperature Monitoring Systems represent a paradigm shift in agricultural innovation, offering a synergistic blend of precision, efficiency, and sustainability. By harnessing the power of IoT technology, farmers can transcend the limitations of traditional farming methodologies, unlocking new frontiers of productivity and environmental stewardship. As the agricultural landscape continues to evolve, these systems stand poised to shape the future of cultivation, ushering in an era of smarter, greener, and more resilient agriculture.

2.METHODOLOGY

The Methodology of an IOT based Aeroponic chamber temperature monitoring system methodology to monitor the temperature in an aeroponic chamber, you can use temperature sensors placed strategically throughout the chamber. These sensors will measure the temperature at different points and send the data to a central monitoring system. The monitoring system can then display the temperature readings in real-time and alert you if there are any fluctuations or deviations from the desired temperature range.

2.1 PROPOSED BLOCK DIAGRAM

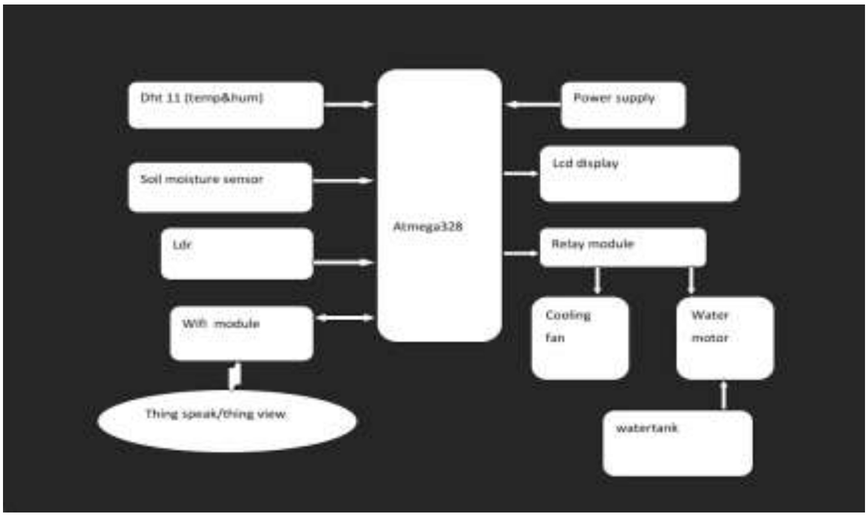


Fig 2.1 Proposed Block Diagram

2.2 COMPONENTS

ARDUINO UNO

Arduino Uno is a popular microcontroller board based on the ATmega328P chip.It features digital and analog input/output pins, USB connectivity for programming and communication, and a power jack for external power supply. The board includes a 16MHz quartz crystal oscillator, a USB connection, 14 digital I/O pins (6 of which can be used as PWM outputs), 6 analog inputs, and a reset button. Arduino Uno is widely used in various DIY projects, robotics, and IoT applications due to its simplicity, versatility, and extensive community support with Arduino Uno, users can write and upload programs, called sketches, using the Arduino Integrated Development Environment(IDE).

RELAY

Relays are pretty cool devices used in electrical circuits. They act as switches that can control the flow of electricity. When a small electrical signal is applied to the relay, it activates an electromagnet, which then moves the switch contacts to either open or close the circuit. This allows relays to control high-power devices using low-power signals. They are commonly used in applications like home automation, industrial control systems, and automotive electronics.

LDR MODULE

The LDR module, also known as a Light Dependent Resistor module, is a sensor that detects light intensity. It consists of a Light Dependent Resistor (LDR) and supporting circuitry. The LDR is a type of resistor that changes its resistance based on the amount of light falling on it. When exposed to light, the resistance of the LDR decreases, and when in darkness, the resistance increases.

WATER MOTOR

The water motor helps circulate and regulate the temperature of the water in the chamber. It plays a crucial role in maintaining the ideal conditions for the plants.

DHT11

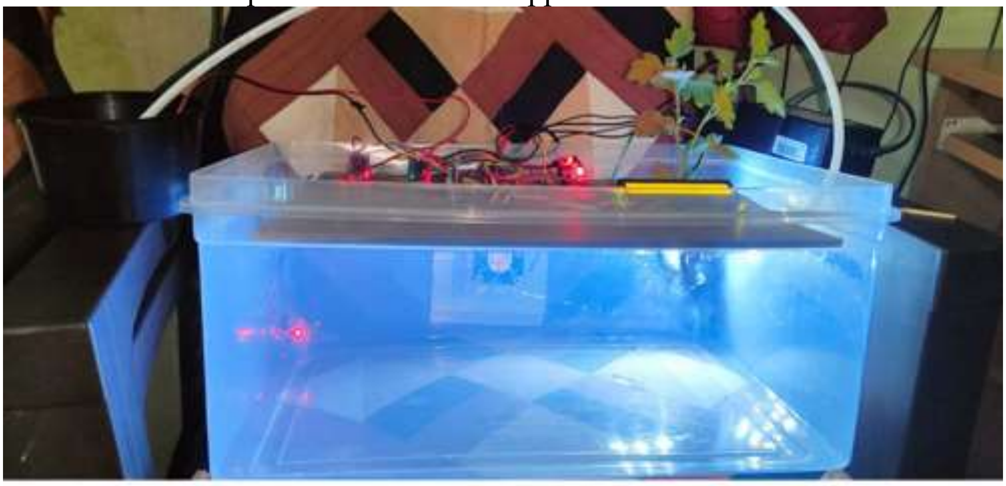
The DHT11 sensor is a popular sensor used to measure temperature and humidity in various applications. It consists of a capacitive humidity sensor and a thermistor to measure the surrounding air's humidity and temperature. The sensor provides digital output, making it easy to interface with microcontrollers like the ATmega328P.

PELTIER MODULE

The Peltier module, also known as a thermoelectric cooler, is a device that can generate both heating and cooling effects by utilizing the Peltier effect. It consists of two different types of semiconductors sandwiched between ceramic plates. When an electric current is applied to the module, one side becomes hot while the other side becomes cold.Peltier modules are commonly used in various applications, such as temperature control in electronic devices, refrigeration systems, and even in some portable coolers and wine coolers.

SOFTWARE AND CONTROL DESIGN

The Arduino IDE is used as the software platform for the microcontroller, while Android Studio is used for the development of the mobile app.



3.OUTPUT

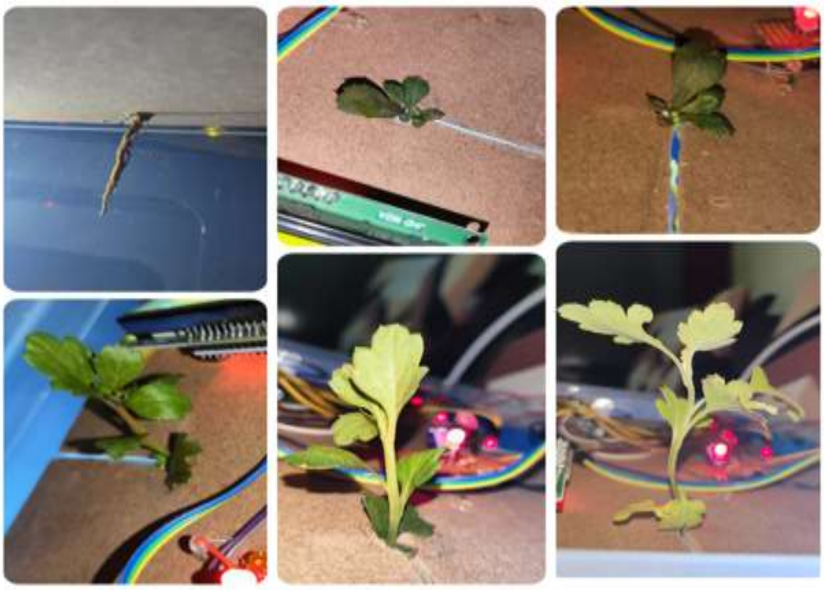


Fig 3.1 Output Images

4. CONCLUSION

In conclusion, the implementation of a robust temperature monitoring system in an aeroponic chamber is essential for achieving consistent and high-quality crop production. By providing precise control, early detection of issues, energy efficiency, remote monitoring capabilities, and data analysis, this system plays a vital role in enhancing overall productivity and sustainability in aeroponic farming operations.

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