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# IOT BASED GREENHOUSE MONITORING SYSTEM

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**Abstract-** Keeping plants healthy and prosperous requires the best possible growing environment. But staying on top of all environmental changes and equipment statuses or failures can be a challenge. Green house temperature should not go below a certain degree, High humidity can result to crop transpiration, condensation of water vapor on various greenhouse surfaces, and water evaporation from the humid soil. Maintaining a controlled temperature within a greenhouse environment is crucial. Temperature fluctuations can damage or kill your plants in only a few hours. Internet of Things(IOT) is one of the latest advances in Information and Communication Technologies, providing global connectivity and management of sensors, devices, users with information. In today's greenhouses, many parameter measurements are required to monitor and control for the good quality and productivity of plants. The sensors used here are moisture sensor , Temperature & Humidity sensor. The other important part of this project is that it is fully automatic. Arduino automatically turns on and turns off the appliances. From the data's received, Raspberry PI3 automatically controls Moisture and Temperature. Where the recorded temperature and humidity are stored in a cloud database and the results are displayed in a webpage, from where the user can view them directly.

**Keywords-** Sensors, Arduino, LCD display, Raspberry PI3

## 1.0 INTRODUCTION

Crop production is a challenging business, with the crops being constantly exposed to unfavorable weather conditions. Weather and climate conditions play an important role in determining the pace of crop production. However, during times when the global food security strongly depends on crop production, there is no place for any limitations. Therefore, the search for solutions resulted in farm management practices that involve farming in a controlled environment. Greenhouse farming is one of the basic variations of farming in a controlled environment .Greenhouse farming is the unique farm practice of growing crops within sheltered structures covered by a transparent, or partially transparent, material.

Green house vegetable farm

**Fig:1.Model of Greenhouse Vegetable Farm**

Considering the different types of structure, the term *Greenhouse farming* also includes:

- **Shade houses**; covered in woven or other material with gaps that allow sunlight, air, and moisture to pass
- **Screen houses;** covered with screening material that provides protection from pests and severe weather conditions, mostly practiced in hot or tropical areas
- **Crop top structures;** structures without walls, covered only with a roof

## 1.1 ARDUINO UNO

The Arduino UNO is an open-source microcontroller board based on the Microchip ATMega328p microcontroller and developed by ARDUINO. The board is equipped with sets of digital and Analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the ARDUINO IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo.


**Fig:2 Arduino UNO**

**Advantages of Arduino**

- Allows users to write programs for Arduino using C or C++.
- Programming environment is easy to use for beginners.
- Very inexpensive and flexible.

## 1.2 MOISTURE SENSOR

Moisture sensor is used to measure the water content(moisture) of soil. when the soil is having water shortage, the module output is at high level, else the output is at low level. This sensor reminds the user to water their plants and also monitors the moisture content of soil. Soil Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium. In soil, dielectric permittivity is a function of the water content. The sensor creates a voltage proportional to the dielectric permittivity, and therefore the water content of the soil. The sensor averages the water content over the entire length of the sensor. It is used to measure the loss of moisture over time due to evaporation and plant uptake, evaluate optimum soil moisture contents for various species of plants, monitor soil moisture content to control irrigation in greenhouses and enhance bottle biology experiment.

1.3 RASPBERRY PI 3 B+

The Raspberry Pi 3 Model B+ is the latest production Raspberry Pi 3 featuring a 64-bit quad core processor running at 1.4 Giga hertz. It incorporates built-in Wi-Fi and Bluetooth connectivity with enhanced dual-band 2.4 GHz and 5 GHz Wi-Fi, Bluetooth 4.2/BLE and faster Ethernet. Pi 3 Model B+ has a 1.4GHz 64-bit quad-core Broadcom Arm Cortex A53-architecture processor compared with the Raspberry Pi 3 Model B's 1.2GHz CP

1.4 TEMPERATURE AND HUMIDITY SENSOR

The DHT11 is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analogy input pins needed). It's fairly simple to use, but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds, so when using our library, sensor readings can be up to 2 seconds old.

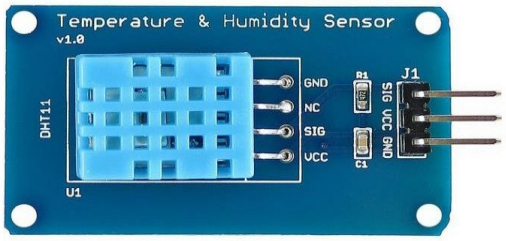


**Fig:3 DTH11 Sensor**

**2.0 LITERATURE SURVEY**

Azahar -2019, has proposed a method for the automated greenhouse system is presented, with an aim to improve the crop productive under a controller environment , Forth is purpose temperature, light, humidity and soil moisture sensors are used to collect critical data. Arduino mega 2560 is used to take necessary decisions based on the threshold value of these environmental parameters. The control system then generates control signals to actuate exhaust fan and sprinklers, depending upon the environmental parameters. Users can keep track of the environmental parameters and crop health through android application. Moreover , actuators can also be actuated through android application if required. For improvement the crop growth and maintaining the health of the crop growth and maintaining the health of the crops a special combination of red and blue light emitting diodes (LEDS) is used. The greenhouse system is powered by solar panel to make it's a self-sufficient unit.

2019 -Nuttakaran, has proposed a method for the Internet of things (IOT) plays a big important role in agricultural industry recently in order to provide a support to farmers such as growth monitoring system of temperature, humidity and water supply, and also early disease monitoring and detection system. To provide a smart farming solutions, this paper proposed an IoT system with a bot notification on tomato growing stages. The tomato dataset was obtained from Shin chi Agri Green, the tomato greenhouse in Fukushima, Japan. We trained and tested the deep learning model to detect the fruit proposal region. Then, the detected regions were classified into 6 stages of a classification with the weight accuracy of 91.5%.

B M Bhavani(2018), has proposed a method for the Greenhouse deployment of farms gives hope for the farmers on higher crop yield, through lowering risks against pests, insects and adverse climatic conditions. Automation of greenhouse benefits the farmers in various ways by detection of soil and water quality and automatic irrigation. Involving scientific process in this automation boosts the benefits on agricultural activities. The current status of the greenhouse can be collected and sent to the cloud infrastructure for further decision making. This paper deals with the design and implementation of a model for IoT based agricultural greenhouse system for better crop yield. The system uses light-weight MQTT protocol for device to device communication. This paper aims to leverage an IoT based agriculture system in a greenhouse and hence achieve the goal of reduced human intervention by automatically detecting and controlling various climatic factors such as soil moisture, air humidity and light intensity to automatically monitor the irrigation, aeration and lighting facilities of the greenhouse**.**

LijunLiu,2018 **,**has proposed a method for the With the rapid development of agriculture in our country, people's demand for the quality and production of greenhouse agricultural products is constantly improving, in order to better meet the demand for vegetable greenhouse environment monitoring, this paper designs a kind of vegetable greenhouse monitoring system based on ZigBee and GPRS, the system is integrated with wireless sensor network technology and GPRS technology for data collection, wireless transmission, remote communication and monitoring. The system sets up wireless sensor LAN network with ZigBee technology, and collects temperature and humidity and light intensity data to the coordinator node, then using GPRS technology to send data to the Internet, and finally using Visual Studio software to realize human-computer interaction interface with ASP.NET technology, to realize the vegetable greenhouse environment remote monitoring. The system has the characteristics of mobile flexibility, forming network fast, low cost and low power consumption, Experiments have proved that the system is stable and the measuring accuracy is higher, which can meet the needs of the monitoring of the greenhouse and can be widely used in agricultural production.

Hugo Sampaio (2017), has proposed a method for the A greenhouse monitoring system using hierarchical wireless sensor network (WSN) is presented in this paper. The main parameters required to monitor and control a greenhouse are air humidity and temperature, ground moisture and environment lightness. For the data gathering of these parameters, a hierarchical WSN is presented in this work. In this configuration, the sensors, aggregated with all gathering functionalities, processing and wireless data transmission capabilities, denoted as sensor nodes, are in the lowest level. The router nodes are provided in the middle level to transmit data from sensor nodes to a controller named coordinator node. The coordinator node, in the highest level, is used to communicate with a central base, where all data received are analysed. The details of a simple implementation of this monitoring system are presented. Many tests are carried out and the results showed that developed monitoring system is working well.

Muhammad Faizaan Siddiqui (2017), has proposed a method for the Recent era has brought upon a major global food shortage due to the climatic changes in the world. So in order to deal with this issue of global food shortage households must need to grow a reasonable deal of vegetables and other crops using artificial greenhouses. An artificially controlled greenhouse yields more crops per square meter compared to open field cultivation since the microclimatic parameters that determine crop yield are continuously examined and controlled to ensure that an optimum environment is created. This research paper addresses and tries to resolve a few issues that are faced by plants caretakers using the engineering approach so that he/she could remain satisfied even when he/she is physically away for a long duration of time because the automated system will take care of everything in the absence. This automated system works using sensors and actuators, which are controlled by a microcontroller and monitor and manage every environmental parameter required for the good growth of plants.

Kritika Rao(2015), has proposed a method for the A greenhouse is a structure generally made of glass designed to provide protection and controlled environment to raise plants indoors. In order to achieve high quality and quantity of produce, proper management and data collection of the greenhouse environment is required. Manual practice of plant monitoring is laborious and time consuming. The proposed greenhouse system is an application which demonstrates the concept of Internet of Things and involves ubiquitous monitoring and controlling of environmental parameters within the greenhouse, which directly or indirectly control the plant growth and so their production. The system thus designed, mainly aims to remotely monitor and control the greenhouse using temperature sensor, light sensor, soil moisture, water level sensor and actuators through a customized webpage. Moreover, Realtime representation of the sensed data is graphically plotted as well as stored for improved monitoring and further analysis, illustrating the concept of cloud instrumentation

Jayapal Baviskar (2014) , has proposed a method for the Greenhouse facilitates precise monitoring and controlling of various parameters, so as to cultivate quality conscience crops without slaying resources. The cabling laid for the sensors, deployed inside the Greenhouse is not feasible. Hence the need for an automated system employing wireless communication and remote sensing is imperative. This paper proposes a Wireless Sensor Network (WSN) based embedded system and deals with the implementation of ZigBee network (over IEEE 802.15.4) for remote controlling of the Greenhouse parameters. The detailed information regarding establishment of ZigBee network in Star topology as well as in Mesh Topology, inside the Greenhouse is illustrated. It also demonstrates the real time monitoring of parameters such as temperature, humidity, as well as the total power consumption of the system, with the help of a PC based GUI application developed on Java platform.

Thangavel Bhuvaneswari , has proposed a method for the Gardening is one of the popular hobbies among the people in the midst of busy work culture and urban life style. Gardening seems to release the stress, healthy spending of the leisure time effectively. But the apartment living has no free space for gardening. As a result, small scale greenhouse is now the hottest trend in the century. Greenhouse is a structure that the user used to grow the plants. It is built with a specific need for the type of plant they wish to grow. So the structure varies depending on type of plant and scale of size. Although it creates a perfect environment for plants, it needs human care to control the optimum status of the house such as ventilation. Automated greenhouse is to ease people when they wish to grow plants. It helps to monitor the situation, when they are not at home. The main aim of this paper is to minimize the human care needed for the plant by automating the green house and monitor the in-house environment status. A single unit of the greenhouse structure prototype has been constructed and integrated with the sensors. The control system is designed with Adriano Uno microcontroller. Servo motors have been used to push the roof when there is rain detected. A 12 volt fan is also installed and turns ON when the temperature is too high. The prototype developed is simulated under five different places and the results are analysed.

Weimin Qiu (2014), has proposed a method for them to meet the requirements in real-time, reliability and sustainability for crop-growth environment monitoring in greenhouse precision agriculture, this paper designed intelligent greenhouse environment monitoring control system which is based on ZigBee and embedded technologies, in order to achieve intelligent control greenhouse crops growing environment. The system is based on ZigBee wireless network, using temperature and humidity sensors, light intensity sensors for real-time detection of greenhouse environmental factors, sending to the upper machine though wireless, comparing with the default values, adopting the idea of intelligent home, achieving intelligent control for the greenhouse fans, lights, irrigation equipment.

## 3.0 METHODOLOGY

In this paper, our proposed system receives three parameters from the sensors and activates the actuators if the actual values are more than the threshold values and also stores these values in the database enabling them to be accessed from anywhere, anytime. This paper also sheds light on the automatic control over the climatic conditions inside the greenhouse. There are different seasonal crops which can be grown only under certain conditions. Onions, garlic, shallots etc. are the winter crops which require cold conditions for their growth. Cucumbers, melons etc. are the summer crops which require moderate or hot climatic conditions.

The prototype we used comprises of moisture sensors, temperature & humidity sensors, Raspberry PI and water pipes to supply water from tank controlled by DC motors. Moisture sensors (YL 69) are installed near the roots and temperature & humidity (DHT11) sensor is installed further away to detect the temperature and humidity. These sensors send their data to the Raspberry PI to analyses the results.

The Raspberry PI will turn the inlet value on, to water the spinach, until the soil moisture value becomes greater than the threshold value. greenhouse, if the temperature and humidity values are above the reference value (calculated according to then crop – spinach),to maintain them to be within the threshold levels, sliding door will be opened and fan will be switched ON.

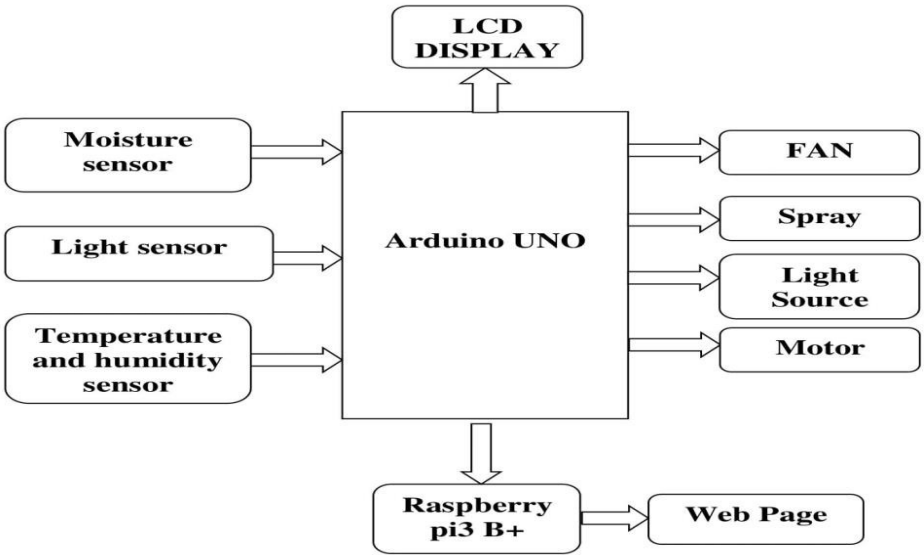


**Fig:4 Block diagram of proposed system**

Advantage of proposed systems:

- Low cost setup.
- Total automation of greenhouses / nurseries / bio tech parks.
- It can be used domestically.
- Easy to use, install, operate & troubleshoot.

## 4.0 CONCLUSION

In this paper, we proposed a IOT based greenhouse monitoring system over conventional farm is that we were able to produce insecticide free and pesticide free crops and create a climate for the proper growth of plants . Moreover, this system can be installed by any individual in his house (Rooftop greenhouse), who doesn't have knowledge about farming. Since we can maintain any climatic condition in this type of Greenhouse, it is possible to expand any type of crop. Hence, we grow plants like Hibiscus which are imported to India. We can reduce 70%-80% water requirement. It also increases yield and rate of growth and produces organic agricultural products. Most vital' we are able to connect farmer directly to consumer using IOT. It reduces effort and time of farmer for making farming efficient and profitable activity.

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