IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 9, Issue 6, June 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.542

9940 572 462 | 6381 907 438 | ijircce@gmail.com | www.ijircce.com

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.542 |

|| Volume 9, Issue 6, June 2021 ||

| DOI: 10.15680/IJIRCCE.2021.0906168 |

A Survey on Smart Greenhouse System using IOT

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ABSTRACT: Greenhouse is a facility where crops are cultivated in a regulated manner. The available greenhouse systems are human-monitored systems that require constant human visits that cause the worker discomfort and also decrease the yield if the temperature and humidity are not controlled properly and consistently. That paves the way for the concept of greenhouse automation. Greenhouse Automation System, formed by the integration of the Internet of Things and the integrated system, addresses the problems faced in the green house and provides for the automated control and monitoring of the greenhouse environment, replacing the undeviating management of farmers. It eliminates the direct control of the human being. The paper also proposes to automate activities in the greenhouse setting using the Arduino and to use a system to measure moisture, temperature, sunlight and humidity, to increase the operational rate and minimize the inconvenience caused to farmers.

KEYWORDS: Smart Greenhouse system, IOT, Agriculture, Automation, Sensors

I. INTRODUCTION

According to the UN projections, world population will rise from 7.8 billion today to 9.7 billion in 2050 that signifies food production has to be raised. The agriculture industry is accountable for fulfilling human's need for food, energy, and shelter to a great extent.

Agriculture Modernization has already started by the tech savvy farmers. For the next generation agriculture fields, data collected from sensors would become the fertilizer to grow crops.

There are a variety of problems related to conventional farming practices. Due to lack of awareness among farmers, they are not in a position to carry out their activities precisely.

In order to produce better and more reliable results, a smart greenhouse system will be built that reduces man's work and produces better results. Automation of agricultural activities will transform the agricultural domain from manual and static to intelligent and dynamic, leading to higher production with less human supervision.

As we know, the greenhouse features environmental parameters such as humidity, temperature, humidity, light, etc. And often because of the lack of awareness among farmers, they are not able to carry out their activities precisely. Typically, they conduct such activities on the basis of their own past observations and their gut feelings, which can lead to unpredictable outcomes for most of the time. So in order to cover it up and to achieve better and more precise outcomes, this method is used for what activities a farmer can perform in various environmental conditions.

II. LITERATURE SURVEY

Some of the previous systems used android phones to track the green house, but it was not monitored using Android in remote areas.

[1] One of them is based on Global Mobile Communications System (GSM) Notifications are sent via SMS, but this is a downside. System used to be any time the user had to type commands that were Time consuming and expensive. The greatest downside of these structures was that there was always a person who had to be present in a greenhouse or in the vicinity of a greenhouse. This is the first problem that has been solved in the system. That people don't necessarily need to be in the greenhouse. Plants in the greenhouse are cultivated in a controlled climate. The Temperature differences can cause plant damage.

[2] Wireless Sensor Networks have been often used in the context of Greenhouse architectures. The architecture is IoT-based and built on top of switched Ethernet and Wi-Fi. Some sensors in the proposed architecture require a one-second real-time deadline. Riverbed simulations prove that there is zero packet loss and no over-delayed

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packets. An important contribution of this work is the design of a channel allocation scheme that prevents interference in this relatively large Greenhouse system.

[3] Internet of Things (IoT) is used for remote monitoring and analysis of data. Also, an android application is developed to display those data in a short range through Bluetooth technology. The system controls the temperature, humidity, and light and soil moisture level by sensing the values from sensors and controlling heaters/coolers, sprayers, bulbs and water pumps accordingly. The proposed system monitors temperature and humidity, soil moisture and take action according to results. The systems do not need any human interaction. It also includes with a database helpful for future analysis and reports. This system is very suitable to be deployed at places like North Pole and winter climate countries where people live but plant does not grow due to heavy winter. If this system is used in those countries, one person can manage multiple Green-houses to grow a vast number of plants due to its efficient use of time and automatic controlling ability. That person will only need to monitor about the condition of the green-houses and fix something that cannot fixed by the proposed system such as cutting off any infected leaves of the plants, uprooting any infected trees and so on. Also, IoT will enable a person to monitor from remote distances and efficiently utilize the time and energy.

[4] Wireless Sensor Network (WSN) technology is one of the important technologies to implement the ubiquitous society, and it could increase productivity of agricultural and livestock products, and secure transparency of distribution channels if such a WSN technology were successfully applied to the agricultural sector. Middleware, which can connect WSN hardware, applications, and enterprise systems, is required to construct ubiquitous agriculture environment combining WSN technology with agricultural sector applications, but there have been insufficient studies in the field of WSN middleware in the agricultural environment, compared to other industries. This paper proposes a context-aware middleware to efficiently process data collected from ubiquitous greenhouses by applying WSN technology and used to implement combined services through organic connectivity of data. The proposed middleware abstracts heterogeneous sensor nodes to integrate different forms of data, and provides intelligent context-aware, event service, and filtering functions to maximize operability and scalability of the middleware. To evaluate the performance of the middleware, an integrated management system for ubiquitous greenhouses was implemented by applying the proposed middleware to an existing greenhouse, and it was tested by measuring the level of load through CPU usage and the response time for users' requests when the system is working.

[5] In this paper presents a system to overcome the drawbacks in the current greenhouse monitoring structure. The proposed system in this paper monitors the humidity levels and surrounding temperature and control fans, humidifiers, dehumidifiers and heaters. The designed system has two modes as manual and auto mode. Furthermore, parameter values such as maximum and minimum temperature, maximum and minimum humidity values can be changed by sending a SMS to the system. This system has been developed by using Arduino microcontroller, GSM module and DHT11 temperature/humidity sensor. This design can be used for monitoring and controlling temperature and humidity value via SMS.

Chrysanthemum is one of the important commodities of cut flowers in the world. Major producing countries such as Japan and the Netherlands only supply less than 60% and the countries in Southeast Asia, including Indonesia and Malaysia only supplies about 10% of total world demand. It's indicating that the demands for chrysanthemums are still high. For optimization of production, chrysanthemums cultivation is usually carried out in a green house. Each stage of cultivation required different climatic conditions, so it takes complicated treatments if it done conventionally. In this paper, a comprehensive review of the literatures that deal with the application of automation control technology in chrysanthemum green house. The representative application of each technology as well as its advantages and limitations are discussed Control is conducted base on the factors that affect the greenhouse climate, such as temperature, humidity, and lighting. In the first phase of planting, it will focus to control the irrigation system and temperature control which will automate the operation of the heater and fan for cooling, based on the results of the temperature sensor and humidity sensor. Vegetative phase focused on the control of lighting, irrigation systems and temperature, based on the results of the temperature sensors, humidity sensors and light sensors. While in the flower induction phase it focused on irrigation systems and temperature controlling. The discussions ended with the conclusion and identify several important areas where further research could be done.

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III. METHODOLOGY

A. *Analysis:*

Automation of farm activities can transform agricultural domains from being manual and static to intelligent and dynamic leading to higher production with lesser human supervision.

The agriculture in the greenhouse is more affected by environmental factors. Key environmental factors for the quality and improved productivity of plant growth are temperature, relative humidity, Lighting, soil moisture and CO2 levels in the greenhouse. Continuous monitoring of these factors offers relevant information on the individual impact of the different factors on the achievement of maximum crop yields.

In addition, it will not only protect the farmer from scorching heat & severe cold but also save their time for to and from journey to the field.

The system would carry out tasks such as the Smart Irrigation System Using IoT Technology with the goal of automating the complete irrigation system. And the light sensor is often used to sense the dark space and the lights are turned on automatically. It automatically turns on the lights when the sunlight is below the visible area of our eyes. The temperature sensor senses the temperature of the atmosphere and maintains the temperature in the greenhouse on the basis of the data obtained.

II. SYSTEM DESIGN

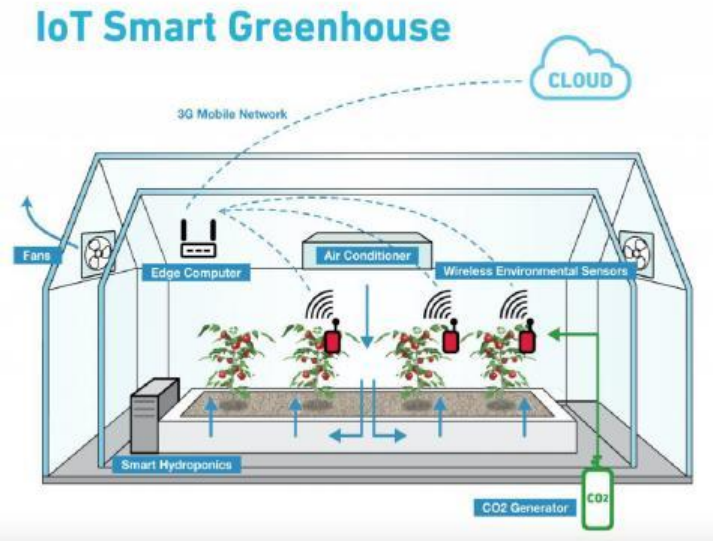

Fig.1.Smart Greenhouse System Structure

Within the greenhouse, soil sensors and other environmental sensors are established inside the greenhouse in order to collect environmental statistics applicable to the greenhouses' crop growth including temperature, CO2 level, and humidity. And soil data like soil humidity, soil moisture.These sensors collectively represent a wireless sensor network to gather environmental and soil records from the greenhouse.

Based on the data collected through various interfaces, the control system in the greenhouse will automatically control the greenhouse system to ensure better growth of the environment for the crops.

A. *System Components:*

a) Arduino UNO

Fig.2.Arduino UNO

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc.

It has 14 digital input/output pins, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery.

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Light Sensor:

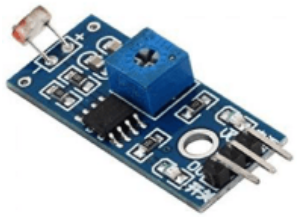

Fig.3.LDR Sensor

Fig.4.PhotoDiode

The values read from LDR sensors are used for detecting light intensity. Based on the intensity value, the lights will be turned on/off in the greenhouse.It is a form of light sensor that converts light energy into electrical energy (voltage/ current).

Photodiode is a type of semi conducting device with PN junction. ... The photo diode accepts light energy as input to generate electric current. It is also called as Photodetector, Photo Sensor or Light Detector.

b) Temperature Sensor:

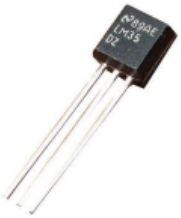

Fig.5.Temperature sensor

Plants require the proper environmental conditions for optimal growth and health. To ensure optimum plant growth, a greenhouse must be maintained at a specific temperature. As a result of this, temperature measurement is required.

The temperature sensor (LM35) will sense the temperature in the greenhouse and according to the values read, it will turn on/off the fan to maintain the temperature.

III. CONCLUSION AND FUTURE WORK

The reliability and performance of the system is more reliable than the manual system. The proposed method is capable of calculating the actual amount of moisture present in the soil. Again, it is very difficult for humans to calculate real light intensity, temperature and humidity; whereas this proposed method can do all of them very precisely. It reduces the chance of human error to maintain a greenhouse in a particular environmental situation. It is also environmentally friendly. With the addition of wireless technology between sensors, the device can be more efficient, cost-effective for larger areas and easy to implement. But this technology with wire connections is more suited for small-scale agribusiness.

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|| Volume 9, Issue 6, June 2021 ||

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INNO SPACE
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Impact Factor: 7.542

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ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

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