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IOT Based Green House Monitoring and Controlling

M. Jagadeesh & Dr.M. Yohan M.Tech., Ph.D.

[1]Master of Technology in Mechanical Engineering (Energy Systems) Jntu College Of Engineering Anantapur.

[2]professor Of Mechanical Engineering, Director Of Faculty Development Centre, Jawaharlal Nehru Technological University, Anantapur.

Abstract:

The greenhouse industry is the fastest growing sector worldwide. The green house separates the crop from the environment. Thus providing some way of shelter from the direct influence of the external whether condition. A structure enclosed by a glass or fiber used for cultivation and protection of inner plants is called as a green house. This a transparent case to allow the sunlight to get into it. Here the temperature is maintained at a desired range. It is also called as a cold frame. It is necessary for such a casing to be maintained at the required climatic condition. Various parameters like humidity, temperature, soil moisture, light, water level indicator etc. effect the functioning of such an enclosure. In this project a proto type greenhouse system is designed. For sensing the climatic parameters in the green house. Based on the characteristic of accurate perception efficient transmission and intelligent synthesis of internet of things, the system can obtain real time environmental information for crop growth and then be transmitted.

This project is more ideal condition that will be maintained in the green house which favors the growth of the plants inside the system. .

Keywords

Greenhouse, crop, humidity, water, moisture, soil, sunlight, glass, fibre.

1. Introduction

Greenhouse is a kind of place which can change plant growth environment, create the best conditions for plant growth, and avoid influence on plant growth due to outside changing seasons and severe weather. For greenhouse measurement and control system, in order to increase crop yield, improve quality, regulate the growth period and improve the economic efficiency, the optimum condition of crop growth is obtained on the basis of taking full use of natural resources by changing greenhouse environment factors such as temperature, humidity, light, and CO2 concentration.

Greenhouse measurement and control system is complex system it needs various parameters in greenhouse automatic monitoring, information processing, real-time control and online optimization. The development of greenhouse measurement and control system has made considerable progress in the developed countries, and reached the multi-factors comprehensive control level, but if the foreign existing systems is introduced, the price is very expensive and maintenance is not convenient.

In recent years, Sudan has launched many projects based on greenhouse. The measurement and control system used in these greenhouses is mostly based on cable, so it is not only wiring complex, but also unfavorable to improve the system efficiency. With the rapid development of the low cost, low power sensor and wireless communication technology, the conditions that construct wireless greenhouse measurement and control system becomes mature, and it is important to realize agricultural modernization.

Today agriculture is changing in response to the requirements of modern society, where ensuring food supply through practices such as water conservation, reduction of agrochemicals and the required planted surface, which guarantees high quality crops are in demand. As it is well known that greenhouse is a building or complex in which plants are grown. These structures range in size from small sheds to industrial-sized buildings. Greenhouses are often used for growing flowers, vegetables and fruits. Greenhouses are very useful for they provide an optimal temperature around plants, protect them from weather extremes, extends the growing season, allowing you to sow plants earlier and harvest plants later and allows economic crops such as tomatoes, cucumbers, melons and aborigines to crop more successfully. Basic factors affecting plant growth such as sunlight, water Content in soil, air humidity, temperature, CO2 concentration.

All things need energy to grow, human and animals get energy from food. Plants, on the other hand, get energy from the sun light through a process called photosynthesis. This is how light affects the growth of a plant. Without light, a plant would not be able to produce the energy it needs to grow. Aside from its effect through photosynthesis, light influences the growth of individual organs or of the entire plant in less direct ways. The plant grown in the dark will have a tall and spindling stem, small leaves, and both leaves and stem, lacking

chlorophyll, are pale yellow. Plants grown in shade instead of darkness show a different response.

There are many previous studies in this area which should be reviewed for helping in proposing a system with solvable problem in greenhouses. Stipanicev and Marasovic have proposed system is an embedded Web server unit system based on TINI board, by collecting data from distributed sensors and activating connected actuators using simple 1- wire local network. On the other side Web server is connected to the Internet through Ethernet or dial-up network. They have claimed that the developed system shows all advantages of Network Embedded System Technology (NEST), like the possibility of changing physical topology and low dimensions and cost in comparison with PC based system, preserving the full functionality at the same time.

A., Benzaouia, F., Tadeo and M., Nachidi [1] has proposed system to control of air temperature and humidity concentration in greenhouses is described by means of simultaneous Ventilation and heating systems by using Takagi- Sugeno (T-S) fuzzy models and the Parallel Distributed Compensation (PDC) concept. And showed that the robust fuzzy controller effectively achieves the desired climate conditions in a greenhouse, using this T-S fuzzy model, the stability analysis and control design problems can be reduced to sufficient conditions expressed as Linear Matrix Inequalities (LMIs) [1].

G., Xi-shan, Y., Xiang-long, W., Li-ren, Z., Yiming Qian [2] have compared the advantages of ZigBee with other two similar wireless networking protocols, Wi-Fi and Bluetooth, and proposed a wireless solution for greenhouse monitoring and control system based on ZigBee technology. As an explorative application of ZigBee technology in Chinese greenhouse, it may promote Chinese protected agriculture. With the capabilities of self-organizing, self-configuring, Self-diagnosing and self-healing, the ZigBee based monitoring and control system provides nearly unlimited installation. Flexibility for transducers, increases network robustness, and consider ably reduces costs. Therefore, they concluded that the ZigBee-based monitoring and control system can be a good solution for greenhouse monitoring and control [2].

Elmusrati [3] have suggested a different approach for implementing WSN in greenhouse environment by making use of a commercial wireless sensing platform provided by Sensinode Inc. The hardware design of the system consists of Sensinode's Micro 2420U100 operates as basic measuring node, with four commercial sensors (e.g. humidity, temperature, light and CO2). The idea behind this development is to test the reliability and feasibility of a prototype wireless environment monitoring system in commercial greenhouse. The experimental result showed that the network can detect local difference in the greenhouse climate caused by various disturbances in the environment [3].

Palaniappan [4] have proposed an embedded greenhouse monitoring and control system to provide a highly detailed micro-climate data for plants within a greenhouse environment with an innovative method of growing temperate crops in a tropical environment using microclimatic conditions. The greenhouse was equipped with conventional wired sensors that provide readings of the air temperature, light intensity and nutrient solution temperature in the mixing tank. The acidity and concentration of the nutrient solution were manually measured ,and adjusted accordingly, and high resolution data, collected with the deployment of a network of wireless sensors to provide sufficient data to develop pa model for the growth of these crops under Aeroponic conditions. The researcher claimed that the reliability of the star network was relatively high, with many nodes performing with a data transmission rate above 90%, where the minimum data transmission rate for all the nodes was 70% [4].

Abdul Aziz [5] have proposed system has a measurement which capable of detecting the level of temperature to developed a remote temperature monitoring system using wireless sensor and Short Message Service (SMS) technology. This system also has a mechanism to alert farmers regarding the temperature changes in the greenhouse so that early precaution steps can take and testing several types. This extended to include more environmental variables to be monitored in the agricultural greenhouse which relate to the increment of fruits and vegetables productivity. For example, other than temperature, the soil and water acidity level in the greenhouse also play important role to the quality of fruits, enhanced to produce a system that can trigger automatic actions of related components such as the sprinkler, lighting and air ventilators, rather than just send alert notification message, the proposed system is enhance by implementing artificial intelligent components to enable advanced implementations such as self-learning, predicting, and define ambiguous situation which provide preventive measures [5].

Lee [6] have suggested the 'Paprika Greenhouse System' (PGHS) which collects paprika growth information and greenhouse information to control the paprika growth at optimum condition. Also controls ventilators, humidifiers, lightings and video-processing through Graphical User Interface (GUI) Application by analyzing the measured data. The system provides with the 'growth environment monitoring service', which is monitoring the paprika growth environment data using sensors measuring temperature, humidity, illuminance, leaf wetness and fruit condition, the 'artificial light-source control service', which is installed to improve the energy efficiency inside greenhouse, and 'growth environment

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control service', controlling the greenhouse by analyzing and processing of collected data [6].

Chiung, Guan and Jwu [7] have utilized Field Point of National Instrument to build the greenhouse environment control system, and LABVIEW as programming language for compiling. They have used smart mobile (or PDA) to control the Personnel Computer (PC) server through the wireless network where the Field Point will adjust environment of greenhouse through controlling the device. Moreover, user can master the status of the greenhouse through web cam, and which use the smart mobile to control greenhouse environment system on anywhere. The result of this proposed system showed that the designed system could be more effective in manpower savings and raising the economic value of products i.e. Phalaenopsis [7].

Deore and Umale [8] have given an emphasis on WSN approach for greenhouse monitoring and control. A control system is developed and tested using recent ATmega microcontroller. The farmers in the developing countries can easily use designed for maximizing yield. ATmega microcontrollers are preferred over other microcontrollers due to some important features including10bit ADC, sleep mode, wide input voltage range and higher memory capacity. The design system considered optimization and functional improvement of the system. The system has several advantages in term of its compact size, low cost and high accuracy [8].

A., Agarwal, Mittal et al [9] have designed hardware for green house monitoring various sensors are used to control the environment parameters such as temperature, humidity, and light intensity for green house and soil wetness for crop growth. The system comprises of sensor, ADC, microcontroller and actuators. When any of the above mentioned climatic parameters cross a safety threshold which has to be maintained to protect the crops, the sensors sense the change and the microcontroller reads this from the data at its input ports after being converted to a digital form by the ADC. The system has successfully overcome quite a few shortcomings of the existing systems by reducing the power consumption, maintenance and complexity, at the same time providing a flexible and precise form of maintaining the environment. The continuously decreasing costs of hardware and software, the wider acceptance of electronic systems in agriculture, and an emerging agricultural control system industry in several areas of agricultural production, will result in reliable control systems that will address several aspects of quality and quantity of production [9].

K. S., Berezowski [10] has reviewed the landscape of the application of wireless sensor networking in greenhouse management to make computer engineer more aware about this specific application domain and the space it offers for applying IT and communication infrastructure, as well as to make horticulture researchers more aware of what wireless technologies have to offer and how to optimize their usage in the greenhouse. Also identified, formulated and discussed the design space of a few in opinion most important problems in developing efficient and cost effective WSN deployments for greenhouse.

2. Project Design

In this chapter the block diagram of the project and design aspect of independent modules are considered. Block diagram is shown in the below:

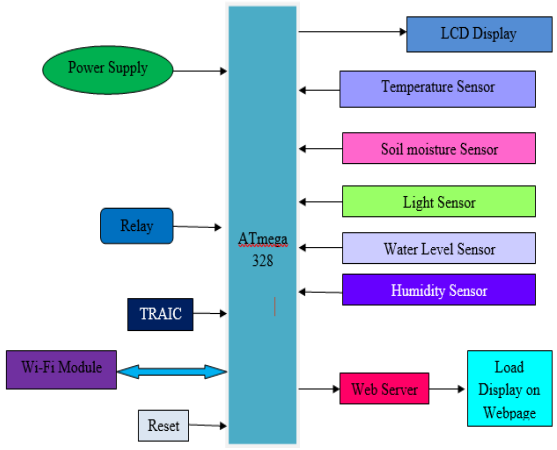

Fig1: Block diagram of Hardware

3. Results and Discussions

The basic block diagram of greenhouse system is as shown in fig. An Arduino platform micro- controller is used to obtain values of physical data through sensors connected to it. And then sensor's collected data is given to Wi-Fi module.

- An Arduino based Greenhouse Monitoring and Controlling is designed.
- The Arduino can be programmed with Arduino software (IDE).
- Internet of Things concept is used for showing the sensed data on web portal page.

Fig2: lcd screen display output

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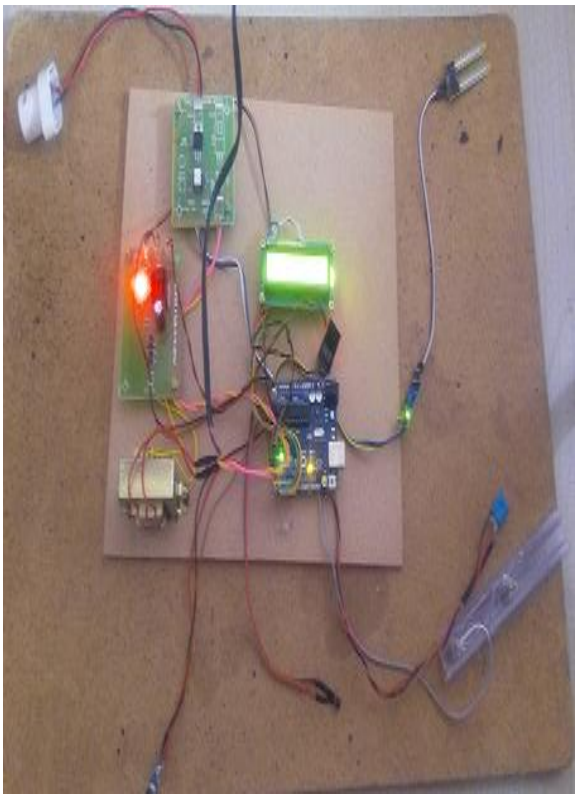

Fig 3: Project Overview

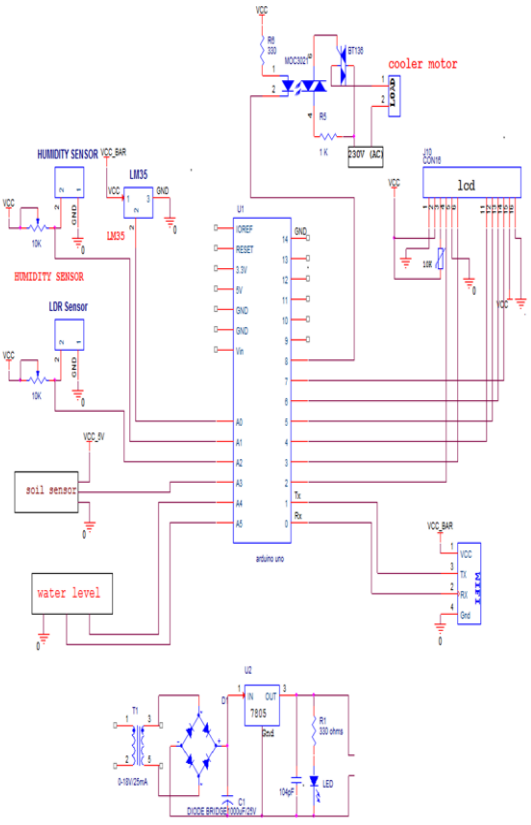

Fig 4: Schematic Diagram of Proposed Design

In this proposed system we have used atmospheric sensor's, which is LDR light sensor, LM35 temperature, DHT11 humidity sensor, Soil Moisture sensor and water level indicator. For these sensor's we have denoted some specific conditions or the threshold values .As per their climate the value will be change and the controlling action will be taken by relays which is connected to the output side. And the changed data of atmospheric sensor's we can observed for analyzing on the screen of serial monitoring using the Arduino Uno kit and their IDE software.

4. Conclusion

Automatically control environmental conditions within greenhouse allowing any type of plants to be grown all year round. Eliminates risk of greenhouse not being maintained at specific environmental conditions due to human error. Minimize labor costs involved in maintaining a greenhouse.

Here, proposed design is implemented with Arduino platform for greenhouse monitoring, controlling temperature, humidity, and light and soil moisture with the help of Web server using IOT.

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