

Conservatory Monitoring and Control System using IoT

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ABSTRACT

Greenhouses are climate-controlled structures with walls and roof specially designed for offseason growing of plants. Most greenhouse systems use manual systems for monitoring the temperature and humidity which can cause discomfort to the worker as they are bound to visit the greenhouse every day and manually control them. Also, a lot of problems can occur as it affects the production rate because the temperature and humidity must be constantly monitored to ensure the good yield of the plants. Internet of Things is one of the latest advances in Information and Communication Technologies, providing global connectivity and management of sensors, devices, users with information. So, the combination of IoT and embedded technology has helped in bringing solutions to many of the existing practical problems over the years. The sensors require here are moisture sensor, LDR and DHT11 (Temperature & Humidity sensor). From the data's received, Arduino automatically controls Moisture, Temperature, Humidity efficiently inside the greenhouse by actuating an irrigating pipe, cooling fan and LED respectively according to the required conditions of the crops to achieve maximum growth and yield.

1. INTRODUCTION

Conservatory is climate-controlled structures with walls and roof specially designed for offseason growing of plants. Most greenhouse systems use manual systems for monitoring the temperature and humidity which can cause discomfort to the worker as they are bound to visit the greenhouse every day and manually control them. Also, a lot of problems can occur as it affects the production rate because the temperature and humidity must be constantly monitored to ensure the good yield of the plants. Internet of Things is one of the latest advances in Information and Communication Technologies, providing global connectivity and management of sensors, devices, users with information. So, the combination of IoT and embedded technology has helped in bringing solutions to many of the existing practical problems over the years. The sensors require here are moisture sensor, LDR and DHT11 (Temperature & Humidity sensor). From the data's received, Arduino automatically controls Moisture, Temperature, Humidity efficiently inside the greenhouse by actuating an irrigating pipe, cooling fan and LED respectively according to the required conditions of the crops to achieve maximum growth and yield.

A green house is where plants such as flowers and vegetables are grown. Greenhouse's warm-up during the day when sun-rays penetrates through it, which heats the plant, soil and structure. Greenhouses help to protect crops from many diseases, particularly those that are soil borne and splash onto plants in the rain. Greenhouse effect is a natural phenomenon and beneficial to human being. Numerous farmers fail to get good profits from the greenhouse crops for the reason that they can't manage two essential factors, which determines plant growth as well as productivity. 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. To overcome such challenges, this greenhouse monitoring and control system comes to the rescue. This project demonstrates the design and implementation of various sensors for greenhouse environment monitoring and controlling.

This greenhouse control system is powered by Atmega328 microcontroller. It consists of a temperature sensor, light sensor, soil moisture sensor, LDR sensor, LCD display module, 12V DC fan/Bulb and pump. The temperature sensor senses the level of temperature. If it goes high, the DC fan gets on and when the temperature goes low, the fan gets off. The soil moisture sensor senses the water level as the level decreases, the pumps get on. There is a continuous increase in demand for food production technology. Sudan is a country where the economy is dependent on agricultural produce. Sudan weather conditions are characterized by having predominantly long and hot summers and short and mild winters. Such climatic conditions put a great strain on the types of crops that could be successfully grown. This is very much true with most horticultural vegetables with medium thermal requirements (tomato, pepper, cucumber, watermelon, marrow, green bean, eggplant). Agricultural means can satisfy the food production demand. But due to isotropic climatic conditions, this ultimately affects the plant growth. Pests and diseases, and extremes of heat, humidity, light and temperature and irrigation is necessary to provide water. The farmers have been using different irrigation techniques for increasing production. These techniques were done by human intervention. But due to this, sometimes either the plants consume more water or the water reaches late up to the plants. In other words, a greenhouse is a structure that provides protection and a controlled environment for raising plants indoors. The primary issue of greenhouse-based horticulture is to manage the greenhouse environment optimally in order to comply with the economic and environmental requirements. We can use an automatic or manual microcontroller (Arduino) based system. For automatic monitoring and control for greenhouse, we are developing an embedded system which will record the temperature, moisture and other parameters that will control the environmental conditions in the plant field. Moreover, for effective control, an interface application is used along with the embedded system. Secondly, transmitter and the receiver need to be tested for their functionality. It can be done by sending a bit of data from the transmitter to the receiver. The push button and the LED can be used as the representation of data sending and receiving. Or displaying the transition frame in a virtual terminal. Finally, the software of the system, for that there are two parts which have to be considered. They are the software for the programming and the Visual Studio C# programming for GUI application. The Visual Basic studio software is used to make a connection to the remote monitoring using GUI application. Hyper terminal is used to record data that have been received through the serial connection. The last part in order to achieve the objective is to test the output of the system. The driver circuits which consist of relay and transistor are needed to be tested so that the cooling fan and the irrigation valve are functional. To test the relay is by giving appropriate power supply to its coil.

2. LITERATURE SURVEY

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 a greenhouse is a building or complex in which plants are grown. These structures range in size from small sheds to industrialized buildings. Greenhouses are often

used for growing flowers, vegetables and fruits. Greenhouses are very useful for they provide an optimal 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. These physical factors are hard to control manually inside a greenhouse and there is a need for automated design arises. One of the benefits of growing crops in a greenhouse is the ability to control all effective elements of the production that important to be monitored because it is directly related to the growth and development of plants. Different crop species have different optimum growing temperatures and these optimum temperatures can be different for the root and the shoot environment and for the different growth stages during the life of the crop. Since we are usually interested in rapid crop growth and development, we need to provide these optimum temperatures throughout the entire cropping cycle. If a greenhouse were like a residential or commercial building, controlling the temperature would be much easier since these buildings are insulated so that the impact of outside conditions is significantly reduced. Water vapor inside the greenhouse is one of the most significant variables affecting the crop growth. Humidity is important to plants because it partly controls the moisture loss from the plant. The leaves of plants have tiny pores, CO₂ enters the plants through these pores, and oxygen and water leave through them. Transpiration rates decrease proportionally to the amount of humidity in the air. This is because water diffuses from areas of higher concentration to areas of lower concentration. Due to this phenomenon, plants growing in a dry room will most likely lose its moisture overtime. The damage can be even more severe when the difference in humidity is large. The humidity control is complex because if temperature changes then relative humidity changes inversely. Temperature and humidity are controlled by the same actuators. The main priority is for temperature control because it is the primary factor in the crop growth. Based on the inside relative humidity value the temperature set-point can be adjusted to control the humidity within a determined range. Hence to control the required humidity is very complex task. For proper control of humidity internal air can be exchanged with outside air by properly controlling ventilations of the greenhouse. 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 most striking effect can be seen between a plant grown in normal light and the same kind of plant grown in total darkness. 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. Moderate shading tends to reduce transpiration more than it does photosynthesis. Hence, shaded plants may be taller and have larger leaves because the water supply within the growing tissues is better. With heavier shading, photosynthesis is reduced to an ever-greater degree and, weak plants result. Soil water also affects the crop growth. Therefore, the monitor & control of soil condition has a specific interest, because good condition of a soil may produce the proper yield. The proper irrigations and fertilizations of the crops are varying as per the type, age, phase and climate. The pH value, moisture content, electric conductivity and the temp of a soil are some key parameters. The pH values and other

parameters will help to monitor the soil condition. The temperature and the moisture can be controlled by the irrigation techniques like drift and sprinkles system in a greenhouse. The temperature of the soil and the inside temperature of the greenhouse are interrelated parameters, which can be, control by proper setting of ventilation. Since the temperature control is depends on direct sun radiation and the screen material used, the proper set point can adjust to control soil temperature. The temperature set-point value depends on actual temperature of the inside and outside of the greenhouse.

3.PROPOSED METHOD

An embedded system is a system which is going to do a predefined specified task is the embedded system and is even defined as combination of both software and hardware. A general-purpose definition of embedded systems is that they are devices used to control, monitor or assist the operation of equipment, machinery or plant. "Embedded" reflects the fact that they are an integral part of the system. At the other extreme a general-purpose computer may be used to control the operation of a large complex processing plant, and its presence will be obvious. The very simplest embedded systems are capable of performing only a single function or set of functions to meet a single predetermined purpose. In more complex systems an application program that enables the embedded system to be used for a particular purpose in a specific application determines the functioning of the embedded system. The ability to have programs means that the same embedded system can be used for a variety of different purposes. In some cases, a microprocessor may be designed in such a way that application software for a particular purpose can be added to the basic software in a second process, after which it is not possible to make further changes. The simplest devices consist of a single microprocessor (often called a "chip").

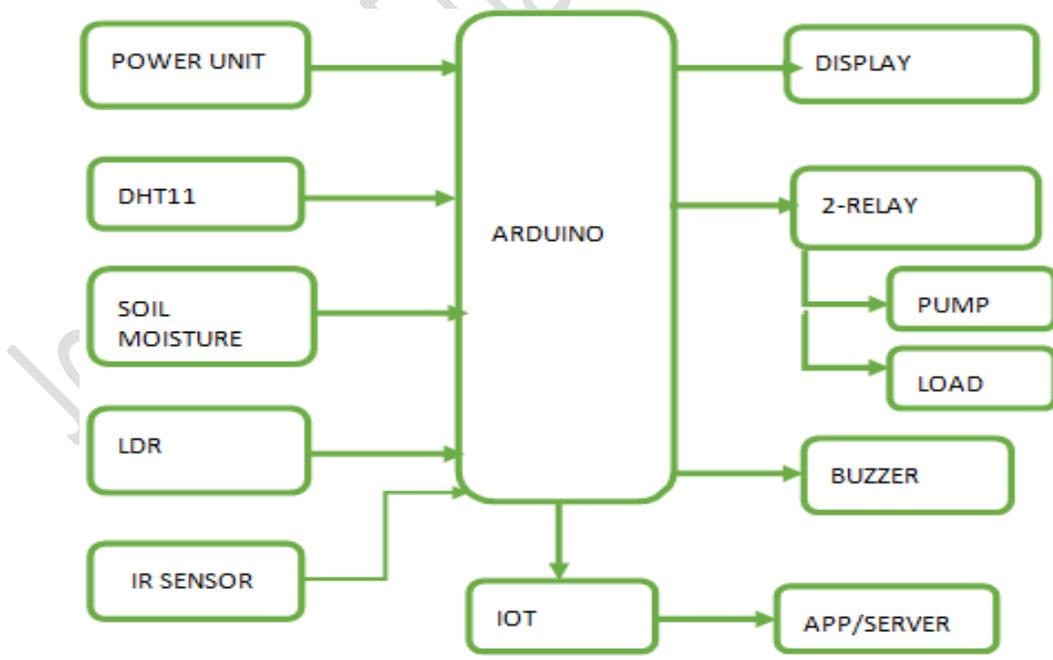


Figure 3.1: Block diagram of embedded system

4. RESULTS



5. CONCLUSION

It is our great pleasure that we have successfully completed our project that presents a design of a simple and low-cost monitoring and control greenhouse system based on an Arduino technology. A temperature, humidity and light sensors were integrated with fan, heater and pump to figure out the sensing and responding unit. Arduino mega and serial interface were utilized to be the processing and communication units respectively. The proposed displaying and controlling via GUI promising solution lower running costs, and increase flexibility and reliability in a greenhouse management system. Compatibility, compactness, portability and low power consumption is some of important key elements in our design. Therefore, a carefully selection of sensing devices and circuitry components is also very important especially when interfaced to the microcontroller. The management scenario of the entire environment of the greenhouse has a crucial importance in utilizing the attached responding elements, where the logical relation between them should be studies firstly. In conclusion, greenhouse climate monitoring and controlling is one attractive application field to create GUI system for monitoring and controlling.

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