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Smart Greenhouse Based on IoT Application

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Abstract: Control systems have in recent days modified and introduced irrigation to meet the needs of people. Getting determined the amount of irrigation needed is a complicated process and many important factors must be taken into account. This paper provides an efficient automatic irrigation system based on the use of wireless network and the server and client's web service as the basis for computing and monitoring various changes required in green house. The two key factors in our model are power reduction, control and monitoring over long distances. The results show that the control model analyses the sensing data and the specific method for measuring the values of adapted sensors and also the self-controlling of the output linked equipment. The findings also show that our system has many beneficial properties such as simple management of network and controlling motors. In the proposed design method, four sensors are adaptable to monitor environmental changes within the greenhouse, such as soil moisture , humidity , temperature and light sensor. Since irrigation begins often when different depletion ratios of all sensors are available to operate plugged devices for different operations.

Keywords: Green House, Self-Controlling, Soil Moisture, Humidity, Temperature, Light Sensor

1. Introduction

In agriculture, the smart greenhouse is an advance that creates an automated plant-growing microclimate using sensors , actuators, control systems, and monitoring for the management of growing conditions and automation of growing processes. Greenhouse is a building for the growing and managing of plants with glass walls and a roof [1]. Greenhouses are often widely used in planting seeds, vegetables , fruit and tobacco. In order to provide water, it is important to control pest and diseases, as well as extreme heat and humidity and irrigation. Greenhouses defend crops from extreme hotness or coldness, protect plants from storms and blizzards and help to protect from pests [9]. Regulation of light and temperature makes greenhouses the perfect location for plant cultivation [10]. In other words, a greenhouse is a system that covers and regulates the plan on the ground [5]. The primary challenge of greenhouse gardening is the optimum control of the greenhouse climate to satisfy economic and environmental requirements.

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The high costs of running a greenhouse where people are continuously hired to inspect, track and irrigate crops discourage farmers from using greenhouse cultivation practices nowadays. Irrigation is an important thing in the greenhouse system. The water we supply must ensure plants can thrive in such circumstances. The water we provide is the main factor. As we are all aware, most gardeners use the manual system to supply irrigation to their plant. Either the plants die when the plant does not have enough water or vice versa. In addition, the gardener also needs to monitor the greenhouse in order to ensure their plant conditions are safe.

The automatic watering system and remote monitoring are used to maintain the condition and overcome the problem. It reduces the time if automatic instead of manual watering is used. The plants or crops need fewer workers. For control of temperature in the greenhouse and watering, sensors like temperature sensor and soil moisture detector. It also has the ability to remotely control the greenhouse condition through the wireless module of your device. The details will be transmitted using radio frequency and shown with visual basic tools from third parties. The user therefore knows the greenhouse condition without going to the site and receiving information.

The objective of this project is (1) to provide a monitoring system to help to monitor and control the system using a mobile application called Blynk, (2) to develop a project in which can be controlled using manual and auto push button using phone application and (3) to test, validate and verify the greenhouse automated system and design a user manual and deployment strategies to ensure that it is working in its intended environment.

This study is aimed specifically at crop husbandry in green houses, covering the agriculture sector. Given the hard factors in the natural world, this is intended to increase crop productivity. The machine, for example, is used to regulate temperatures, moisture, sunlight and watering conditions automatically in a green house. Details on the condition in the green house shall be given to the customer. This information is transferred as a user interface that the user can also control and adapt the values that change the green house status (conditions) appropriately. Several scopes that need to be considered in this project that is sensor used to control the watering system is soil moisture sensor, fan system control based on temperature sensor is used as greenhouse temperature controller , the condition of the Sensors & outputs are to be monitor with remote display based on wireless module and a communication unit based on Iot where a Wi-Fi module which NodeMCU is used to send data to the phone application [5] . The application will display the sensors and the system condition which allow users to control it .

2. Literature Review

Compared to previous research, as example from R. K. Kodali, V. Jain, and S. Karagwal.developed a smart greenhouse using Arduino UNO as the core of the system that sends notifications to some devices. The developed method can be recommended for controlling and monitor humidity and temperature in protected houses / greenhouses, especially, in the areas where the internet facility and mobile network signal is poor [3].

Next, Jayashree, A. Manami, Harshitha, and R. Mohan state that this the parameters can be controlled from anywhere in the world. This enables the farmers to grow crops properly. The disadvatages from their research, an app cannot be enhanced to give notifications to the user when any of the parameter gets above or below a certain value.

Furthermore, in greenhouse, a significant amount of energy is used to heat and ventilate them to maintain desirable temperature setpoints [5] . The intention of this project is to design a simple, easy to install, user friendly to monitor and record the values of temperature, humidity, soil-moisture and sunlight of the natural environment that are continuously modified and controlled in order optimize them to achieve maximum plant growth and yield. Greenhouses form an important part of the agriculture and gardening sectors in our country as they can be used to grow plants under managed climatic conditions for optimum produce [7]

Some research from [8],[9],[10] describes the same objective Plant growth directly governs with climatic parameters like sunlight, soil, humidity etc. Their proportion must be controlled and automated according to plant requirement. Furthermore, compared to previous research, some components and modules remain the same. Among the significant differences between the projects done is that this system is used on a microcontroller, while the previous research are done on Arduino uno. Besides, Blynk application also included in this project.

3. Methodology

Few tasks for systems hardware and Blynk application software have to be done in order to attain the scope goal. There are four components to remember for the hardware of the device. Firstly, it needs to be tested and reviewed by both Arduino uno in this device. User must ensure that the Arduino uno is started later and that the correct software is inserted into your Arduino IDE.

The second is to test its operating capabilities for the transmitter and the recipient module. User can do this by transmitting any data from the sender to the receiver. The LED can be used for the display and reception of data. After that, both Arduino uno can integrate the circuit and then connect.

Eventually, to check its functionality, the WiFi module is required. This ensures that the data can be sent back to the system's Arduino uno and retrieved via WiFi module . This can be copied to the EEPROM of the Arduino uno by using the C++ language software.

For the software of the system, there are two parts which have to be considered. They are the assembly language programming and the Visual Basic programming for Blynk application. For the assembly language, the coding needed to be testing on the Arduino IDE simulator software [12]. The purpose of this simulator program is to debug errors. The Visual Basic 6 software used to make a connection to the remote monitoring using Blynk 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 motor are functional [13]. To test the relay is by giving appropriate power supply to it .

3.1 Block diagram of Smart greenhouse

Figure 1 shows the overall block diagram which consists of Arduino Uno as the controller which are acts as the interface for hardware and software component.

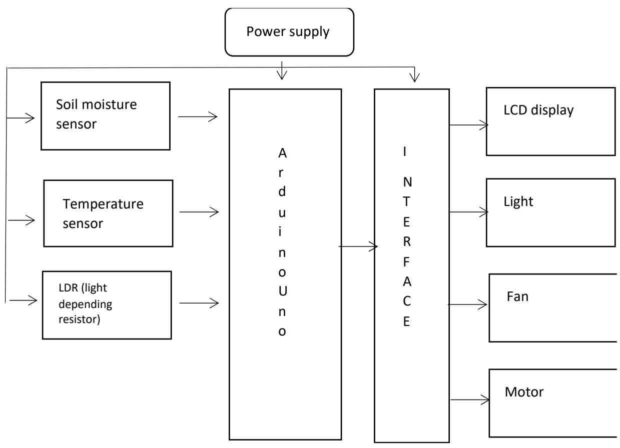

Figure 1: Block diagram of smart greenhouse consist of the operation of the Smart Greenhouse

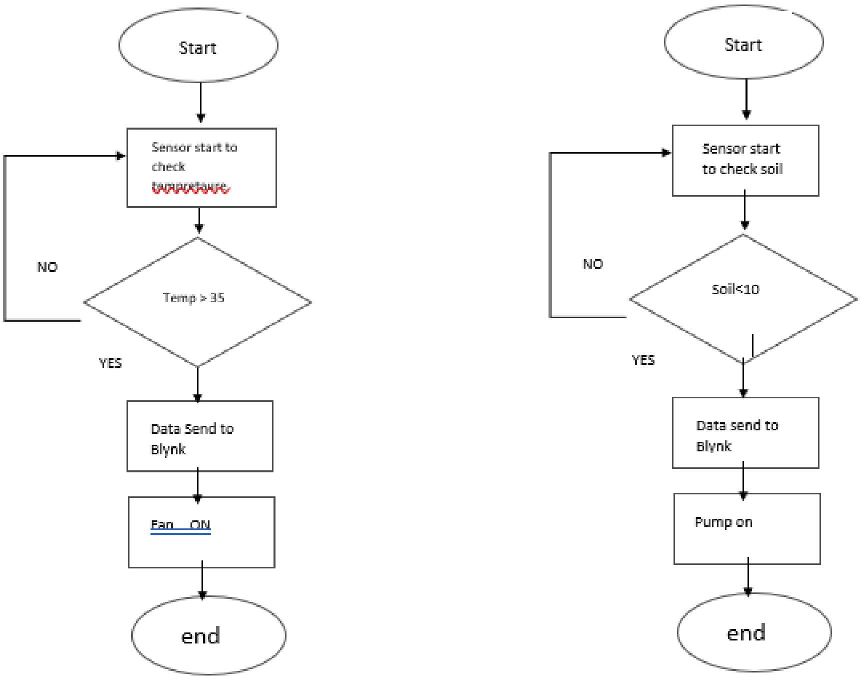

Figure 2: Flowchart of the Smart greenhouse using IOT application

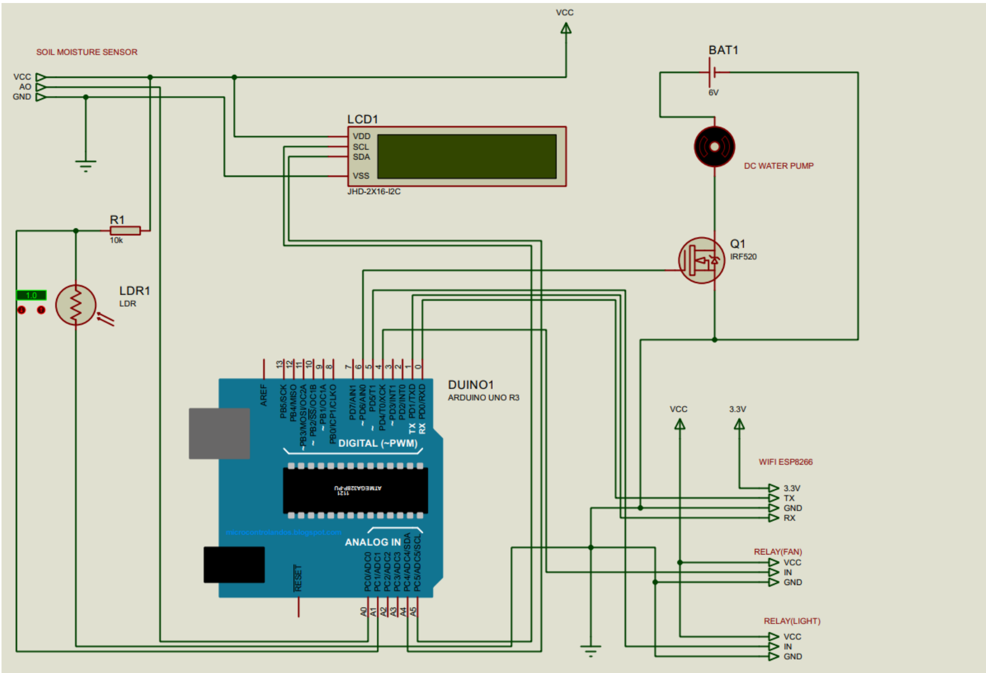

Figure 3: Sensor Wiring Connection

Figure 3 shows the wiring connections for all sensor, soil moisture sensor , LDR , temperature sensor. All the components are given with 5 V power source from batteries .

3.2 Complete Prototype of the project

The full project prototype, as seen in the figure below. The whole circuit and all the modules put in this package. This prototype will be placed on top of the user’s bicycle. The supply for this project is just a 1.5 Volt AA battery with an output not exceeding 5.0 Volts. This is because all of the components in this project use 5.0 Volt dc supply.

Figure 4: The overall of the prototype

Figure 5: The front of the prototype

Next, the diagram below shows the wiring and structure of all components used in the box. All the wires used were fastened to look neat and ensure that the cover can be closed. As for the sensor, it is positioning at the wall of the prototype .

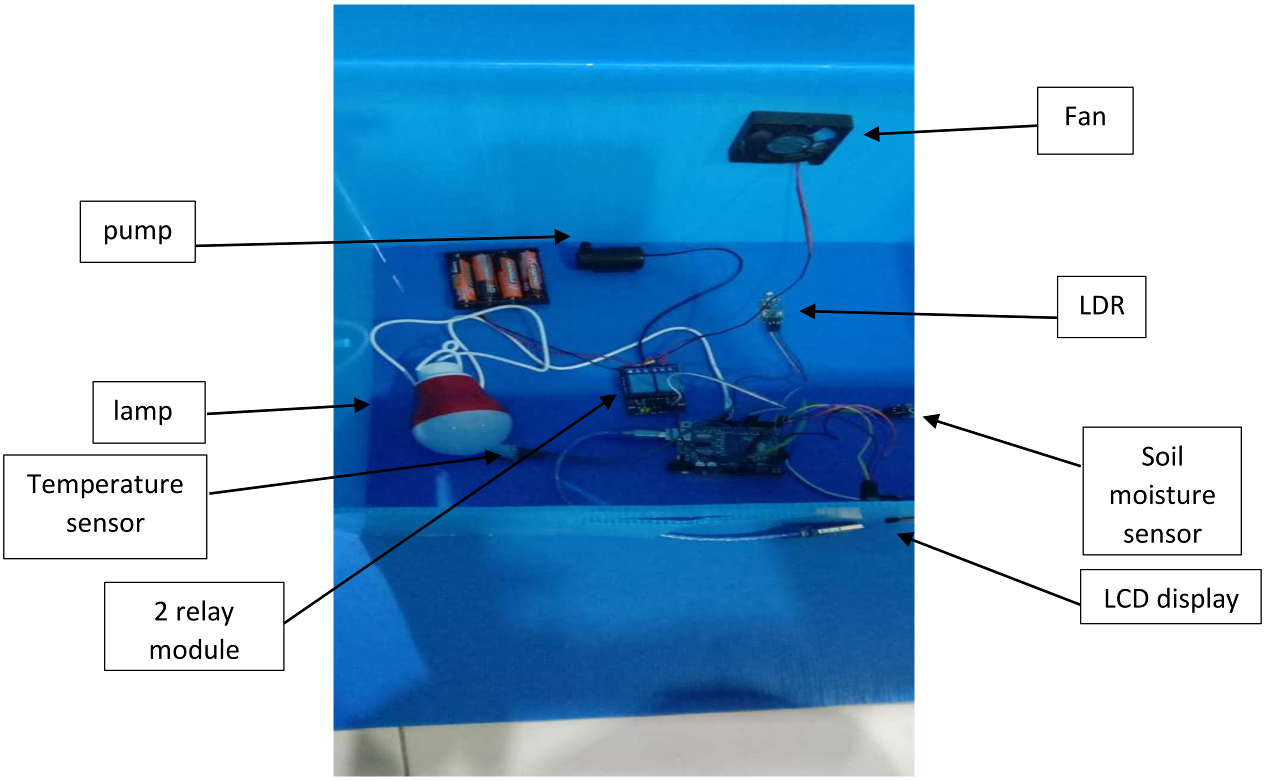

Figure 6: Wiring structure inside the prototype

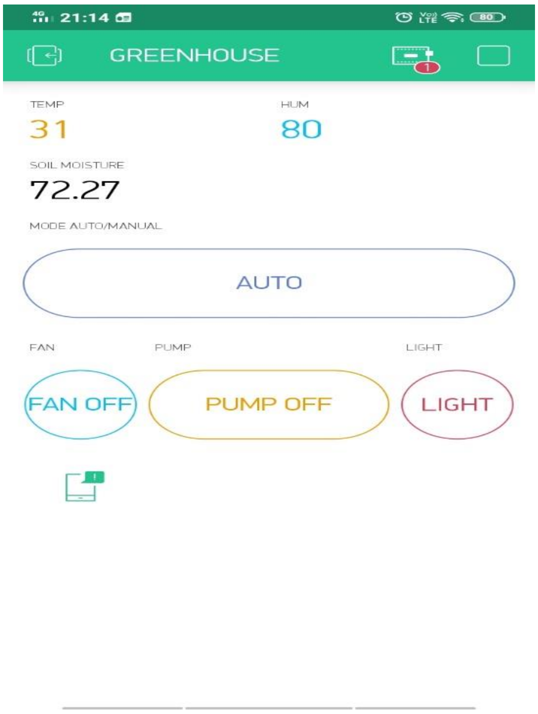

Figure 7: Features in application Blynk

3.3 Automatic Control using Blynk Application

Figure 7 demonstrate the framework created for automated mobile phone control of the project . There are 3 buttons in the blynk application. At the top of the blynk application , it stated a value of temperature and soil moisture when it is operated in automatic.

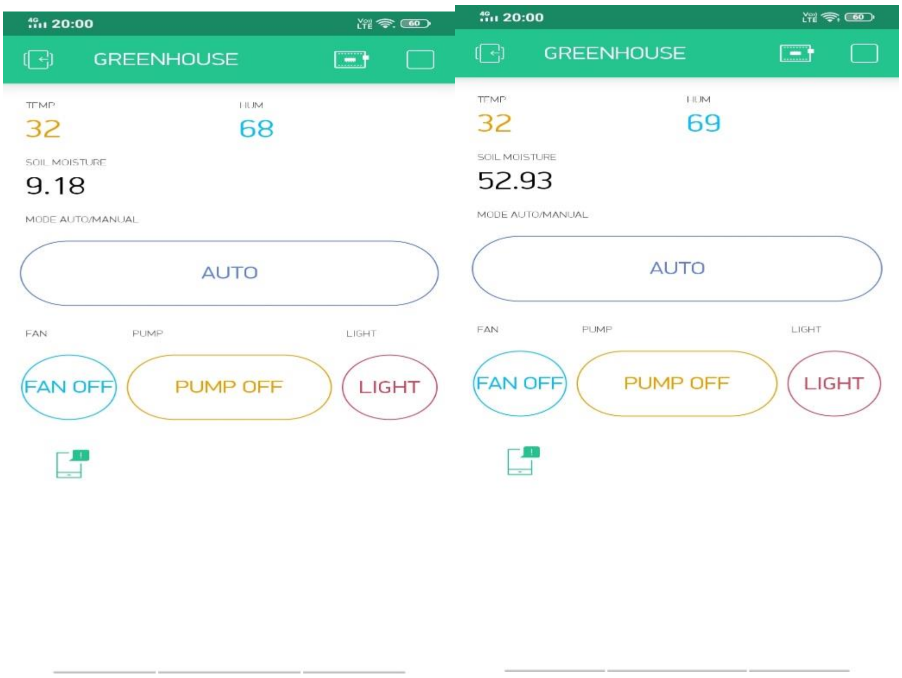

Figure 8: Auto mode in Blynk application

Figure 8 shows a set of notifications set by blynk application received by users . The blynk will alert users about the project's condition , particularly when the pump is on or when the sensor is on. It is to ensure thet the user keeps updating at all times , even if users are elsewhere . The water pump will continue to operate until the soil reaches more than 10 and the operation will stop . Figure 8 left show that the soil moisture sensor is less than 10 so that the pump will not operate while the right figure show that the soil moisture sensor is more than 10 so that the pump will not operate . The main benefit of this notification is that users can be easily updated everywhere about the plant and system .

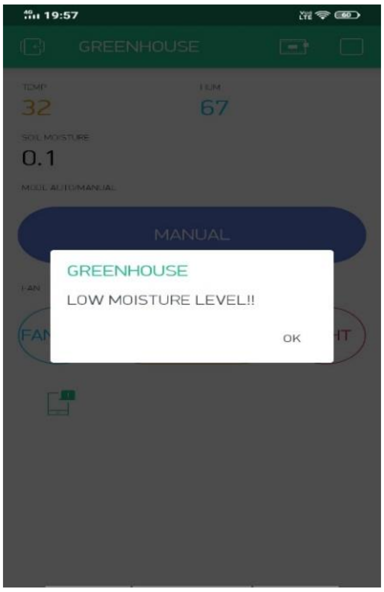

Figure 9 : A set of notification send by blynk

Figure 9 show a notification a send from blynk state that the soil moisture sensor are low. This is just in auto mode, so that the pump will operate simultaneously until the value of soil moisture sensor are more than 10.

4. Discussion

Figure 10 and 11 show that when the fan and lamp is turn on manually, so that the fan and light will turn on. When the user turn off the light and fan, the light and fan will turn off. Similar to pump, when the user turn on the pump manually, the pump will operate and run manually. It is easy for the user to make sure if the auto mode goes wrong or crash, so that the user can control manually.

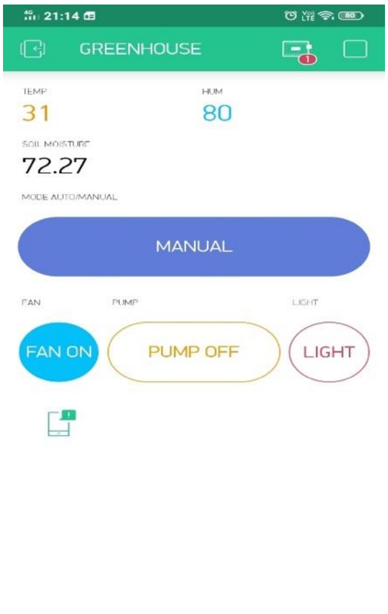

Figure 10 : A manual mode when fan On

Figure 11: A manual mode when light On

5. Conclusion

The device is ideal for large-scale agricultural operations as well as small-scale farming. For larger agri-businesses, the cost of conditioning equipment may be raised, but maintenance costs are the same in all fields and slightly lower than the cost of labor. In addition, the system's performance and accuracy are more accurate than the manual systems. People will see whether the soil is or is not wet. But the system proposed can measure the actual amount of moisture in the soil. Again, the real light intensity, temperature and humidity calculation for humans is very hard, although the proposed method will all do it with great precision. It reduces the risk of human errors to create an eco-friendly greenhouse. It is also environmentally friendly. In addition. The device can be accurate, cost-effective and easy to operate with wireless technologies between sensors. However, this technology for small-scale agriculture with wire connections is better suited.

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