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Greenhouse Environment Monitoring and Controlling System

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Abstract:- Agriculture is a major part of our lives as human beings. A lot of research has been carried out in order to be able to develop a monitored and controlled greenhouse system/environment that will help in solving the main problems relating to agriculture which is to enable the increase in the crops being cultivated all year round in the comfort of a small space like the home, and also to reduce human interaction in a small-scale greenhouse environment. So accordingly, an automated greenhouse monitoring and control system was proposed for the sole purpose stated above. The methodology used in building the green - house monitoring and control system is a wired connection.

Keywords:- *Greenhouse, Sensors, Monitoring, Controlling, Arduino.*

I. INTRODUCTION

In this time and day, everything can be monitored and con- trolled automatically. Unfortunately, in an important sector like agriculture, the manual process is still very active, meaning the automatic monitoring and control of a greenhouse system hasn't completely scaled through just yet, especially when it comes to small scale farming. The reason whereby the automation of a greenhouse system hasn't been put to a full-fledged use may be in view of several reasons, such as the absence of technical know-how, high cost and the requirement of high maintenance. Agriculture has stood out amongst the most im- portent occupations of individuals since the early advancement of humans and sadly, even to date, manual interventions in farming are inescapable. When it comes to a greenhouse monitor and control system, it is a very important part of agriculture as it can be used to grow plants under a controlled climatic condition for ideal plant produce , it is also to degree important in the sense that it shields plants from weather extremes by having a controlled climatic environment, it broadens the developing season and also empowers you to sow plants earlier and harvest plants later In the case of this project, there will be the presence of an automatic greenhouse which will involve the system being closely controlled and monitored in a set climatic condition which is needed for optimum farm/plant produce.

II. METHODOLOGY

A lot of research has been carried out in order to be able to develop a monitored and controlled greenhouse sys- tem/environment that will help in solving the main problems relating to agriculture which is to enable the increase in the crops being cultivated all year round in the comfort of a small space like the home, and also to reduce human interaction in a small-scale greenhouse environment. So accordingly, an automated greenhouse monitoring and control system was pro - posed for the sole purpose stated above. The methodology used in building the greenhouse monitoring and control sys - tem is a wired connection. The system was built using a number of connection wires, sensors, LCD, a cooling system, A power bank, LEDs, LDRs, Arduino board among a few other components. The result obtained was a fully functioning sys- tem that was set to monitor the greenhouse environment refer to Figure.1

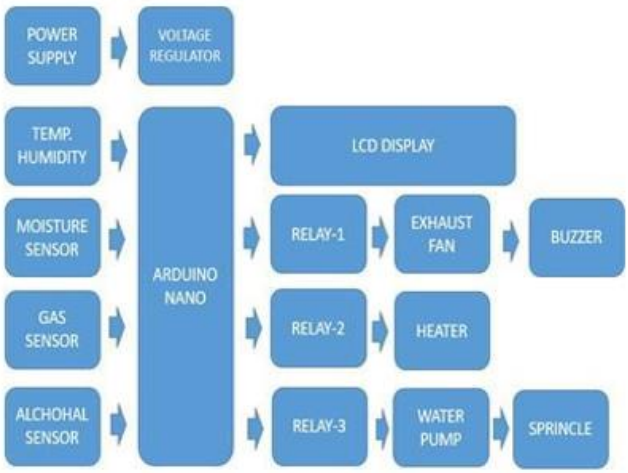

Fig 1. Block Diagram

Block Diagram depicts the fundamental greenhouse system block diagram. There are four sensors in the green- house monitoring system. The micro controller system takes input from these sensors. The micro controller receives input in the form of analog data. The controller transforms this data into digital form. Through Bluetooth, the data is displayed on the LCD display and can also be displayed on the Android applications. As a result, temperature, moisture, gas and alcohol parameters are automatically monitored. The coding-built embedded system can control the parameter values once they have been monitored. This is a controlling system that is automated. The user controls the Android application at his own will. Control is carried out using the Android application in accordance with the user's knowledge and the desired output.

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III. ENVIRONMENTAL FACTORS

A. Temperature

Environmental factor that is strongly related to the growth of plants. As a result of this, the control and monitoring of temperature in a greenhouse environment are quite important and this has been made easier to achieve, with the help of green - house technologies. In further explanation, it could be explained that plants produce heat as they take in CO2 and take out oxygen. The heat produced can help in the growth of plants like tomatoes but when there is an excess accumulation of heat produced, without the presence of proper ventilation, it could cause crop diseases. In order to avoid this, tempera - ture controls could be used in bringing the temperature down- in order to help in keeping plants at the right temperature for a good harvest.

B. Humidity

Later on process CO2 which makes the greenhouse very moist after some time. The dampness could be avoided in order to maximize plant growth by having a proper ventilation system and also possessing great management of a heating system. If these two factors aren't put in place, the greenhouse could harbor diseases, and also, the growth of molds which will cause harm to the plants being cultivated. The carbon dioxide is needed for photosynthesis, which is the process whereby plants make their own food. Carbon dioxide is gotten from the air in the atmosphere or from water. During photosynthesis, the plant uses carbon dioxide to produce carbohydrates, which works to promote plant development.

IV. SYSTEM ARCHITECHTURE

The whole purpose of this system is to create an effective greenhouse environment which will drastically reduce the cost of labor and also help small scale farmers cultivate crops

all year round. The system consists of sensors, microcontrollers, and actuators. The system works in such a way that when the environmental parameters cross a safety threshold, the sensors detect a change and the microcontroller reads the data from its input ports and performs the suitable action in order

to bring the parameter back to its required level. The actuators (fan, led, buzzer) are switched on based on the instruction passed to the microcontroller. An LCD is employed to show the condition inside the greenhouse. Lastly, the entire setup be - comes user-friendly, easy to put together and quite portable.

With respect to the temperature, humidity and light intensity, when the temperature passes the set optimum threshold value, the relay will perform the required action which is to either bring the temperature down when it's too high(27_C) by turning on the cooler and turning the heater on when the temperature is too low. Similarly, when the set value for humidity gets higher than 60%, the heater gets turned on.

Also, with the light intensity fixed at 80%, if the value happens to get higher, the light is turned off which results in a reduction of light intensity in order to avoid the production of bad crops.

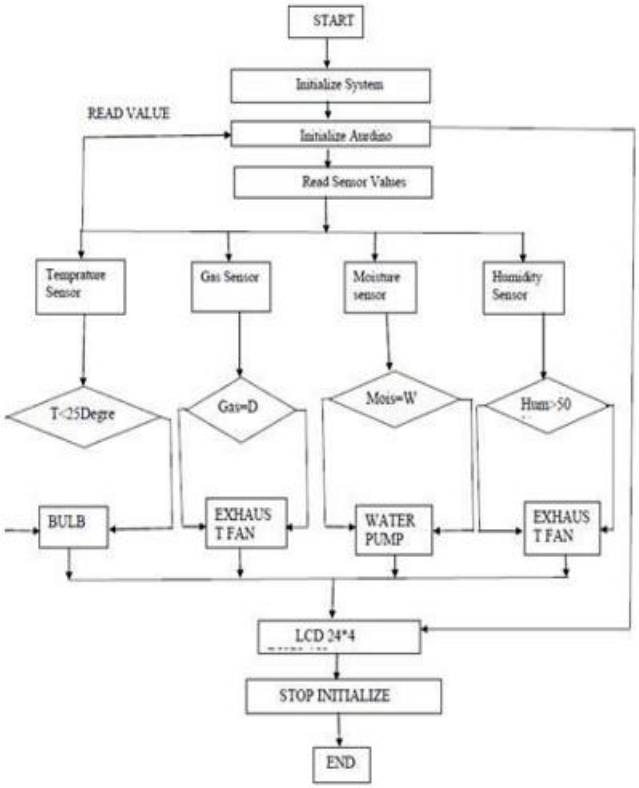

Fig 2. Flow Chart

This subsection gives brief information on the set values of the parameters of the tomato crop which is used in this research. These parameters are

1. The user shall set the temperature suitable for a tomato at 27_C
2. The user shall set the value of Humidity suitable for a tomato at 60%
3. The user shall fix the Light intensity at 80%
4. The user shall set the CO2 level at 400

Furthermore, the set values stated above aid in the control of the greenhouse. An example of this could be explained follows; With respect to the temperature, humidity and light intensity, when the temperature passes the set optimum threshold value, the relay will perform the required action which is to either bring the temperature down when it's too high (27_C) by turning on the cooler and turning the heater on when the temperature is too low. Similarly, when the set value for humidity gets higher than 60%, the heater gets turned on. Also, with the light intensity fixed at 80%, if the value happens to get higher, the light is turned off which results in a reduction of light intensity in order to avoid the production of bad crops.

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A. Programming Language

The programming language used in controlling the microcontroller is C/C++, this language is preferred because it is the language of hardware and it is the main language used in programming the microcontroller (Arduino).

V. HARDWAERE REQUIRMENT

A. Arduino

Arduino has a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) which runs on the computer and enables it to write and upload the code to the board.

B. Liquid Crystal Display

LCD (liquid crystal display) is the technology used for displays in a notebook and, other smaller computers.

C. Humidity And Temperature Sensor

The sensor used in this project is the DHT22 sensor which is a low-cost sensor used for the measurement of temperature (-40 to 80°C) and humidity (0-100%).

D. Light Intensity Sensor

A Light Intensity Resistor (LDR) is a component that has a (variable) resistance that changes with the light intensity that falls upon it and LDR is are also called photoresistor. This allows them to be used in light sensing circuits.

E. Gas Sensor (MQ2)

Gas Sensor (MQ2) is used for spotting gas leakage in an environment.

F. Fan

This serves as the coolant for the Greenhouse monitoring and control system.

G. LED

They serve as an indicator of the Greenhouse monitoring control system.

VI. SYSTEM IMPLEMENTATION

In respect to the implementation, the input devices which are the sensors, and the output devices which are the actuators were all connected to the microcontroller in order to be able to monitor and control the greenhouse effect. In detail, the actuators respond to fluctuations (Increase/decrease of the set threshold for temperature, humidity, light intensity, and CO2 level) of the environment variables in the greenhouse environment. For example, the fan serves as the actuator for controlling the temperature and humidity level of the greenhouse environment, Light bulb for light intensity and for CO2.

Fig 3. System Implementation

VII. SYSTEM TESTING AND RESULT

The greenhouse's temperature, humidity, moisture, alcohol and gas level could all be tracked by the greenhouse's monitoring and control system. Based on the various changes in the environment, the various sensors were able to initiate an actuator. The best outcome is to facilitate small-scale farmers' con- venience and ease of plant growth. A greenhouse's low price is important to some consumers, but it is difficult to achieve due to the numerous modern technologies required. The high initial capital cost, on the other hand, has the potential to save more money in the long run while also conserving the environment if we look at the bigger picture. The goal of the green- house monitoring system is to stabilize the conditions if the environmental parameters are detected and monitored by the sensor. Based on the sensor input, actuators are used to control the parameters. It can be done manually or automatically. The actuators are controlled by the user in manual mode using SMS inputs, which are not implemented in our project. The actuators are controlled in automatic mode using a database of previous events.

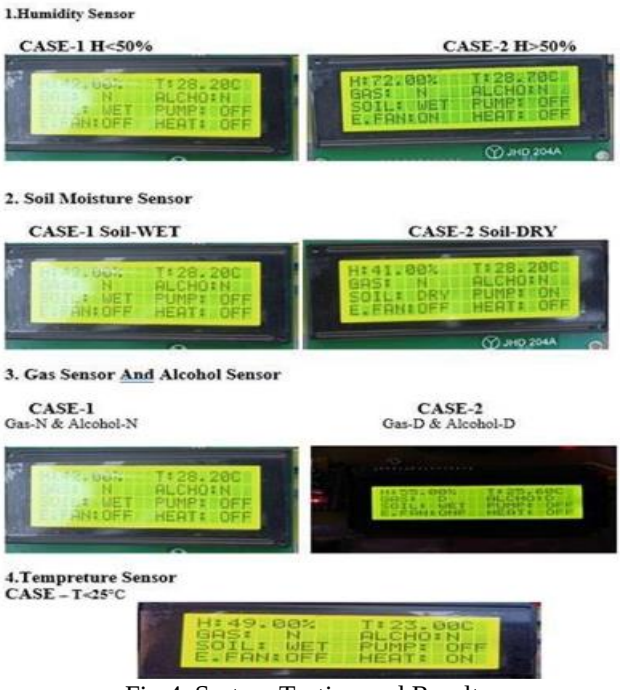

Fig 4. System Testing and Results

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SR.NO.	ACTUATOR SENSORS	CONDITION	ACTION TAKEN
1.	Humidity Sensor	1.H > 50% 2.H < 50%	1.If the Greenhouse Humidity is Greater Than 70% Then the System Taken Action By Turning ON Exhaust Fan. 2. If the Greenhouse Humidity is Less Than 70% Then the System Taken Action By Turning OFF Exhaust Fan.
2.	Temperature Sensor	1. T > 25°C 2. T < 25°C	1.If the Greenhouse Temperature is Greater Than 24°C. Then the System Taken Action By Turning OFF Heating Bulb. 2. If the Greenhouse Temperature is Less Than 24°C. Then the System Taken Action By Turning ON Heating Bulb.
3.	Soil Moisture Sensor	1.Soil - WET 2.Soil -DRY	1.If The Soil Moisture is WET which will be Indicating on LCD Display Then The Water Pump is OFF. 2. If The Soil Moisture is DRY which will be Indicating on LCD Display Then The Water Pump is ON.
4.	Gas Sensor And Alcohol Sensor	1.Gas-N Alcohol-N 2. Gas-D Alcohol-D	1.If Gas is Not Detected in The Greenhouse Which is Harmful to The Crops Then The Exhaust Fan is Turn Off. 2.If Gases is Detected in The Greenhouse Which is Display on The LCD Display, Then The Exhaust Fan is Turn Off.

Fig 5. Result

VIII. CONCLUSION

The fact that Smart Greenhouse was able to produce crops without the use of pesticides or insecticides, create a climate conducive to plant growth, and even provide an alternative means of income through agriculture, such as selling tube well water, is what sets Smart Greenhouse apart from conventional farming.

In addition, anyone without prior farming experience can in- stall this rooftop greenhouse system in his home. It is possible to cultivate any kind of crop in this kind of greenhouse be- because it can keep any kind of climate. We are able to produce 70% to 80% of our water requirements. Organic products are produced as well as the yield and growth rate are both in- creased. Most importantly, we can use lot to connect farmers directly with consumers, keeping farmers out of the hands of middlemen. It makes farming more profitable and efficient while also reducing farmer effort and time.

REFERENCES

[1]. Jeyashree.K1 and C. G. , "monitor and control of environment for greenhouse using sensor networks," international Journal of Advanced Research in Electronics and Communication Engineering(IJARECE), vol. 5, p. 5, march 2016 2016.

[2]. R. H. Hussain, A. F. Marhoon, and M. T. Rashid,"Wireless monitor and con- trol system for greenhouse," International Journal of Computer Science and Mobile Computing, vol. 2, pp. 69-87, 2013.

[3]. Al-Adwan and M. S. Al-D, "The use of zigbee wireless network for monitor- ing and controlling greenhouse climate," International Journal of Engineering and Advanced Technology (IJEAT), vol. 2, pp. 35-39, 2012.

[4]. J. J. Zhou, X. F. Wang, X. Wang, W. Zou, and J. C. Cai, "Greenhouse monitor- ing and control system based on zigbee," in Applied Mechanics and Materi- als, 2013, pp. 768-771.

[5]. G. Qiang and C. Ming, "Research and design of web-based wireless sensor network management system for greenhouse," in Computer and Electrical Engineering, 2008. ICCEE 2008.International Conference on, 2008, pp. 657-661.

[6]. K. Rangan and T. Vigneswaran, "An embedded systems approach to monitor green house," in Recent Advances in Space Technology Services and Climate Change (RSTSCC), 2010, 2010, pp. 61-65.

[7]. Gaikwad, A. Ghatge, H. Kumar, and K.Mudliar, "Monitoring of Smart Greenhouse," 2016.

[8]. M. Mahdavian, M. B. Poudeh and N. Wattanapongsakorn, "Greenhouse Lighting Optimization for Tomato Cultivation considering Real-Time Pricing (RTP) of Electricity in the Smart Grid," in IEEE 2013 10th International Confer- ence on Electrical Engineering/Electronics,