JSS MAHAVIDYAPEETHA
SRI JAYACHAMARAJENDRA COLLEGE OF ENGINEERING
MYSURU-570006

“AUTOMATED IRRIGATION SYSTEM”

SUBMITTED BY

GOWTHAM B YADAV - 4JC14EC035

GUNACHANDAN P - 4JC14EC036

H M GAURAV- 4JC14EC037

SUBMITTED TO

MR.SHIVAPRASAD N
MRS.ANITHA S PRASAD

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

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CHAPTER 1

INTRODUCTION

Agriculture uses 85 % of available freshwater resources worldwide, and this percentage will continue to be dominant in water consumption because of population growth and increased food demand. There is an urgent need to create strategies based on science and technology for sustainable use of water, including technical, agronomic, managerial, and institutional improvements. There are many systems to achieve water savings in various crops, from basic ones to more technologically advanced ones. For instance, in one system plant water status was monitored and irrigation scheduled based on canopy temperature distribution of the plant, which was acquired with thermal imaging. Irrigation systems can also be automated through information on volumetric water content of soil, using dielectric moisture sensors to control actuators and save water, instead of a predetermined irrigation schedule at a particular time of the day and with a specific duration.
A greenhouse is an exceptionally outlined homestead structure building to give a more controllable environment to better harvest generation, crop security, product seeding and transplanting. Also, the accessible space of area for developing yields has been altogether diminishing, following to more space of area is vigorously utilized for housing and commercial ventures as a part of this present day period. In most tropical nations, the utilization of greenhouse has been developed for cost effective farming i.e. organic products, new blossoms and vegetables generation. The effectiveness of plant creation inside greenhouse depends fundamentally on the conformity of ideal atmosphere development conditions to attain to high return at low cost, great quality and low natural burden. To attain to these objectives a few parameters, for example, light, temperature and humidity, soil moisture must be controlled ideally given certain criteria through warming, lighting, ventilation and water creation. Persistent checking and controlling of these ecological variables gives significant data relating to the individual impacts of the different elements towards acquiring most extreme harvest creation. Greenhouse situations present remarkable difficulties to great control. Temperature changes happen quickly and fluctuate broadly relying upon sun powered radiation levels, outside temperatures and moistness levels in the greenhouse. Poor light intensity and high stickiness frequently bring about poor natural product set and quality. More exact control can decrease heating fuel and electrical expenses, expand the efficiency of laborers by empowering them to go to more important assignments, empowering directors and producers to settle on better administration choices and invest more energy dealing with the procedure. Today, programmed control frameworks are the standard for advanced greenhouse, with proceeded with changes as the innovation forces. Environment conditions can be kept up by these programmed control frameworks, where the framework can be worked consequently. The principle parts of any control framework are estimation controller, information preparing, information securing, information presentation and recording. In nature control framework, every parameter must be kept up incessantly inside a certain reach. Be that as it may, no such models yet exist for business greenhouse cultivation. In the agrarian area, particularly creating nations, the use of the earth control innovation is still constrained,

basically on account of its high cost. Hence, a supportable improvement of natural observing and control framework for escalated greenhouse generation is inescapable. In this thesis, we have proposed a framework that can gather the data identified with greenhouse environment and yield status and control the greenhouse consequently in view of the gathered data to foresee and follow up on circumstances for splendidly controlled climatic 9 conditions. By thickly observing climatic conditions, this exploration has the reason for making relationship between sensors flags and reference estimations, breaking down the development, advancement of yields and the natural variables to which they are uncovered. Moreover, control programming will give information procurement and control, genuine time graphical show, dates and time labels the data and stores it for present or later utilize. Also, by consistently observing various natural variables without a moment's delay, an agriculturist has the capacity see how development conditions are fluctuating, and respond to those progressions with a specific end goal to expand effectiveness.

1.1 OBJECTIVE

In this work, we have proposed a framework that can gather the data identified with greenhouse environment and yield status and control the system automatically in view of the gathered data. By theoretically observing periodic conditions, this study has the reason for securing connection between sensors flags and reference estimations. Control programming will give information finding of ongoing show. Through long time running and functional utilizing, the framework has been demonstrated that it has numerous points of interest. To monitor the environment inside greenhouse different parameters have been considered such as temperature, humidity, soil moisture, water level etc. using different sensors like DHT11 temperature and humidity Sensor, grove-moisture sensor etc. which will be interfaced with microcontroller. It is a closed loop system that will execute control action to adjust temperature, humidity and soil moisture if any unwanted errors (high/low) occur.

1.2 BACKGROUND

A greenhouse is a structure with a glass or plastic roof and frequently glass or plastic walls; it heats up because incoming solar radiation from the sun warms plants, soil, and other things inside the building. In other word, a greenhouse is a structure usually made of glass or clear plastic that provides protection and a controlled environment for raising plants indoors. Water is the most important element in our life. Without it, we cannot survive. As we know, most of the gardener uses manual system to water their plant in the garden and also in the greenhouse. This system is inefficient. When we water manually, the possibility to over watering is high. Some plant can drown when we supply too much water to them.

In order to overcome this problem, automatic greenhouse watering system is used. Sensors such as temperature sensor and soil moisture detector are used to control the watering system in a greenhouse. The system also has the capability to control the water level. As we know, some parts of India sometimes faces drought problem. So, there will be a tank that will act as a reservoir tank in case of water problem. In this tank, there is a sensor to ensure the water level is always at its maximum level.

1.3 PROBLEM STATEMENT

Irrigation is the most important cultural practice and most labor intensive task in daily greenhouse operation. Knowing when and how much to water is two important aspects of irrigation. To do this automatically, sensors and methods are available to determine when plants may need water.

1.4 ORGANIZATION OF REPORT

Chapter one gives the introduction to the project which includes objective ,problem statment.The second chapter is all about the literature survey.The third chapter is all about design and working.Next chapter tells about the hardware specifications ,major specifications neeeded for proper working.The fifth chapter gives details about the working and analysis.Next chapter tells us about the feasibility of the project and in the final chapter,it contains all the references used to complete this project.

CHAPTER 2

LITERATURE SURVEY

" *The development of models and strategies to control the environment of greenhouse crops started with the shoot environment, that is, with the greenhouse climate. One important reason was that influencing variables such as temperature, humidity, irradiation or CO2 concentration are easier to measure and to control.* " [Hans Peter Klaring, 2000]

From this research, we can see that there are a few factors that need to be control in a greenhouse. Those factors that need to be considered are temperature, humidity, irradiation or carbon dioxide concentration. But, in this project, factors that are going to be considered are soil moisture, temperature and humidity in a greenhouse.

- The implementation is electricity powered automated irrigation system that consists of a distributed wireless network of soil moisture and temperature sensors deployed in plant root zones.

- This model has a solar energy backup along with battery in case of lack of electric supply.

- Each sensor node involved a soil-moisture probe, a temperature probe, a microcontroller for data acquisition.

- The sensor measurements are transmitted to a microcontroller-based receiver. This gateway permits the automated activation of irrigation when the threshold values of soil moisture and temperature are reached; Keeping in mind that the water present in the tank is adequate for irrigation.

CHAPTER 3

DESIGN

3.1 BLOCK DIAGRAM AND WORKING

The proposed model for smart irrigation system is based on microcontroller. With the use Arduino development kit (UNO R3 ATmega328P), the sensors collect the data from the environment viz. humidity, temperature, soil moisture content (resistance) also the water level in the tank. This information is sent to the microcontroller.

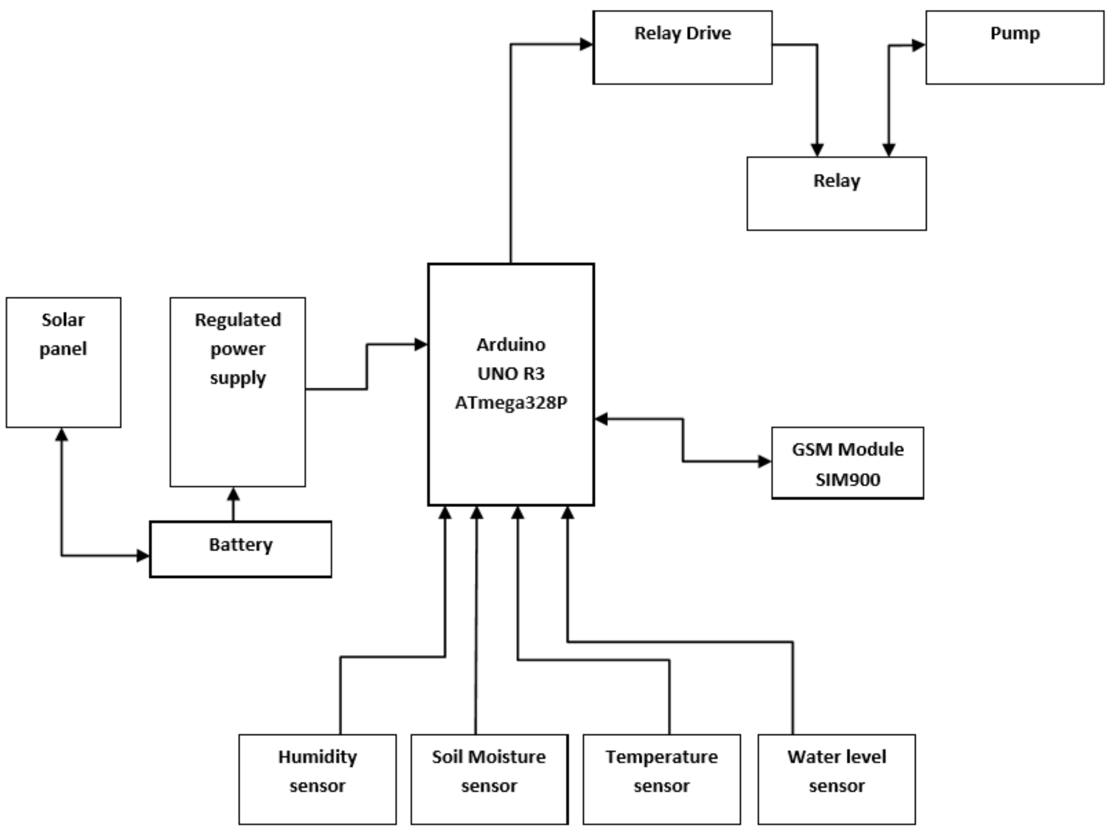


Figure 1: Block diagram of the proposed model

3.2 WORKING

The circuit works with a regulated power supply but in case of emergency the circuit has a backup of solar energy and a battery backup, provided that even the water pump has the supply.
GSM module is interfaced with the circuit to provide communication between the user and the interface so that a smooth operation can be performed.
Based on the information collected from the sensors the microcontroller sends the signal to the user to control the switch of the motor. But if the data collected is well above the threshold values i.e., if the soil is fully dried up and require immediate attention the circuit takes full control of itself overriding the user call, so that the pump starts on its own to irrigate the area ensuring that the area is well irrigated .

The circuit involves various relay and relay drives which are linked to the water pump for proper switching of the model.
With the increased demand for supply of water proper usage has to be monitored. So making use of these types of techniques can control the usage of water resources.
This prototype model which is developed can be implemented to a small area. Golf courses and other sports court where a strict irrigation of water is monitored for proper growth of grass.

CHAPTER 4

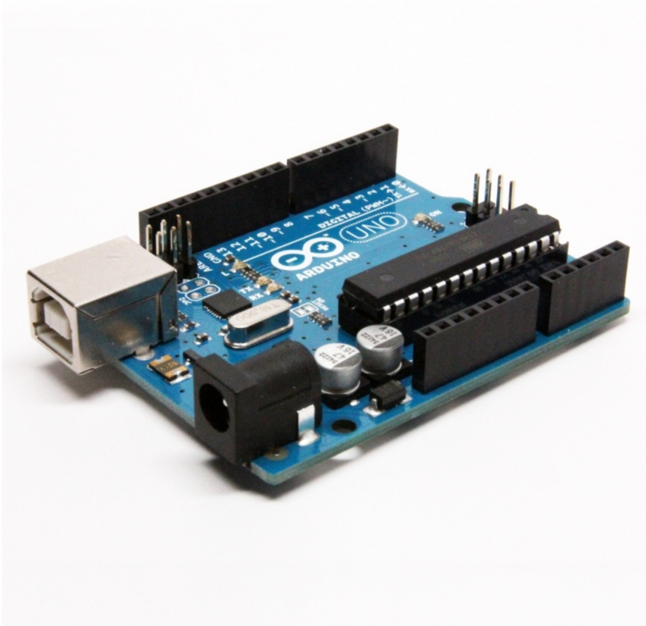
HARDWARE SPECIFICATIONS

Hardware Requirements

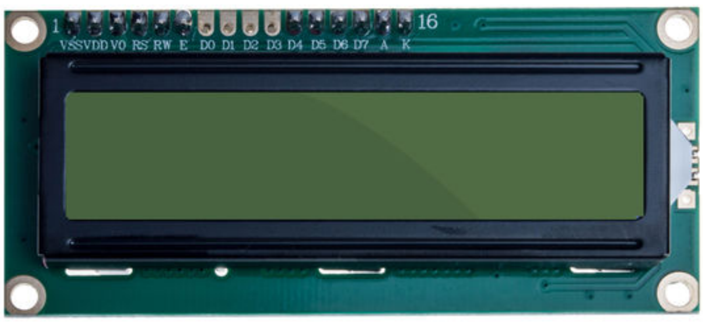
1) Arduino UNO R3 ATmega328P
2) Soil Moisture Sensors(LM393)
3) Humidity and temperature sensors(DH11)
4) Water level sensor
5) Alphanumeric LCD Display Backlit 16X2 (JHD162A)
6) GSM Module (SIM900)
7) General purpose PCB
8) Regulated power supply
9) Battery
10) Solar panel
11) Relay & Relay drive (ULN2003)
12) Water pump
13) Resistors, Capacitors, potentiometers

4.1 Arduino Development kit (Uno R3 ATmega328P):-

Arduino is a situated of advancement sheets that accompany pretested equipment and programming libraries. That is to say, easy to Arduino board and begin adding to your task immediately.

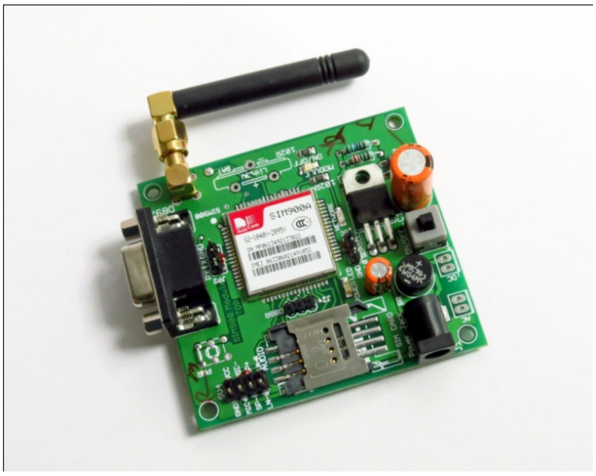


4.2 ALPHANUMERIC LCD DISPLAY BACKLIT 16X2 (JHD162A)



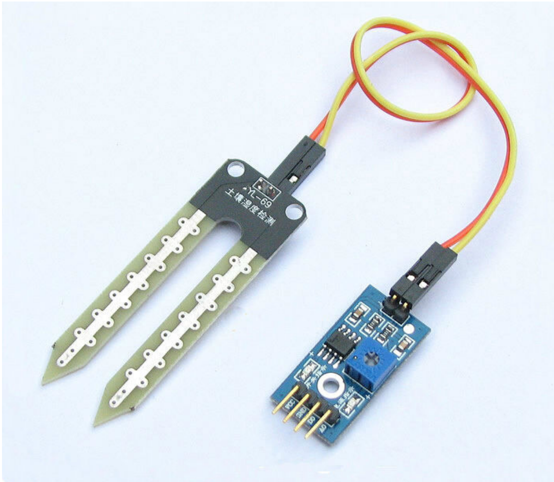
4.3 GSM MODEM MODULE:-

- The SIM900 is a Cellular modem that operates over the GPRS/GSM network.
- It supports both the GPRS packet-switched and the GSM circuit switched data services.
- The Modem delivers performance for Voice, SMS, data fax with low power consumption.



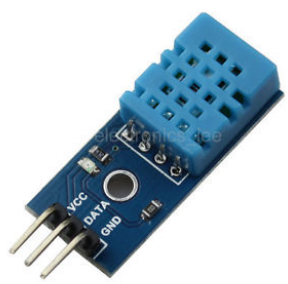
4.4 GROVE SOIL MOISTURE (LM393):-

This Moisture Sensor can be utilized to recognize the dampness of soil or judge if there is water
around the sensor, let the plants inside greenhouse connect for human help. They can be exceptionally to utilize, simply embed it into the dirt and after that read it. With help of this sensor, it will be feasible to make the plant remind: thirsty now, need some water.



4.5 Humidity and Temperature Sensor(DHT11):-

DHT11 Temperature & Humidity Sensor highlights a temperature & stickiness sensor complex with a calibrated digital signal input. By utilizing the selective computerized sign securing system and temperature & dampness sensing innovation, it ensures high reliability and 19 excellent long-term stability. This sensor incorporates a resistive-sort moistness estimation segment and a NTC temperature estimation part, and associate with a high- execution 8-bit microcontroller, offering fabulous quality, quick reaction, hostile to obstruction capacity and expense adequacy.
Each DHT11 component will be entirely balanced in the lab that will be to a great degree exact on dampness adjustment. The adjustment coefficients are put away as projects in the OTP memory, which are utilized by the sensor's inner sign distinguishing methodology. The single-wire serial interface makes framework reconciliation brisk and simple. Its little size, low power utilization and up-to-20 meter signal transmission settling on it the best decision for different applications, including those most requesting ones. The part is 3-pin single line pin bundle. It is advantageous to associate and unique bundles can be given in response to popular demand.



Applying the DHT11 sensor past its working reach expressed in this datasheet can bring about 3 % RH sign movement/error. The DHT11 sensor can improve to the aligned status bit by bit when it returns to the typical working condition and works inside its range. If its not too much trouble make an effort to remain mindful that working the DHT11 sensor in the non-typical working conditions will quicken sensor's maturing procedure. Relative humidity to a great extent relies on upon temperature. In spite of the fact that temperature compensation innovation is utilized to guarantee exact estimation of RH, it is still unequivocally encouraged to keep the dampness and temperature sensors working under the same temperature. DHT11 should to be mounted at the spot quite far from parts that may create heat. Long time presentation to solid daylight and bright may spoil DHT's execution.

4.6 Relay and Relay drive (ULN2003):-

- Relay is an electrically operated switch.

- The board has four relays driven by ULN2003 IC and MCT2E IC for isolation purpose.

- The board works on 12V but the input signal can come directly from microcontroller output working 5V to control relays.

- Each relay can switch varierty of AC or DC high voltage, high current loads working at 110V or 220V AC mains like lights, fans, motors and such. The status of relay is indicated by individual LEDs.
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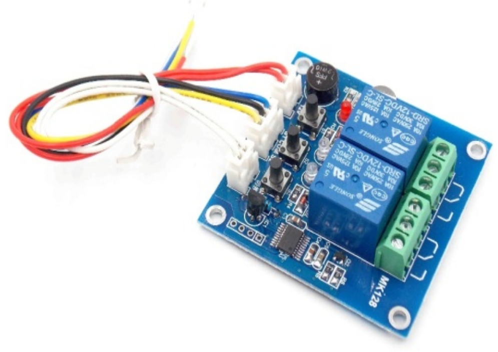

CHAPTER 5

WORKING AND ANALYSIS

5.1 DHT11 TEMPERATURE AND HUMIDITY SENSOR

The sensor builds up a direct voltage versus RH yield that is ratio metric to the supply voltage. That is, the point at which the supply voltage fluctuates, the sensor yield voltage follows in the same extent. It can work over a 4-5.8 supply voltage range. At 5V supply voltage, and room temperature, the yield voltage ranges from 0.8 to 3.9V as the mugginess changes from 0 % to 100 % (noncondensing). The output voltage is converted to temperature by a simple conversion factor. The general equation used to convert output voltage to temperature is:

Temperature (oC) = (Vout * 100) / 5 oC

Sensor output voltages be taken into account according to the formula:

RH = ((Vout / Vsupply) 0.16) /0.0062, typical at 25 ° C

	Condition	Minimum	Typical	Maximum
Power Supply	DC	3V	5V	5.5V
Current Supply	Measuring	0.5mA		2.5mA
	Average	0.2mA		
	Standby	100uA		150uA
Sampling Period	Second	1		

TABLE : Electrical Characteristics

5.2 SOIL MOISTURE (GROVE)

The elementary idea behind using soil moisture sensor to control irrigation is simple: when plants use water, they take it up from the substrate, so the water content of the substrate decreases. Soil water sensors detect these changes and can be used to open an irrigation valve when the substrate water content drops below a user-determined set-point. This results in frequent applications of small amounts of water, and the frequency of irrigation is adjusted automatically based on the rate of substrate water depletion. This irrigation approach automatically replaces water that is used by plants or lost through evaporation and assures that plants are never exposed to drought stress. By irrigating with the amount of water actually needed by the plants, water use and leaching can be reduced greatly. This minimizes pollution without using expensive recycling irrigation systems or large ponds to capture runoff.
Soil condition is very important for plants for a great output. As far as we can see moisture of soil is depending on the water level of the soil. So in this paper we prefer a soil moisture sensor to sense the condition of soil whether it is dry, humid or watery. If the soil condition is dry it is automatically on the servo to on the water supply. When the soil becomes humid it will close the water supply automatically.
The proposed model for smart irrigation system is based on microcontroller. With the use Arduino development kit (UNO R3 ATmega328P), the sensors collect the data from the environment viz. humidity, temperature, soil moisture content (resistance) also the water level in the tank. This information is sent to the microcontroller.
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The circuit involves various relay and relay drives which are linked to the water pump for proper switching of the model.
With the increased demand for supply of water proper usage has to be monitored. So making use of these types of techniques can control the usage of water resources.
This prototype model which is developed is implemented to a small area i.e. greenhouse .

CHAPTER 6

FEASIBILITY OF THE PROJECT

During the development of the project we researched the feasibility in different fields.

HARDWARE: - We chose Arduino microcontroller for movement of data contents and to perform the actions and functions. We used this as it is easy to program and is available everywhere. There are number of sensors available in the build which we chose are capable of sensing the physical environmental factors.

Green House Model: - we choose to make it from hard plywood and wood material which was easily feasible.

EXPENSES: - The project is quite cost efficient. The components are easily available in market. Thus the project is easily affordable.
The model which is build is user friendly as well.

APPLICATIONS

1) By using this project in real time applications we can reduce the wastage of power.
2) No need of human effort to switch ON or OFF the water pump.
3) We used this application in summer seasons by reduce the wastage of water.

CHAPTER 7

RESULT

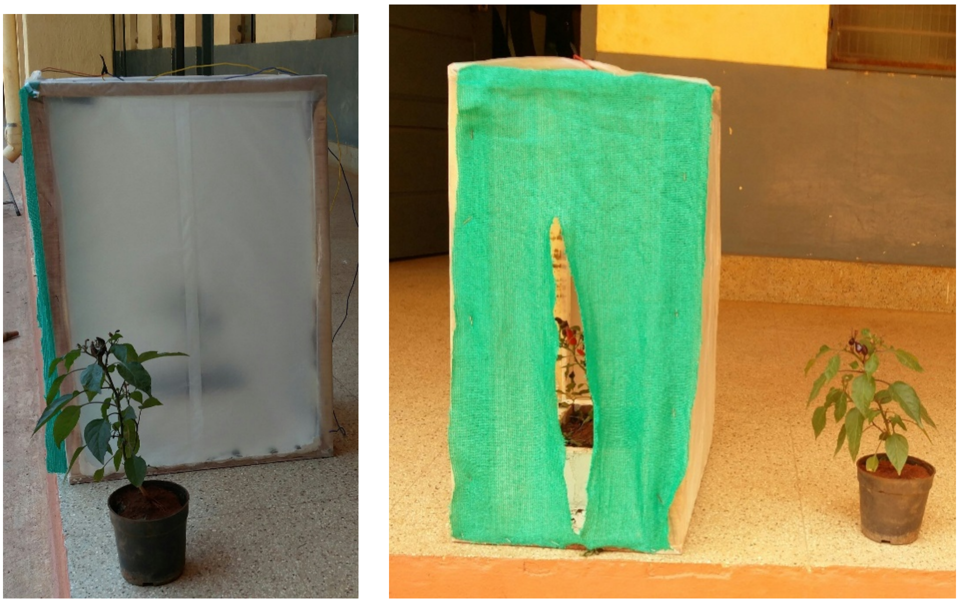

Fig. green house model where plant growth is monitored

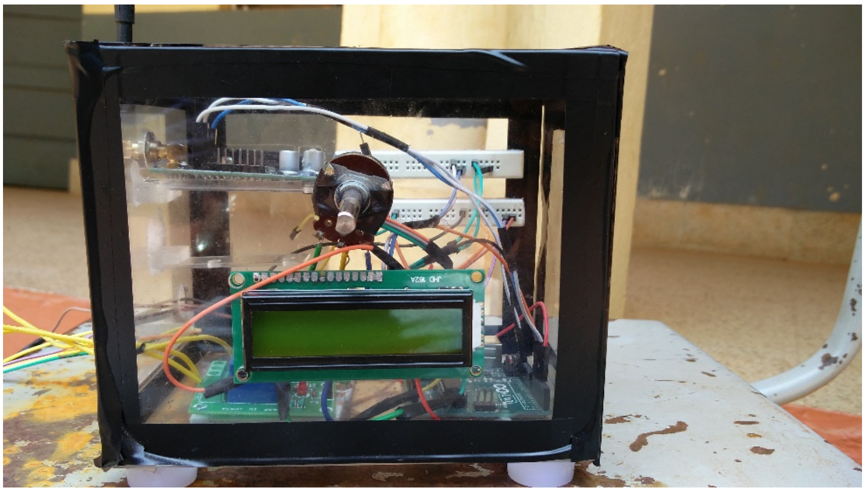

Fig. hardware model of our project

Fig water reservoir where water level sensor and motor is present

Fig. soil moisture and humidity sensor placed in greenhouse

Fig : plant getting irrigated when sensors send interrupts

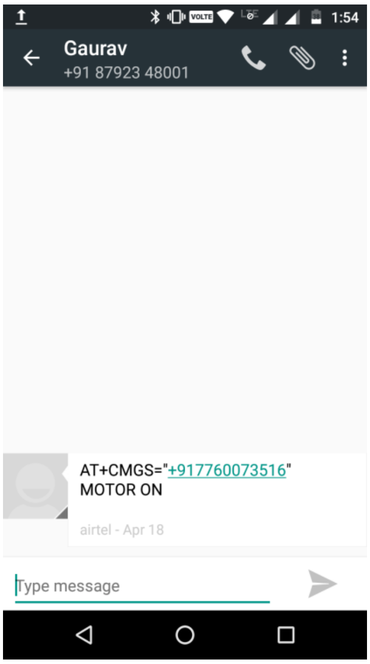

Fig. Message that is sent to the user indicating that the motor is on

CHAPTER 8

CONCLUSION

By the end of the deadline given we have successfully completed our project which we had proposed it earlier. To be confirmed, we have tested our greenhouse project in different places whether it works without any error or not. The framework has effectively overcome very a few inadequacies of the existing frameworks by lessening the force utilization, upkeep and intricacy, in the meantime giving an adaptable and exact manifestation of keeping up nature. Various sensors which are used sensed various parameters that initiated the switching action of motor pump and the temperature controlling fan. Further changes will be made as less costly and more solid sensors are created for utilization in horticultural creation.

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APPENDIX

Arduino Development kit (Uno R3 ATmega328P):-

1) The Arduino Uno is a microcontroller board based on the ATmega328

2) It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

3) Operating Voltage 5V

4) Input Voltage (recommended) 7-12V

5) Digital I/O Pins 14 (of which 6 provide PWM output)

6) Analog Input Pins 6

7) DC Current per I/O Pin - 40 mA

8) DC Current for 3.3V Pin - 50 mA

9) Flash Memory 32 KB (ATmega328) of which 0.5 KB used by boot loader

10) SRAM 2 KB (ATmega328)

11) EEPROM 1 KB (ATmega328) Clock Speed 16 MHz

12) The ATmega328 has 32 KB (with 0.5 KB used for the boot loader). It also has 2 KB of SRAM and 1 KB of EPROM (which can be read and written with the EEPROM library).

LCD DISPLAY BACKLIT 16X2 (JHD162A)

1) Very low power consumption(typically 1ma)

2) Single power supply +5V

3) TTL and CMOS compatible

4) Easily interfaced to 4 or 8-bit microprocessors, CMOS controllers and drivers.

5) Powerful control commands: Display-clear, on/off, shift set function.

DHT11 temperature sensor

TECHNIAL SPECIFICATION

1) Measurement Range 20-90 % RH 0-50 $^{\circ}C$

2) Humidity Accuracy ± 5 % RH

3) Temperature Accuracy ± 2 $^{\circ}C$

4) Resolution 1

5) Package 3 Pin Single Row