### Bachelor’s Degree Report (BSc)

**AUTOMATED IRRIGATION AND MONITORING SYSTEM FOR A GREEN HOUSE**

***A Project Report***

### By

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***BSc Report***

### Project Report submitted in

**Partial fulfillment of the requirements for the Degree of Bachelor of Science in Information Systems**

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## DECLEARATION

We hereby certify that this project carried out by Kamila Abdul and Sekina Ojonoka Baba is a record of our original research work. It has not been presented before in any previous application for a degree except fully acknowledge within this text. References made to published literature have been duly acknowledged.

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Dr Ago Quaye Signature....................................

## DEDICATION

We would like to thank Allah (S.W.T) for seeing us through this really challenging journey. This research is dedicated to our parents for their support and prayers. We would like to appreciate the most loving and supportive parents MR and MRS ABDUL, ENGR and MRS ABDULLAHI BABA for their relentless support towards the success of this project. To our beloved sisters, brother, aunts, and Uncle we thank you for your unending words of encouragement. A very special thanks to Joseph Dalughut, Joshua Atteh and Japhet Danshik your support was highly appreciated as well. To our beloved friends Fauziyah, Zarah, Louisa, Ogadinmma, and Thinnenche we thank you for you constant advice and support in one way or the other.

We pray that the Almighty Allah in his infinite mercy rewards you all and may you all be assisted divinely in your times of need, we could not have done it without you all.

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## ABSTRACT

The aim of this project is to design and construct an automated irrigation and monitoring system for a greenhouse. In this project, we design a system that uses data’s related to a greenhouse environment and yield status to control the designed system for the greenhouse. A greenhouse requires regular monitoring. The current system of irrigation is done manually, which is time consuming, less effective and lead to poor yield. A greenhouse makes it easy to grow crops in an environment where climatic conditions are very adverse. Light, temperature, humidity, soil moisture sensors which will be interfaced with an Arduino microcontroller that will monitor the environment in the greenhouse. The system to be designed will be an automated system for irrigation and monitoring, it will also give the user the option to manually control the system from a web interface.

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# CHAPTER ONE

### INTRODUCTION

Greenhouse is a structure whose wall and roof are made from a transparent glass. A greenhouse allows crops to grow in an environment that produce more yields and crop security. Agriculture is known to play an important role in Nigeria economy. Most of the land that is meant for agricultural uses in Nigeria are now been utilized for housing, oil drilling and commercial use. There are less farm lands for farming but the greenhouse technology can be used as another option for planting. The use of greenhouse technology has allowed planting of crops in an environment that increase crop yield no matter the adverse climatic conditions. Green house technology is a way of providing favorable environmental condition for crops. In a greenhouse crops are protected from disease, cold, pest and excessive radiation. Green house is the modern way of practicing cost effective farming e.g. organic product and vegetable generation. The growth of plants in a greenhouse greatly depends on the conformity of the ideal atmosphere development condition the objective is attain a high yield at a lower cost and less labour. Parameters such as soil moisture, temperature and humidity and light most be put into consideration, there is a need to control this parameter using certain criteria’s such as water creation (soil moisture) and warming (temperature and humidity). These variables need to be monitored and controlled for great yield. There is a constant change in temperature; these changes affect the moistness level in the greenhouse thereby, affecting the growth of the crops. Poor light intensity also leads to poor quality of the crops. Water also has an important role to play in the development of all living things. Therefore, it is important to conserve water for generations to come. Agricultural activities require the use of a lot of water. Most time substantial amounts of water are wasted on agricultural activities. This project solves the problem of wastage of water by creating an automated irrigation system, this system help

minimize water wastage and human labour but improving the plant yield. This scope of this project focuses on just designing an automated irrigation system for a greenhouse.

Programmed systems are now designed for greenhouse, with the constant changes in the technology world. Most environmental conditions can now be controlled with these programmed systems where the systems can now be updated consequently. The main principle of a system is to collect information, process information and information security. The system need to work based on the information provided by the user. In this project we need to collect information related to a greenhouse environment and control the greenhouse based on the information collected (MAMTA och S.S.BELSARE).

The main challenge faced by the modern way of agriculture focuses on how to improve plant growth and reduce cost. This challenge can be used to justify the development of automated irrigation system which will reduce labour, minimize the wastage of water and giver the farmer better opportunity to monitor the farm.

### Background

Nigeria a country with a population of over one hundred and eighty million people and estimated to be the second country in the world with the largest population in the year 2020. Both the economic development and people depend on oil production for national income. The state of the current economic situation is poor because of the lack of oil production in the country. The country is at the peak of economic destruction; there is a need to for both the country and people to focus on agriculture (Olulope och Etumnu).

Agriculture is said to play an important role in the development of a developing country such as Nigeria. Nigeria has a lot land that is now been used for commercial uses not for agricultural activity. The country start encouraging and developing the agricultural system, the economy will improve. Other countries are now using IoT (Internet of Things) for development. Nigeria can also global by going smart using the IoT. Due, to the lack of farm land farmers can use green house to grow fresh and quality crops like tomatoes. A state like Adamawa where the weather condition is too harsh to grow crops like tomatoes farmers can use the green house to grow their crops or vegetables. According to reports on agricultural contribution to the economy it states that agriculture provides forty-five percent of gross domestic product (GDP) in the country (Farms). To improve agriculture and increase food production in the country the country needs to go greenhouse. Greenhouse yields good crop growth. The greenhouse allows light access and light is consumed by the crops in the greenhouse.

### Problem Statement

Plant irrigation is quite difficult and time consuming for a lot people especially working class people. Irrigation for greenhouse requires a reasonable amount of time because the crops growing in a greenhouse are special crops that require specific temperature, humidity and soil moisture such as tomatoes, strawberries and pepper. The automated irrigation and monitoring system reduces the amount of time required to water the plants.

Irrigation of plant is very important in the greenhouse, the automated system solve the problem of irrigation There will be less human labour, wastage of water and poor growth of plants. This system is guaranteed to improve the growth of the plants and increase yield.

### Objective of the project

The main objective of this project is to design an automated irrigation and monitoring system for a green house. In which water is used more efficiently and reduce the cost labour. The user of the system has access to control the system manually or automatically. He can also view the greenhouse using the raspberry pi camera.

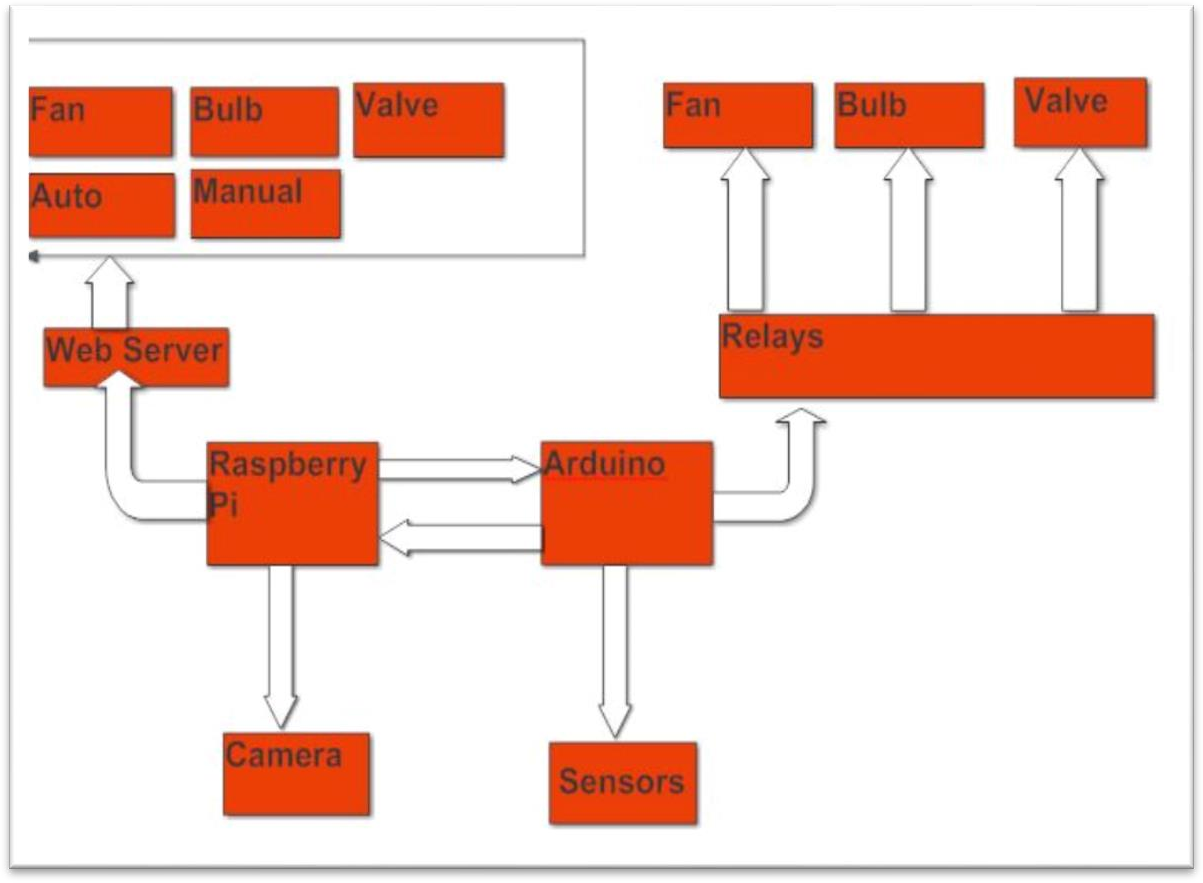
For the system to be implemented the following is needed to be put into consideration;

* + - Maintenance of the system
    - Power supply
    - Expandability
    - Installation cost
    - Water supply

The user need to think of the cost of maintenance of the system, the system needs to be maintained, the system is a very simple system but the cost of installation might quiet high for some people considering the economic situation. There have to be regular water and power supply for the system to work. The system for now will be implemented in a small green house they should be possibility of implementing the system in a large scale that can be investigated.

# CHAPTER TWO

### Overview of the system



**Figure 2-1 A Block Diagram of the system**

### Technologies used

* + - Arduino Uno
    - 4 channel Relay Module
    - Raspberry Pi
    - Humidity sensor
    - Temperature sensor
    - Soil moisture sensor
    - Fan
    - Pump
    - Socket
    - Raspberry Camera
    - Light Bulb
    - Electric wire
    - Solenoid Valve

#### Raspberry Pi

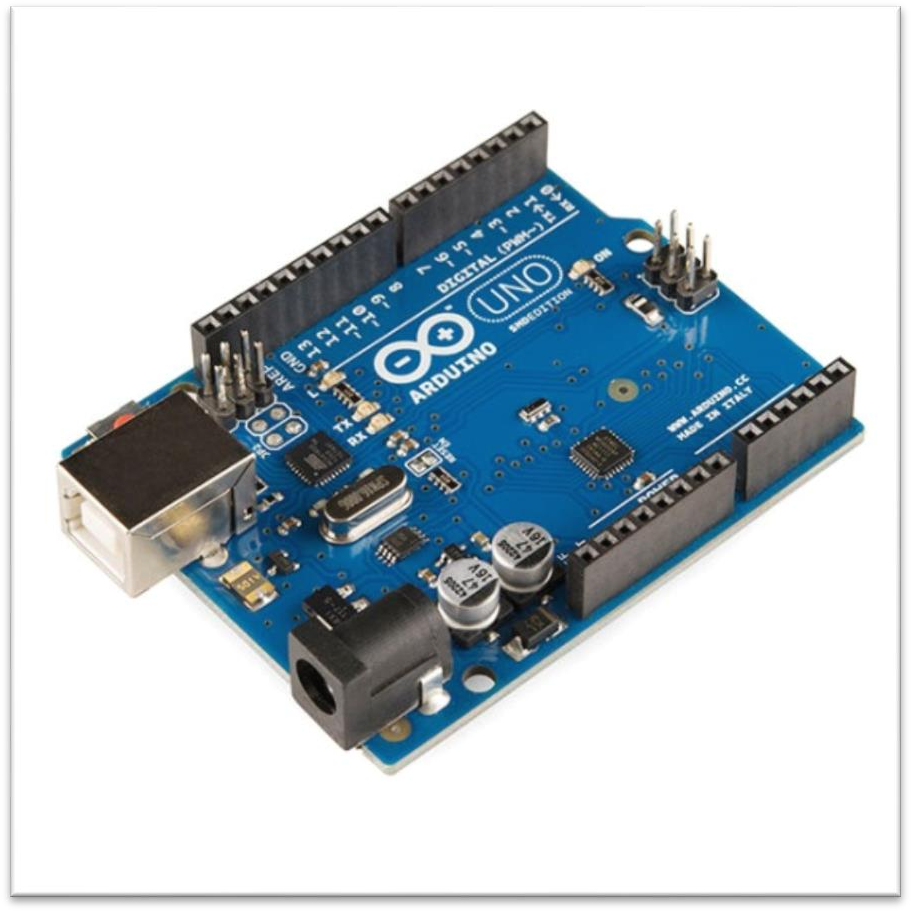
The raspberry pi is single board computer, that can be plugged into a computer or tv to be powered on. It can be used for electronic projects. And it does the work of a computer. To use the raspberry pi you need to install the Raspbian operating system to use the raspberry pi. It can be used with an Arduino for electronic project; it is also an open hardware.



**Figure 2-2 Raspberry Pi**

#### Arduino uno

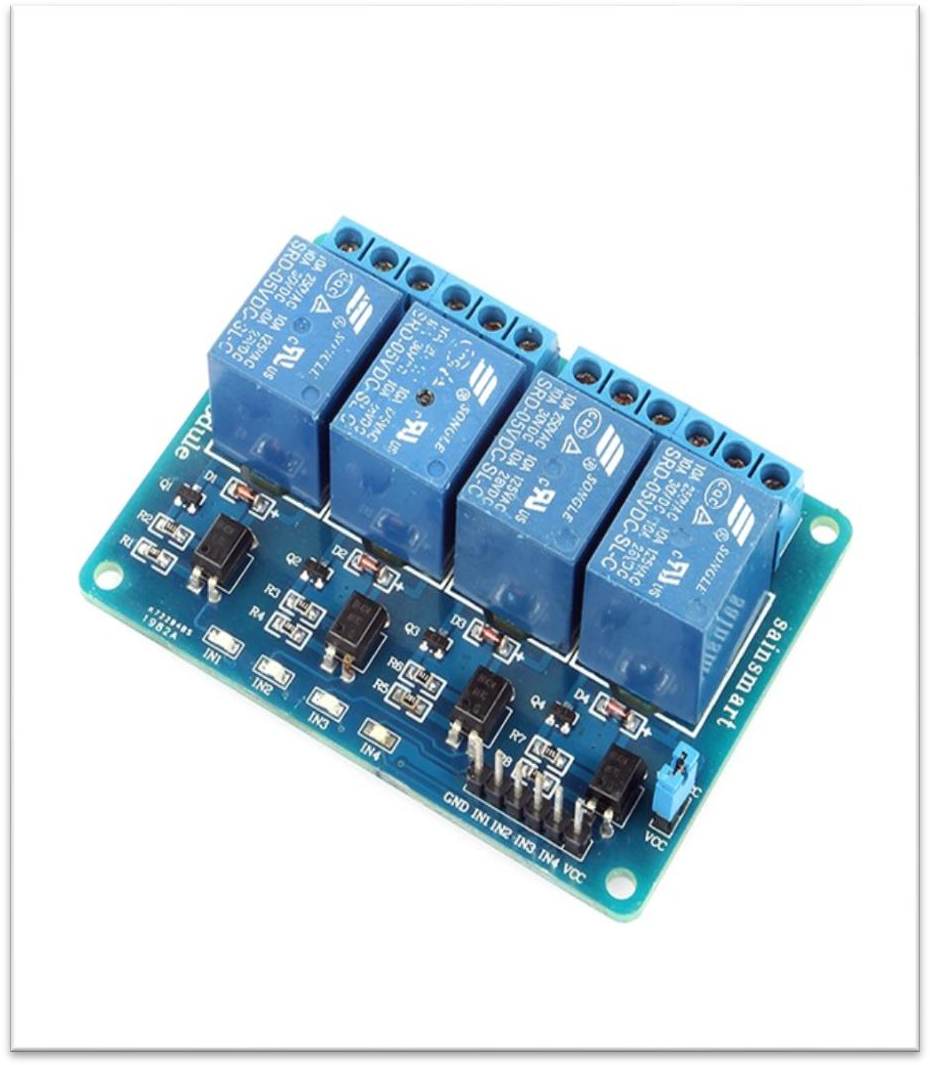
Arduino uno is a microcontroller board that consist of pin (the pins are total of 14) which are digital output/input pins of which six can be used as PWM outputs. It has six analog inputs, a USB connection, and a power jack that uses type A/B cable, an ICSP header and 16 MHz quartz crystal. In this project we used an Arduino IDE to write code and push them . [below](#_bookmark12) is a figure of [An Arduino Uno](#_bookmark13)



**Figure 2-****3 An Arduino Uno**

#### 4-Relay Module

The 4 relay module is particularly used with the microcontrollers such as Arduino uno and Raspberry pi. It is has the capability of serving as switch for turning on/off of devices that are connected to it such as water pump, light bulb and fan. Relay module is made up of a GND, VCC and four INPUT Pin. For the relay to switch on7off appliances it needs a jumper wires connecting from the Arduino to the relay module. It has the normally closed and normally opened. Power is usually supplied to relay via VCC pin (C 1-2).



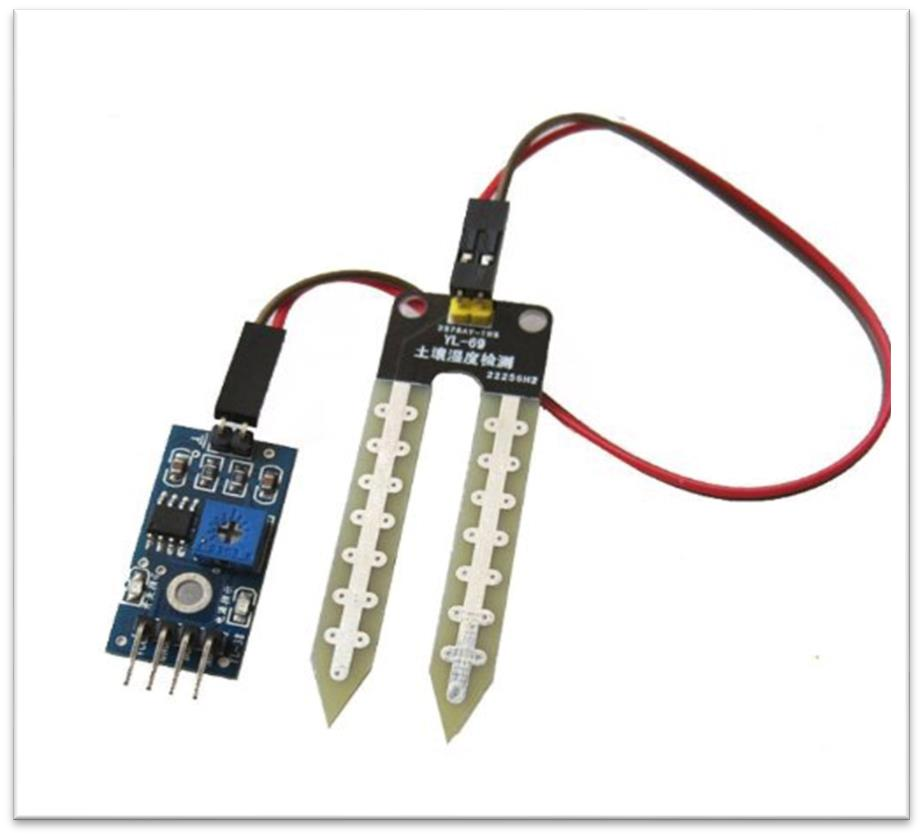
**Figure 4 4-Relay module**

# CHAPTER THREE

### SENSORS

### Soil Moisture Sensor

In this project the soil moisture sensor was used to measure the content of water in the soil, if the soil detect that the soil is dry it turns on the water valve for irrigation but if the soil is wet the system triggers the water valve off. The soil moisture sensor is made up of a probe that can measure the content of the water (volume); this enables current to pass through the sensor to measurement of the moisture value. The sensor detect that the soil is wet the soil detects electricity which means low resistance but a dry soil does not detect electricity that means that there is high resistance (Hamza). The soil moisture consist of four pins, it has the GND, VCC and analog and digital pin.



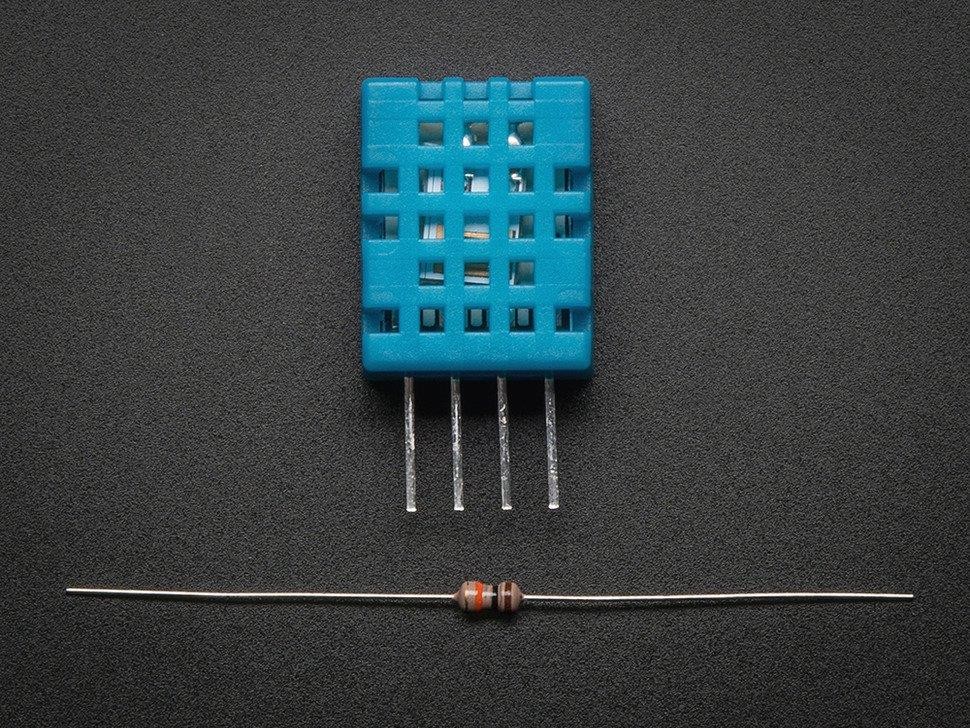
15

**Figure 5 Soil Moisture Sensor**

### Temperature and Humidity Sensor

In this project we used the DHT11 sensor, the purpose of this sensor is to read the change in the temperature of the greenhouse. The greenhouse temperature is high, a message is sent and the fan is turned on. In the code we specified the max temperature, we temperature is at the max temperature the Fan automatically turns on but if it is less than the max temp the fan turns off.

This sensor uses a thermistor to take value of the surrounding air and sends out digital signal to the data pin (Hamza). DHT11 has four pins which include the GND, VCC and the analog/digital pin. This sensor is less expensive, covers small range and has a 3-5v power.

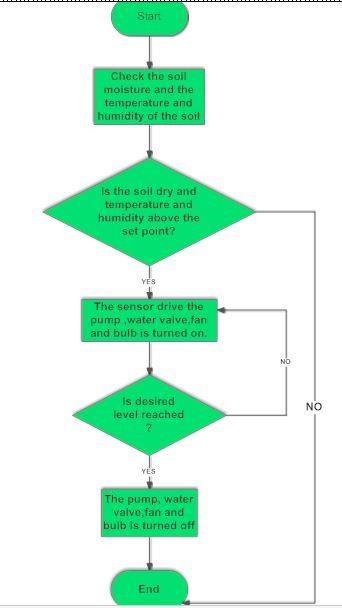
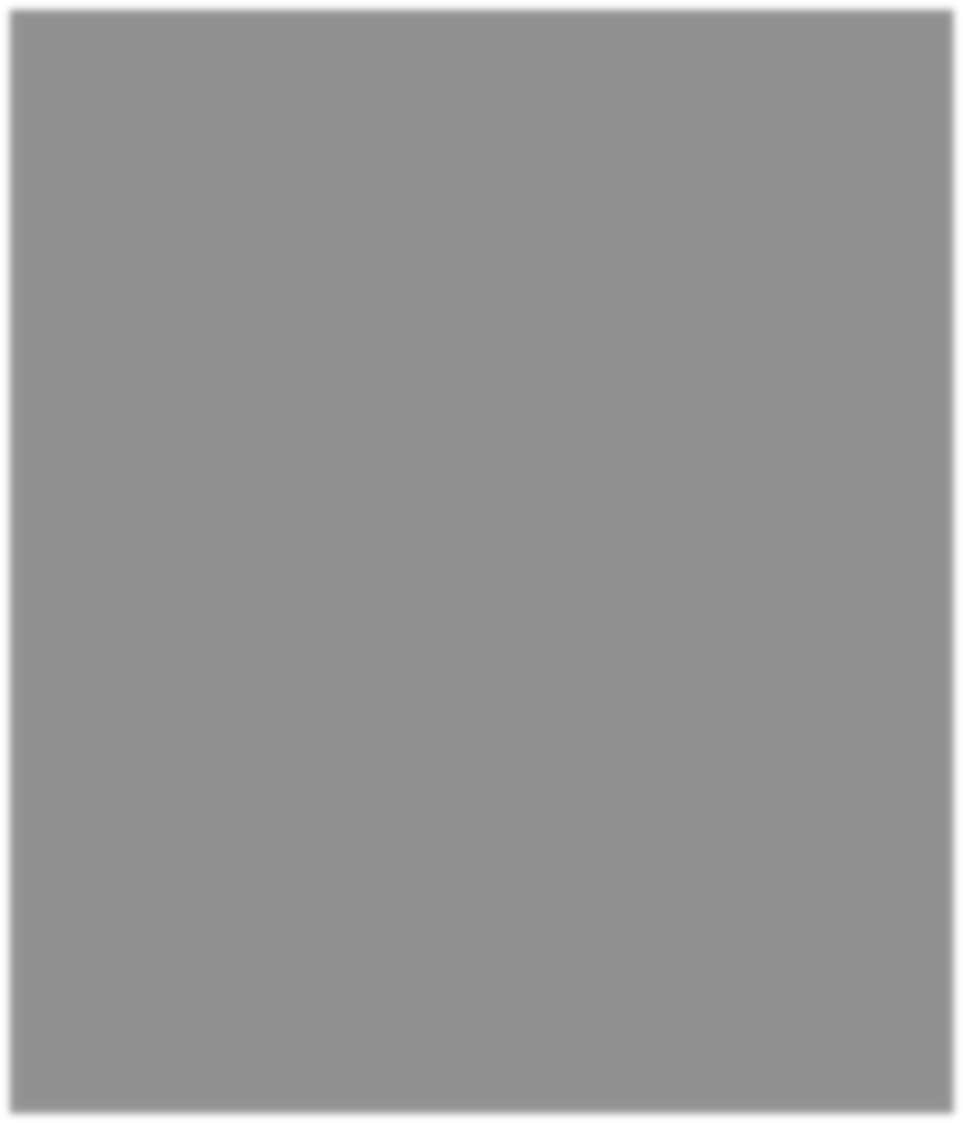


**Figure 6 DHT11 Sensor**

# CHAPTER FOUR

### Analysis

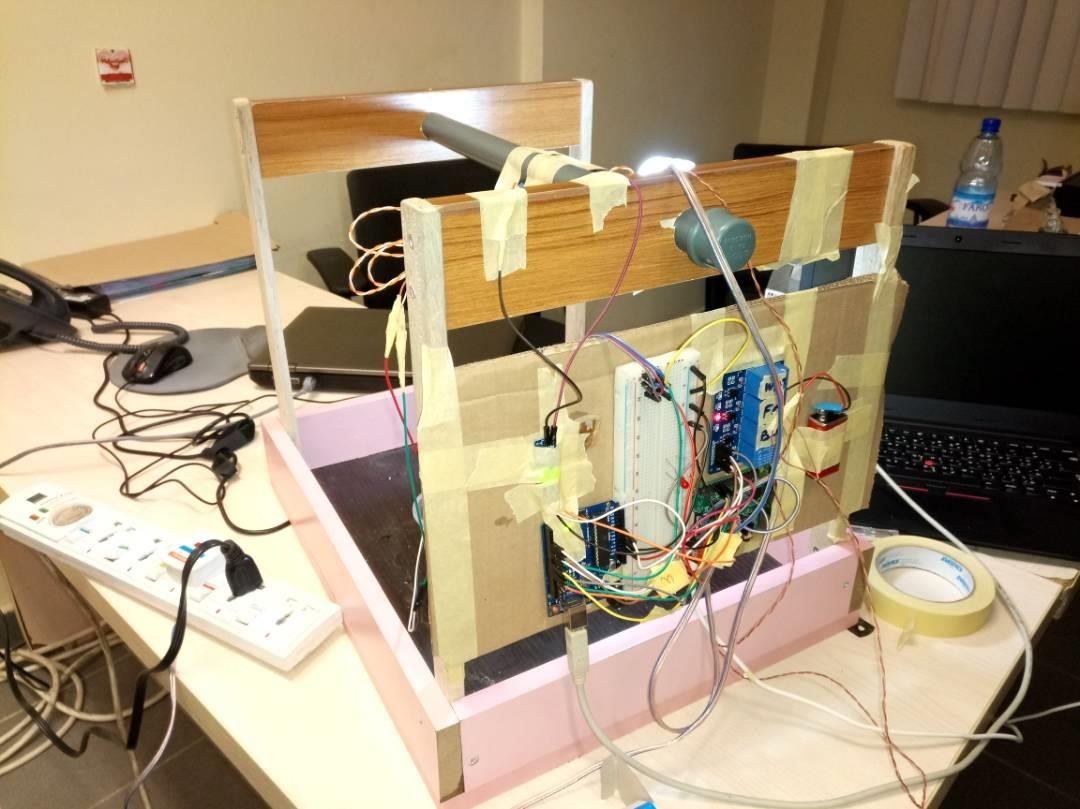
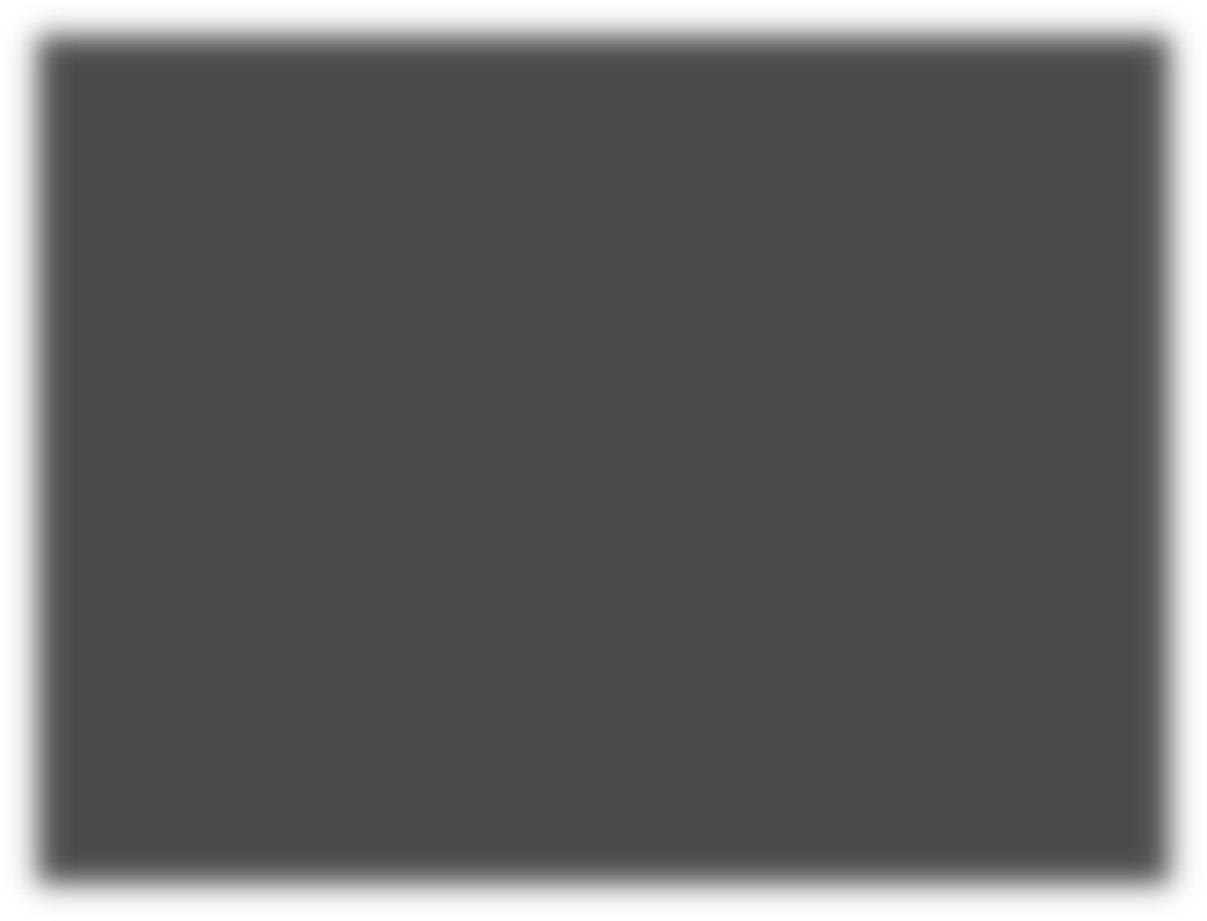
The automated irrigation and monitoring system is working based on system requirement.



**Figure 7 Flow Diagram of the system**

The system works based on two modes 1) the automatic mode 2) the manual mode. The automatic mode work without user interference, the sensors automatically read the soil moisture and temperature value, it automatically turns on the required devices (fan and water valve). The manual mode enables the user of the system to control the system from a web interface. The web interface was created on the raspberry pi, Apache was used as web server, PHP was used to create the web interface and JavaScript was used for the animation to provide interactivity on the website. On the web interface we have power buttons that are can turn on/off the fan, water valve and bulb when in the automatic mode. There is a button that allows the user to change from manual to automatic mode or vice versa. A raspberry pi camera is mounted on the greenhouse to give the user a view of what is happening in the greenhouse.

### Result



**Figure 8 The Automated Irrigation and Monitoring System**

# CHAPTER 5

### CONCLUTION AND RECOMMENDATION

The whole project was a success, the system worked perfectly well. The system worked in a greenhouse, the automated and manual mode can now be used to control what happens in the greenhouse. The user can now monitor the greenhouse with the aid of the raspberry pi camera. The system has been tested; it worked and is error free. To test the system we created small greenhouse with a fan, water valve and bulb in it.

This system will be able to tackle the problem of maintaining and monitoring a greenhouse, because the system is automated. This system will reduce cost of maintain a greenhouse, improve the yield of the crops and saves the time and energy of the owner of the greenhouse. The system can be implemented in a farm land or garden. This project should open a whole new way for the use of IoT in Nigeria and show that there is possibility of using smart technologies. Individuals or government can use this system for their own use because it is more effective. This project can be further expanded with additional features such as automatic fertilizer sprayer in the greenhouse.

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### Appendix

### The code used for the project

#include <DHT.h>

#define PIN\_BULB 3 //io pin for bulb #define PIN\_FAN 4 //io pin for fan #define PIN\_VALVE 5 //io pin for valve

#define PIN\_DHT 6 //io pin for DHT sensor #define DHT\_TYPE DHT22

const int MAX\_TEMP = 28; //change this to your preferred temperature threshold const int MAX\_MOISTURE = 30;

//const int MAX\_HUM = 60;

DHT dht(PIN\_DHT, DHT\_TYPE); //define dht void setup() {

// put your setup code here, to run once:

//set appliance pins to output pin mode pinMode(PIN\_BULB, OUTPUT); pinMode(PIN\_FAN, OUTPUT); pinMode(PIN\_VALVE, OUTPUT);

//switch off all appliances switchOffBulb(); switchOffValve(); switchOffFan();

// dht(PIN\_DHT, DHT\_TYPE);

Serial.begin(9600); //begin serial at baud 9600 dht.begin(); //start dht sensor

}

void loop() {

// put your main code here, to run repeatedly: delay(2000);

checkTemperature(); delay(500); checkMoisture();

}

//checks temperature

void checkTemperature(){

float temp = dht.readTemperature();

// float hum = dht.readHumidity();

if(isnan(temp)){

Serial.println("Failed to read temperature and humidity"); return;

}

//

// Serial.print("Humidity: ");

// Serial.println(hum); Serial.print("Temperature: ");

Serial.print(temp);

Serial.println(" C");

if(temp >= MAX\_TEMP){ switchOnFan();

}else { switchOffFan();

}

// if(hum >= MAX\_HUM){

//

// }

}

void checkMoisture(){

int moistureRaw = analogRead(A0); // 1023 to 0 ===> 0 to 100%

int moistureReal = map(moistureRaw, 1023, 0, 0, 100); Serial.print("Moisture ");

Serial.println(moistureReal);

if (moistureReal <= MAX\_MOISTURE)

{

switchOnValve();

}else{ switchOffValve();

}

}

//call this fucntion to switch on the bulb void switchOnBulb(){ digitalWrite(PIN\_BULB, LOW);

}

//call this function to switch off the bulb void switchOffBulb(){ digitalWrite(PIN\_BULB, HIGH);

}

//call this function to switch on fan void switchOnFan(){ digitalWrite(PIN\_FAN, LOW);

}

//call this function to switch off fan void switchOffFan(){ digitalWrite(PIN\_FAN, HIGH);

}

//call this function to switch on the valve void switchOnValve(){ digitalWrite(PIN\_VALVE, LOW);

}

//call this function to switch off valve void switchOffValve(){ digitalWrite(PIN\_VALVE, HIGH);

}