Automatic Solar Energy Greenhouse Controlling and Monitoring System

Submitted By

Names:	Roll No:
1. Muhammad Yaqoob (Group leader)	19ECE26
2. Abdul Hameed	19ECE32
3. Mujahid Ali	19ECE33
4. Muhammad Ameen	19ECE07
5. Sami Ullah	19ECE15

INTAKE-2019

Supervised By: Engr. Saifullah Memon

Co-supervised by: Engr.Rayees Khan

Department of Electronic Engineering

Balochistan University of Engineering and Technology, Khuzdar

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DEDICATION

It is with the deepest gratitude and warmest affection that we dedicate our project research and thesis to our beloved parents who always pray for us, our teachers who have been a constant source of knowledge and inspiration, and our friends who cooperated with us till its successful completion.

Every difficult task requires both self-effort and the direction of elders, particularly those who were extremely close to our hearts.

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

In the Name of Allāh, the Most Gracious, the Most Merciful

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First and foremost, we must give Allah the glory for giving us this chance and giving us the skills to take use of it. Thanks to the help and direction of many people, this thesis is now available in its current form. Therefore, we sincerely thank every one of them.

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Additionally, I would want to express my gratitude to everyone who has contributed to this project in some way, whether directly or indirectly.

BALOCHISTAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY

KHUZDAR

Certificate

This is to declare that the effort submitted in this final project "**Automatic Solar Energy Greenhouse Controlling and Monitoring System**" is entirely written by the following students under the supervision of Engr. Saifullah Memon and co-supervision of Engr. Rayees Khan

Name.	**Roll No**.
1. Muhammad Yaqoob (Group Leader)	**19ECE26**
2. Abdul Hameed	**19ECE32**
3. Mujahid Ali	**19ECE33**
4. Muhammad Ameen	**19ECE07**
5. **Sami Ullah**	**19ECE15**

This project is submitted in partial fulfillment of the requirement for the award of "Degree of Bachelor of Engineering" in Electronic discipline

Project Supervisor Head of department

Project Title (mention project title here)

Sustainable Development Goals

(Please tick the relevant SDG(s) linked with FYDP)

SDG No	Description of SDG	SDG No	Description of SDG
SDG 1	No Poverty	SDG 9	Industry, Innovation, and Infrastructure
SDG 2	Zero Hunger	SDG 10	Reduced Inequalities
SDG 3	Good Health and Well Being	SDG 11	Sustainable Cities and Communities
SDG 4	Quality Education	SDG 12	Responsible Consumption and Production
SDG 5	Gender Equality	SDG 13	Climate Change
SDG 6	Clean Water and Sanitation	SDG 14	Life Below Water
SDG 7	Affordable and Clean Energy	SDG 15	Life on Land
SDG 8	Decent Work and Economic Growth	SDG 16	Peace, Justice and Strong Institutions
		SDG 17	Partnerships for the Goals

Range of Complex Problem Solving			
	Attribute	**Complex Problem**	
1	Range of conflicting requirements	Involve wide-ranging or conflicting technical, engineering and other issues.	
2	Depth of analysis required	Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models.	
3	Depth of knowledge required	Requires research-based knowledge much of which is at, or informed by, the forefront of the professional discipline and which allows a fundamentals-based, first principles analytical approach.	
4	Familiarity of issues	Involve infrequently encountered issues	
5	Extent of applicable codes	Are outside problems encompassed by standards and codes of practice for professional engineering.	
6	Extent of stakeholder involvement and level of conflicting requirements	Involve diverse groups of stakeholders with widely varying needs.	
7	Consequences	Have significant consequences in a range of contexts.	
8	Interdependence	Are high level problems including many component parts or sub-problems	
Range of Complex Problem Activities			
	Attribute	**Complex Activities**	
1	Range of resources	Involve the use of diverse resources (and for this purpose, resources include people, money, equipment, materials, information and technologies).	
2	Level of interaction	Require resolution of significant problems arising from interactions between wide ranging and conflicting technical, engineering or other issues.	
3	Innovation	Involve creative use of engineering principles and research-based knowledge in novel ways.	
4	Consequences to society and the environment	Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation.	
5	Familiarity	Can extend beyond previous experiences by applying principles-based approaches.	

Table of Contents

DEDICATION ii
ACKNOWLEDGEMENT iv
CHAPTER1 Introduction 1
1.1 Background 1
1.2 Motivation 1
1.3 Benefits 2
1.4 Problem Statement 2
1.5 Objectives 2
CHAPTER2 Literature Review 3
2.1 History 3
2.2 Comparative Analysis 9
CHAPTER3 Green House System 10
3.1 Overview 10
3.2 Greenhouse Gases 11
3.3 Components of Green house 12
3.4 Benefit of Greenhouse 12
CHAPTER4 Methodology 13
4.1Overview 13
4.2 Block Diagram 13
4.3 Flow Chart 14
4.4 Hardware Components 15
4.5 Project Cost 17
4.6 Arduino 17
4.7 Pin Configuration 18
4.8 Photovoltaic Cells 20
4.9 Working of PV Cell 21
4.10 DHT22 Sensor 22
4.11 Soil Moisture 23
4.12 LDR Sensor 24
4.13 Cooling Fan 25

4.14 LCD Screen 26
4.15 Relay Module 27
4.16 12v DC Water Pump 28
4.17 Artificial Light 28
4.18 Battery 29
CHAPTER5 Result And Conclusion 30
5.1 Results 30
5.2 Coding 31
5.2 Data of Sunflower 36
5.3 Sun flower growth stage 38
5.4 CONCLUSION 39
5.5 Recommendation for Future Work 40
CHAPTER6 References 41

List OF Figure

Figure 3.1 Harmful for human health 11
Figure 3.2 Green house environment 12
Figure 4.1 System block diagram 13
Figure 4.2 System Flow Chart 14
Figure 4.3 labeled System 16
Figure 4.4 Labeled System 16
Figure 4.5 Arduino UNO 18
Figure 4.6 Pin diagram 19
Figure 4.7 PV cell module 20
Figure 4.8 Working of PV cell 21
Figure 4.9 DHT22 Sensor 22
Figure 4.10 Soil moisture Sensor 23
Figure 4.11 LCD 27
Figure 4.12 Relay module 27
Figure 4.13 DC water pump 28
Figure 4.14 Artificial light 28
Figure 4.15 Lithium Battery 29
Figure 5.1 Result 30
Figure 5.2 Result 30
Figure 5.3 Sunflower 37
Figure 5.4 sun flower growth stages 38
Figure 5.5 sun flower growing process 39

ABSTRACT

Greenhouse are harmful for the human health but are necessary for the plants growth. Human interaction in greenhouse cause different health issues to the human exposed to greenhouse effects. Our project is to design an automation system to controlling and monitoring greenhouse without exposing off human to greenhouse effects. The proposed model uses Arduino UNO with different sensors to monitor the green house environment. This design system using the automatic solar energy technigues to monitor and control the greenhouse from distance.

The DHT22 temperature and humidity sensor and moisture sensor are the sensors utilized in this system. The Arduino UNO automatically and effectively regulates moisture, temperature and humidity in the greenhouse as the data is received by the activating a drip irrigation pipe and a cooling fan in accordance with the conditons needed by the crops to produce their optimum output. The measerd temperature and humidity are saved in a cloud database, and the findiungs are shown on an application so we can see them right away

CHAPTER1 Introduction

1.1 Background

Greenhouse is usually a glass structure, where temperature humidity and light has controlled automatically for growing plants. Greenhouse environment is beneficial for the growth of plants ut harm full for human health[1].

In today's greenhouses, many parameter measurements are required to monitor and control the good quality and productivity of plants, but to get the desired results there are some very important factors which come into play like Temperature, Humidity, Light and Water, which are necessary for a better plant growth[2].

The Green house is made to keep the plants warm even in cold weather by retaining heat from the sun rays outside. Green house environment is beneficial for the growth of plants but harmful for human health as it may affect different organs of the human body including digestive system and respiratory system. Long term exposure to greenhouse[3].

This system is very efficient for growing good quality plants.

The other important part of this project is that it is fully automatic which we will use controller to automatically turns on and turns off the appliances[4].

1.2 Motivation

Motivation for the design of this project after reviewing the literature and visiting physical greenhouse, we decided to move from manual to fully 'Automatic Solar Energy Green House

Controlling and Monitoring System, which can be easily monitored and automatically controlled. In this project we can control and monitor the environment of greenhouse automatically by using the sensors and controller.

1.3 Benefits

Cost effective – low cost

Most effective in agricultural fields, nurseries and botanical gardens

Low energy consumption

Controlled and monitor the data system automatically

1.4 Problem Statement

This project or research consists of that the farming land is decreasing and the demand of food increasing for growing number of people. Pakistan is experiencing extremely adverse climate conditions which cause poor growth of plants. To solve this issue greenhouse technology build to make healthy food. This project is automated and does not require any human attention.

1.5 Objectives

To design a system that can measure and monitor important parameters like temperature, humidity, light, and water in real-time.

To develop an automated system that can control the above parameters and maintain the desired levels for optimal plant growth.

To increase the quality and productivity of plants grown in greenhouses through the efficient management of the environment.

CHAPTER2 Literature Review

2.1 History

In 2019 Saraswati Shelvane , Madhuri Shedage ,and Akshada phadtare , proposed a greenhouse monitoring using Raspberry Pi platform .They have used Raspberry Pi is the heart of the system which is used for controlling the parameters . Android app is used to display all the value according to Raspberry pi output .The continuous monitoring and controlling of environmental parameter such is temperature ,soil moisture ,light intensity ,humidity, etc are necessary for greenhouse system the main aim of this project is design simple low cost system to monitor the value of environmental parameter and they are continuously updated and controlled in order to achieve optimum plant growth .In Greenhous DHT11 sensor, soil moisture sensor, LDR sensor are the main sensors used in this project which give the exact value of temperature humidity , water content in soil and light intensity respectively Greenhous DHT11 sensor, soil moisture sensor, LDR sensor are the main sensors used in this project which give the exact value of temperature humidity , water content in soil and light intensity respectively .By using IOT we control devices or any environmental needs anytime anywhere.This research focuses on developing a system that can automatically measure and monitor change of temperature light intensity ,humidity and moisture level in greenhouse .The smart greenhouse can be further upgraded in many way and can be used in a wide agriculture application .Smart greenhouse has a blazing scope of future in agriculture field[5]

2020 MD Saif Hannan, Md. Razu Ahmed, Jiabul Hoque, and others proposed an automated greenhouse monitoring and controlling system that uses solar power and sensors. The brains of the system are Arduino, which they have used. In order to cultivate the correct crop in the right soil at the right time, sensors are utilized here to measure the humidity, light intensity, and soil wetness. On the other hand, greenhouse farming refers to a method in which farmers grow crops in ecological settings in which every environmental factor is modified according to the type of crop. With greenhouse automation, farmers may remotely monitor and manage the greenhouse's conditions at any time, from anywhere in the world. Every sensor in the greenhouse is used to gather potential environmental data and integrate the Arduino Uno When a sensor value surpasses a predetermined threshold, the GSM module sends the user an SMS (to store and process data). Through the use of another SMS, the user activates the actuator. Future research is still necessary, though, in order to precisely determine the soil's texture and apply fertilizer [6].

P. Karthikeyan, E. Mohanraj, and P. Prabhu proposed the concept for the Design and Analysis of an Automated Green House Powered by Solar Power. Different kinds of greenhouse systems are used in modern agriculture to produce nutritious crops and lessen the scarcity of fruits and vegetables. Environmental factors like moisture, humidity, and temperature affect how quickly plants grow. By employing solar power, the green house will be able to eliminate all of its drawbacks, including unhealthful seasonal crops and excessive power usage. The PIC microcontroller is responsible for regulating the ideal conditions within the greenhouse system.The system to control greenhouse parameters and achieve desired conditions is put into place. The available sensor devices that are combined with microcontroller boards are highly beneficial [7].

A. Selmani, M. Outanoute, M. El Khayat, M. Guerbaoui, A. Ed-Dahhak, A. Lachhab, and B. Bouchikhi in 2018. Solar-powered autonomous greenhouses Intelligent control systems in greenhouses that promote a comfortable microclimate for plant growth while conserving energy and water resources have been developed through the use of fuzzy logic controls. Modern information technology has led to the development of high-tech greenhouses that priorities indoor environment control. By adapting to changes in the weather, these greenhouses maximize crop growth conditions and the growing season. The system is made up of feedback fuzzy logic controllers that use specialized sensors to log important field parameters and control the relative humidity, soil moisture content, and ambient temperature. A system of fuzzy controls is a fuzzy logic based control system a mathematical framework that employs logical variables with continuous values between 0 and 1 to analyses analogue input values. In actuality, this paper offers a workable method for regulating the interior climate of solar greenhouses that is based on the power-aware design. We suggest a pliable embedded system design that can facilitate key indoor environment parameters to be remotely managed. To regulate the temperature, relative humidity, and soil moisture in a solar greenhouse, an embedded control system is presented. In order to manage and monitor the microclimate and operational resources in the context of a solar greenhouse, we have proposed a novel method for creating an embedded system based on a multithreaded design.

The system's effectiveness was evaluated by displaying notable water and energy savings as well as shielding solar system components from problems caused by dry running. The system will be improved in the following phase so that it can be implemented widely [8].

The most cutting-edge IT technologies are Wireless Sensor Network (WSN) and Internet of Things (IoT) technologies, which offer rapid and distributed data collection and monitoring across a range of industries as well as widespread use. Through a mobile application, the "Microclimate GH" system that was developed enables precise measurements and real-time monitoring of the microclimate of the home mini greenhouse. Monitoring data can be kept on the cloud, where it can be viewed at any time as reports and graphs and analyzed. Three key procedures are being used: lighting, watering, and cooling. The user can quickly and precisely detect microclimate violations and take appropriate action thanks to the results of graphs and histograms analysis the essential actions [.In The ESP32 microcontroller, which has built-in Bluetooth and Wi-Fi modules and a number of advantages over the ESP8266 analogue, is the foundation of this proposed system. The developed system has favorable comparisons with its other prototypes due to its good design and construction, good communication quality, and accessibility for a broad user base[9].

IOT-Based Intelligent Agriculture Greenhouse Environment Monitoring System. These days, The need to find sustainable solutions to manageably conserve natural resources, particularly water resources, and to produce food efficiently and effectively has never been greater due to population growth and climate change. These solutions are also necessary to develop non-extraction-only production systems, control the use of raw materials, and moderate both individual and collective consumption. The greenhouse is the component of this production system that is qualitatively the most significant out of all of the others. In addition to housing the fruits, plants, and air conditioning units, the construction of the crop depends on the type of crop and the requirements for its reproduction based on the climate forecast for the area of interest. figuring out how much electricity it will cost to run it, as shown by the instances where biomass is used, to make power generation from alternative sources a practical and less expensive option [10].

An automated system for monitoring and managing greenhouses that utilises solar power and sensors However, Latin American countries must design and implement specific greenhouse methods, techniques, and technologies to increase crop yields through models to predict the behaviour of the various mechanisms that integrate them and their interactions with the controlled due to differences in technological appropriations, knowledge, and studies developed in the engineering area focused on protected agricultural systems according to situated characteristics[11].

Automated system for greenhouses Many studies in the field of protected agriculture have been conducted since the early 1990s of the 20th century with the goal of suggesting design strategies to increase crop productivity through the use of automation and control technologies. Because of this, a bibliographic search was conducted using the following search parameters in the Science Direct, Google Scholar, IEEE, and Scopus databases: controlled greenhouse, protected agriculture, and crop automation. Similar to other crop protection systems, the greenhouse permits the management of the climate that influences the growth of these; an ideal and balanced process for the plants depends on how certain elements, such as humidity and lighting, are managed and temperature have a positive impact on them. Typically made of wood or metal, a greenhouse has a transparent cover that lets light in and facilitates photosynthesis while preventing much energy from escaping. This equilibrium helps to alter the interior environment, promoting the growth and development of plants within. Low technology, medium technology, and high technology are the three divisions made of these [12].

Agriculture is moving into the digital era thanks to advancements in technologies like Big Data and the Internet of Things. Agriculture is moving towards development in the direction of intelligent machinery and modern information technologies. Subsystems A, B, C, and D of the system are the greenhouse control system, the environment monitoring system, the MySQL remote database, and the Android monitoring software. Subsystem B uses low-power LoRa technology to enable low-power long-distance data transmission, making it particularly well-suited for greenhouses. Users can control every monitoring setting remotely [13].

A Transportable Environment Monitoring System for Greenhouses Multipoint monitoring is required because, according to the Internet of Things, the environmental data of the various areas of a large greenhouse is a requirement for efficient control. A mobile Internet of Things-based greenhouse environment monitoring system was created in response to the issues with the current greenhouse environmental monitoring system. Using mobile acquisition instead of multiple sensing nodes, a four-layer system architecture with exceptional motion control functions was built to realise the automated collection of greenhouse environmental data and take low-cost crop pictures. The system can successfully accomplish multi-point environmental monitoring of the greenhouse, according to the experimental results [14].

An Intuitive Internet of Things System for Managing and Tracking Greenhouse Temperature The Kingdom of Saudi Arabia is well-known for having an extremely hot climate, with summertime highs of over 50 °C. Modern agricultural technologies and creative, environmentally friendly solutions are the only ways to increase agricultural productivity. This system's primary goal is to keep an eye on the greenhouse's conditions and regulate the temperature inside to cut down on energy use while preserving favourable conditions that boost output. The greenhouse environment is monitored using a Petri Nets (PN) model, which also generates an appropriate reference temperature that is subsequently sent to a temperature regulation block. The design attempts to unify and organise a variety of potential unstructured raw data formats that are gathered from various types of IoT devices and technology-independent manner by transforming data into a structured format with the help of model transformations and model-driven architecture [15].

2.2 Comparative Analysis

In this project our aim is to design an Automatic Solar Energy Green House Controlling and Monitoring System to develop an efficient and automated system for monitoring and controlling the essential parameters required for high-quality and productive plant growth in modern greenhouses

CHAPTER3 Green House System

3.1 Overview

A greenhouse is a building with glass walls and a glass roof. The greenhouse is a system for environmental modification and management that allows plants to be grown in climates and seasons that would not otherwise be well suited for their growth. A greenhouse lets you create your own microclimate, controlling the temperature and humidity you expose your plants to. Greenhouse stays warm inside, even during the winter. In the daytime, sunlight shines into the greenhouse and warms the plants and air inside. A greenhouse uses glass or plastic sheeting to allow light rays from the sun to enter the structure where they are absorbed by the plants and converted to heat. When the plants release the heat energy, it is trapped by the glass and the greenhouse stays warm. A greenhouse requires windows, vents or fans to prevent it from getting too hot. The greenhouses that have an additional heating system so the greenhouse stays warm even on cold and cloudy days. Depending on your climate and gardening needs you may need to add a heating system to your greenhouse. If it is extremely cold where you live, or a limited supply of sunshine your plants will not grow successfully without an additional source of heat. Gardeners often deal with the opposite problem in the summer months, struggling to keep their greenhouses cool enough to avoid scorching their plants. One strategy is to paint the roof or your greenhouse white. Since white reflects light and prevents heat absorption this may help keep the damaging rays of the sun at bay. Others have used a white sheet or curtain over the greenhouse to help block the sunlight [16].

3.2 Greenhouse Gases

Greenhouse gases have far-ranging environmental and health effects. They cause climate change by trapping heat, and they also contribute to respiratory disease from smog and air pollution[17]. Extreme weather, food supply disruptions, and increased wildfires are other effects of climate change caused by greenhouse gases or Carbon dioxide, methane, nitrous oxide, ozone, and various chlorofluorocarbons are all human-emitted heat-trapping gases. Greenhouse gases produce an increase in the average surface temperature of the earth over time. Rising temperatures may produce changes in precipitation patterns, storm severity, and sea level.

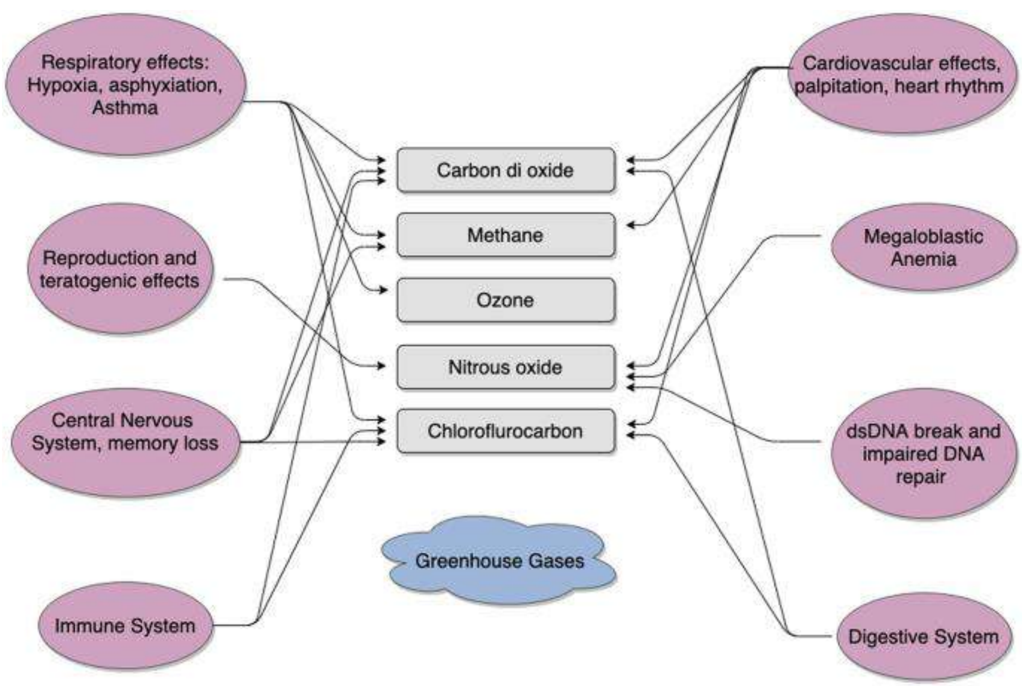


Figure 3.1 Harmful for human health

3.3 Components of Green house

The main components of a greenhouse are its structural components like trusses, purlins, and side posts. Most frames are made from steel, aluminum, plastic, or wood. There are several materials to consider when deciding the kind of foundation to use for the greenhouse[18].

3.4 Benefit of Greenhouse

Greenhouse are energy efficiency that takes advantage of the environmental conditions, such as optimizing the heat inside the greenhouse. Control of microclimate. One of the main advantages of a greenhouse is to control and establish the optimal environment for cultivation.

Figure 3.2 Green house environment

CHAPTER4 Methodology

4.1Overview

All needed equipment's modified by supplying the necessary power +5v. In this project 4 sensors are used ,soil moisture, DHT22 sensor, & sensor LDR sensor. The Arduino is also connected to a cooling fan, a water pump, an exhausts fan, an Artificial lighting, and a motor pump For online cloud monitoring, Ethernet is used to transfer environment values to the devise. Through Ethernet, the server receives and stores all parameters.

4.2 Block Diagram

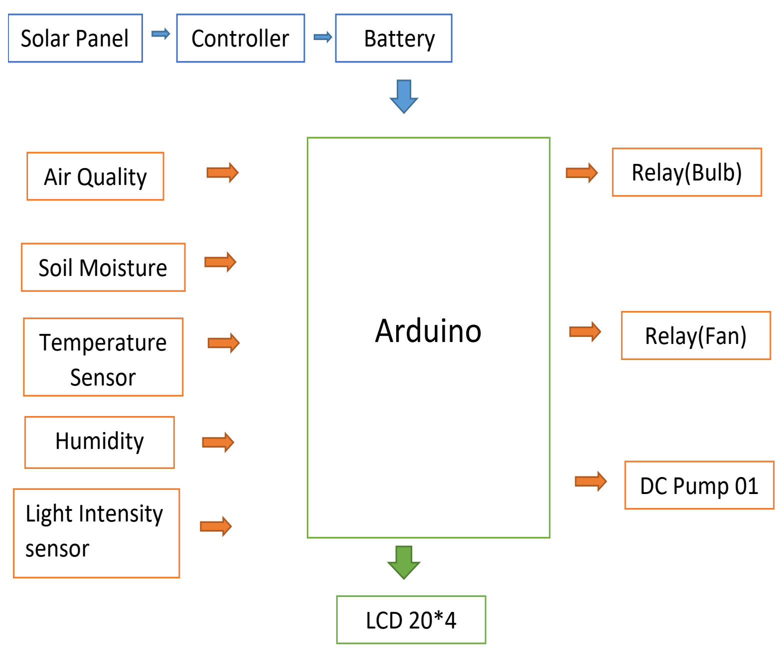


Figure 4.1 System block diagram

Explanation

In this diagram the system shows that the Arduino is the main elements so it can monitor the system by the sensors which are connected to it and then control the system by giving signals to the loads which are connected with them and work accordance of there threshold values.

4.3 Flow Chart

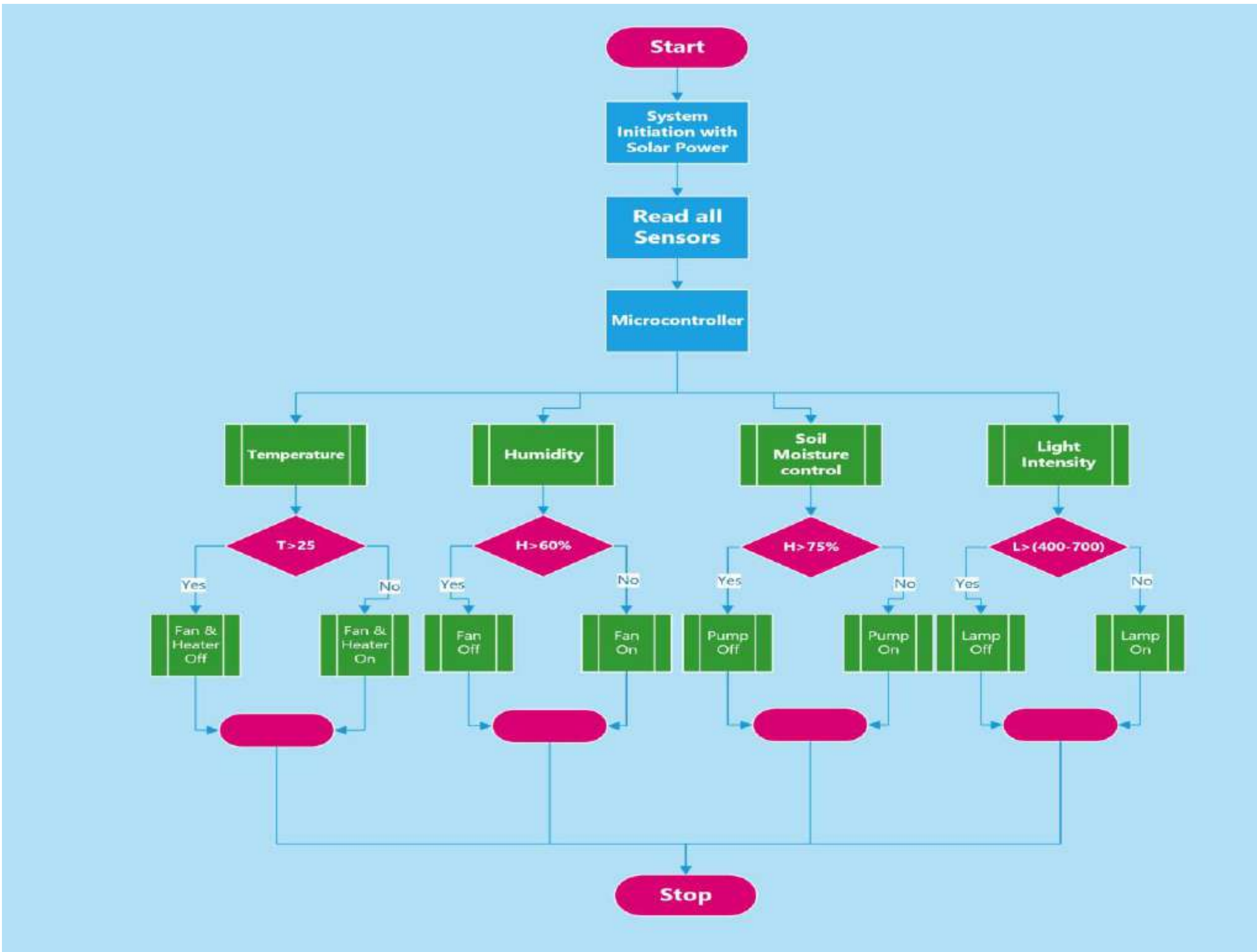


Figure 4.2 System Flow Chart

4.4 Hardware Components

1. Arduino
2. Solar penal
3. Battery
4. DHT22
5. Soil Moisture
6. LDR Sensor
7. Cooling Fan
8. Water pump
9. Artificial light
10. Relay module
11.

Figure 4.3 labeled System

Figure 4.4 Labeled System

4.5 Project Cost

Components	Cost
Arduino UNO	2000
DHT11 sensor	850
Soil Moisture	340
LDR Sensor	150
Cooling fan	450
Water pump	450
Artificial light	800
Relay Module	500
LCD with I2c	1200
Solar panel	4500
Power supply	1500
Battery Charge Controller	400
Frame	12000
Jumpers wire	1300
SD card(16Gb)	750
Total Cost	25740

4.6 Arduino

The open-source electronics platform Arduino is built on user-friendly hardware and software. Professionals, students, and enthusiasts use it extensively to develop interactive electronic creations., GPIO(general purpose input/output) that let us use electronics devices for manual computing and undertake Greenhouse research[19].

Figure 4.5 Arduino UNO

4.7 Pin Configuration

1. **Digital Pins(D0-D13):** These pins can be configured as either input or output and are used for digital signals(high or low)
2. **Analog Pins(A0-A5):** These pins can be used to raed analog voltage levels.They can also function as digital pins.
3. **Power Pins:**
   - **VIN:** Input voltage to the Arduino board when using an external power source.
   - **5V:** Output from the onboard regulator. Provides a regulated 5V supply.
   - **3.3V:** Output from onboard regulator**.** Provides a regulated 3.3V supply.

- **GND:** Ground pins

4. **PWM Pins(~):** These pins can be produce a Pulse Width Modulation(PWM) signal. On the UNO, these are marked with a "~" symbol(e.g,,D3,D5,D5,D9,D10,D11).
5. **Reset Button:** Pressing this button resets the microcontroller.
6. **Crystal Oscillator:** These pins areconnected to the crystal oscillator for clocking the microcontroller**.**
7. **TX/RX Pins:** These are used for serial communication. TX(Transmit)sends data, and RX(Receive) receive data.
8. **ICSP Header:** In-Circuit Serial Programming header for programming microcontroller with an external programmer.
9. **AREF:** Analog Reference voltage for the analog to digital converter.

Pin Diagram

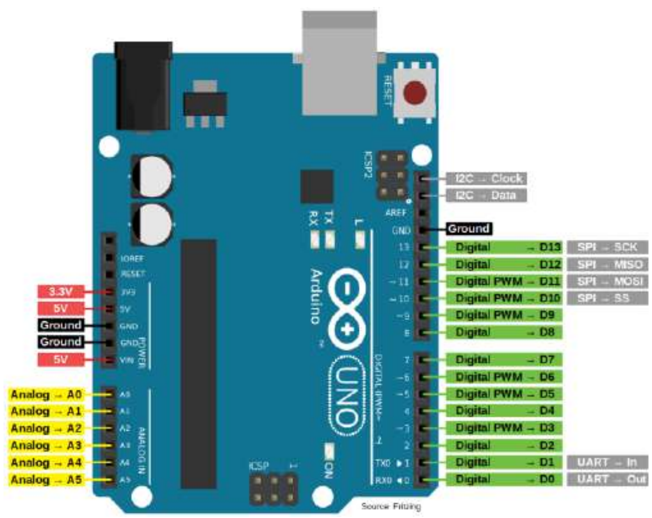


Figure 4.6 Pin diagram

4.8 Photovoltaic Cells

A PV framework is an interconnection of modules that are composed of several PV cells in a series or parallel arrangement. Because a single module's power supply is insufficient to meet the required demand, modules are interconnected to meet that demand. In most cases, the modules in a PV cluster are connected in a specific way to get the right voltages; The framework is then able to produce more and more current content because the individual modules are linked in parallel. The clusters are affixed to a housetop in urban areas[20].

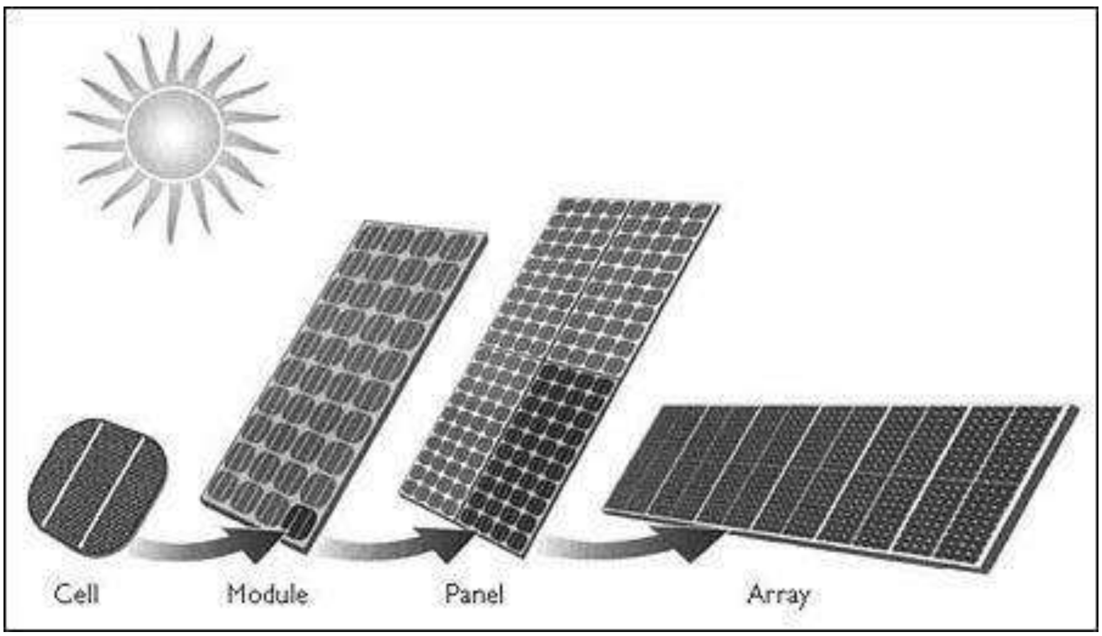


Figure 4.7 PV cell module

4.9 Working of PV Cell

The working of a PV cell is elaborated as when photons of high energy strike the metallic surface of silicon or germanium the electrons get shot out from the conduction band and jump to the valance band. When these electrons jump from the conduction band to the valence band, they absorb the energy of photons and stay for a time of order 3-10 seconds which is called a meta-stable state. At the point when these electrons retain the energy of photons, they will generally bounce from the valence band to the conduction band within the time 8-10 seconds and delivery the assimilated energy as light which is changed over into electrical energy utilizing power electronic connection points.

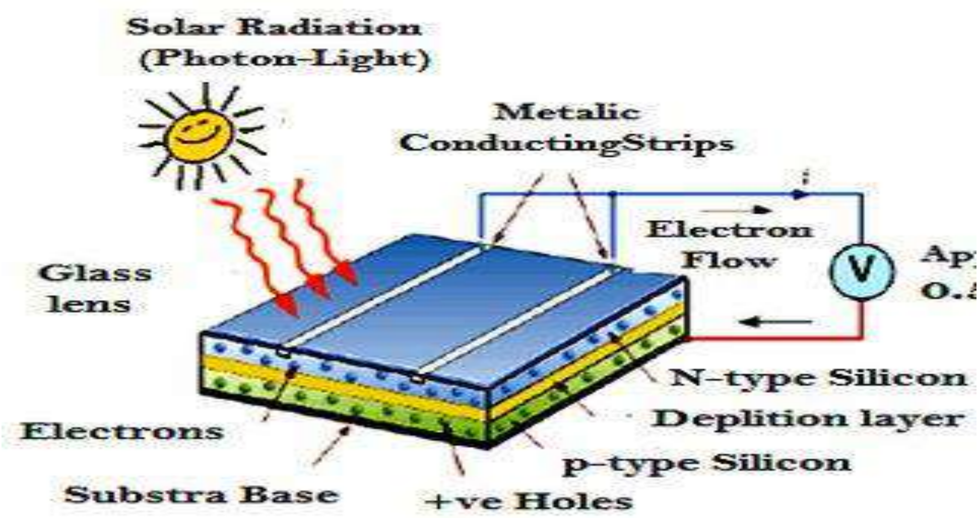


Figure 4.8 Working of PV cell

4.10 DHT22 Sensor

The DHT22 sensor model number (AM2302) measures the temperature and humidity of the ambient air using a thermistor and a capacitive humidity sensor, respectively. It translates these measurements into digital signals that an Arduino, Raspberry Pi, or other suitable microcontroller can interpret .The DHT22 sampling rate is 0,5Hz or one reading every two seconds [21].

Wiring and Interfacing

- **VCC(Power) :** Connect to a 3.3v or 5v power source
- **DATA PIN :** Connect to a digital pin on the microcontroller for data transmission
- **PULL-UP Resistor :** A 5k to 10k ohm pull-up resistor is often used between the data pin and the **VCC** line to stabilize the data signal
- **GROUND(GND) :** Connect to the ground of the power source

Figure 4.9 DHT22 Sensor

4.11 Soil Moisture

Devices called soil moisture sensors model number (REES52) are used to gauge the amount of water in the soil. Because they offer vital information about the water content of the soil, these sensors are useful instruments for researchers, farmers, and gardeners. They also help to optimize irrigation, avoid overwatering, and conserve water resources. An overview of soil moisture sensors and their operation is provided below[22].

Wiring and Interfacing

VCC (Power): Connect to a 5v power source

PULL-UP Resistor: A 5k to 10k ohm pull-up resistor is often used between the data pin and the **VCC** line to stabilize the data signal

GROUND (GND): Connect to the ground of the power source

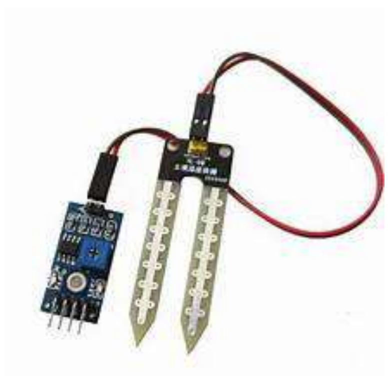


Figure 4.10 Soil moisture Sensor

4.12 LDR Sensor

A photo resistor, sometimes referred to as an LDR (Light-Dependent Resistor) sensor, the Response time of 2 – 50 ms, it is a kind of resistor whose resistance changes depending on how much light strikes it. When an LDR sensor is interfaced with a microcontroller such as an Arduino or Raspberry Pi, the light intensity is read by connecting the sensor to the microcontroller and reading the analogue or digital values. The following is a basic how-to for wiring and connecting an Arduino to an LDR sensor[23]

Wiring and Interfacing

VCC (Power): Connect to a 5v power source

PULL-UP Resistor: A 5k to 10k ohm pull-up resistor is often used between the data pin and the **VCC** line to stabilize the data signal

Connect Analog Pin: Connect a wire to the point where the LDR and fixesd resistor are connected. This wire will go to an analog input pin on the Arduino **A0**

GROUND(GND) : Connect to the ground of the power source

Figure 4.11 LDR Sensor

4.13 Cooling Fan

The greenhouse should have adequate ventilation that is both through and effective. If a greenhouse has enough ventilation to let heated air to escape and cold fresh air to enter the system, it does not need a fan. Fans encourage appropriate air circulation with in the greenhouse, which helps plants develop as healthily as possible. The majority of individuals purchase greenhouse with the intention of keeping the plants warm and away from frost, but they seldom consider the alternative cooling the plants. Plants in greenhouses that lack ventilation perish from the extreme heat. You may use as fan among other methods to make sure your greenhouse has adequate ventilation. DC fans may operate voltages 5 ,12, 24, and 48 volts. The AC fans, in contrast are driven by a fluctuating voltage that alternates between positive and negative values[24].

Figure 4.12 Exhaust fan

4.14 LCD Screen

The LCD display screen has a straightforward Alphanumeric display with 20 characters and 4lines. On a blue background , this LCD 20*4 Character Display contains white letters use the widely use parallel I/O pins are required to interact with this LCD panel. Contains an LED backlight use both 4 and 8 bits modes.

Specification:

1. 20 characters and 4 lines
2. Blue Black light
3. HD44780 Equivalent LCD Controller/driver Built-In
4. 4-bit or 8-bit MPU Interface
5. Standard Type
6. Works with almost any Microcontroller

Figure 4.13 LCD

4.15 Relay Module

This 4channel , 5v relay interface board needs a 15mA driver current for each of its channels. A number of high current applications may be switched and controlled using it. It has high current relays with a 10A AC 250V operating range. The relay module can be used to Track external circumstances, such as whether or not it is running and to keep an eye on a variety of peripheral[25].

Figure 4.14 Relay module

4.16 12v DC Water Pump

A 12v to 3v direct current source is used to power an electric water pump motor model "Model /Number: UI-87325**",** which is known as a dc water pump. To pressurize, transport, or circulate water or other liquids, it users centrifugal force[26].

Figure 4.15 DC water pump

4.17 Artificial Light

One of the most popular methods for enhancing the greenhouse output of food crops is the use of artificial light to augment natural sunshine.However, artificial lighting consumes a lot of electrical power, raising greenhouse production costs and potentially lowering earnings

Figure 4.16 Artificial light

4.18 Battery

A device that stores and produces direct current (DC) electrical energy is referred to as a "battery". Batteries are commonly utilised to power electronic equipment in a variety of applications, from massive industrial systems to small household gadgets.

Figure 4.17 Lithium Battery

CHAPTER5 Result And Conclusion

5.1 Results

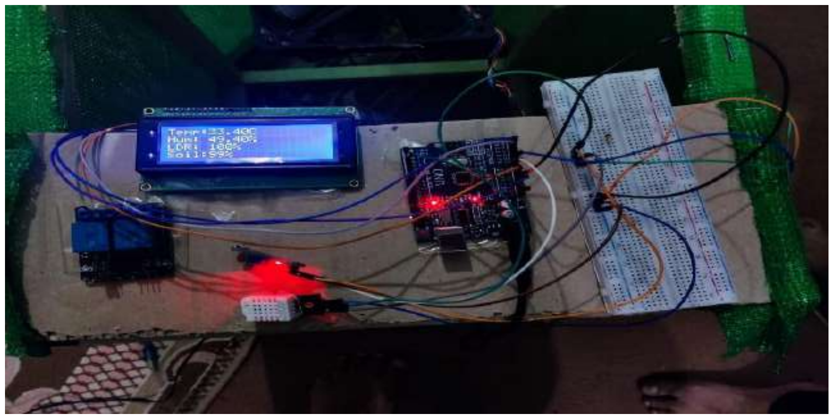


Figure 5.1Result

Figure 5.2Result

5.2 Coding

```
#include <dht.h>
#include <LiquidCrystal_I2C.h>
// Define the DHT sensor
dht DHT;
// Define pin numbers
int dhtsen = 2;
int LDR_PIN = A0;
int SOIL_PIN = A1;
int FAN_RELAY_PIN = 9;
int PUMP_RELAY_PIN = 10;
int BULB_RELAY_PIN = 11;
// Create an LCD object with I2C address 0x27, 20 columns, and 4 rows
LiquidCrystal_I2C lcd(0x27, 20, 4);
void setup() {
  // Delay for 2 seconds
  delay(2000);
// Initialize the LCD
  lcd.begin();
  // Initialize serial communication at 9600 bps
  Serial.begin(9600);
```

In figure 4.1mthe program include libraries and set the threshold values as the values set to the Arduino UNO and also contain the function of general purpose input output which are the pins connected to it.

```
  // Set pin modes
    pinMode(dhtsen, INPUT);
    pinMode(LDR_PIN, INPUT);
    pinMode(SOIL_PIN, INPUT);
    pinMode(FAN_RELAY_PIN, OUTPUT);
    pinMode(BULB_RELAY_PIN, OUTPUT);
    pinMode(PUMP_RELAY_PIN, OUTPUT);

    // Turn on the backlight for the LCD
    lcd.backlight();

    // Set up the initial display on the LCD
    lcd.setCursor(0, 0);
    lcd.print("Temp: ");
    lcd.setCursor(0, 1);
    lcd.print("Hum: ");
  lcd.setCursor(0, 2);
    lcd.print("LDR: ");
    lcd.setCursor(0, 3);
    lcd.print("Soil: ");
  }
```

```
void loop() {
// Read temperature and humidity from the DHT sensor
int senval = DHT.read11(dhtsen);
// Read LDR (Light Dependent Resistor) value
int ldrValue = analogRead(LDR_PIN);
// Read soil moisture value
int soilMoistureValue = analogRead(SOIL_PIN);
// Map LDR and soil moisture values to percentage values
int ldrPercentage = map(ldrValue, 0, 1023, 0, 100);
int soilMoisturePercentage = map(soilMoistureValue, 0, 1023, 0
// Print sensor readings to Serial monitor
Serial.print("Temperature: ");
Serial.print(DHT.temperature);
Serial.print(" °C, Humidity: ");
Serial.print(DHT.humidity);
Serial.print(" %, LDR: ");
Serial.print(ldrPercentage);
Serial.print("%, Soil Moisture: ");
Serial.print(soilMoisturePercentage);
Serial.println("%");
```

```
  // Display sensor readings on the LCD

    lcd.setCursor(5, 0);

    lcd.print(DHT.temperature);

    lcd.print("C ");

    lcd.setCursor(5, 1);

    lcd.print(DHT.humidity);

    lcd.print("%  ");

    lcd.setCursor(5, 2);

    lcd.print(ldrPercentage);

  lcd.setCursor(5, 3);

    lcd.print(soilMoisturePercentage);

    lcd.print("%  ");

  // Control relays based on sensor readings
  // Control Bulb Relay
  if (ldrPercentage > 400 - 700) {
    digitalWrite(BULB_RELAY_PIN, HIGH);
  } else {
    digitalWrite(BULB_RELAY_PIN, LOW);
}
```

```
// Control Pump Relay

if (soilMoisturePercentage > 75) {

  digitalWrite(PUMP_RELAY_PIN, HIGH);

} else {

  digitalWrite(PUMP_RELAY_PIN, LOW);

// Control Fan Relay
  if (DHT.temperature > 25) {
    digitalWrite(FAN_RELAY_PIN, HIGH);
  } else {
    digitalWrite(FAN_RELAY_PIN, LOW);
  }

  // Delay for 2 seconds before the next iteration
  delay(2000);
}
```

We have gathered information on several variables including LDR, temperature, and humidity, and shown in figures (4.3, 4.4, & 4.5)

It is determined that dtsen = 25 is the ideal threshold for the sunflower crop (Humidity and Temperature)

The Arduino UNO automatically opens and activates the exhaust fan if the reading exceeds 25.

The Arduino UNO switches off and disables the exhaust fan if the reading is less than 25.

The Arduino UNO initiates the sump motor, which subsequently engages the water pump, if the moisture level is more than 75%

The Arduino UNO switches off the sump motor, which switches off the water pump, if the moisture level is less than 75%

5.2 Data of Sunflower

Environmental Condition

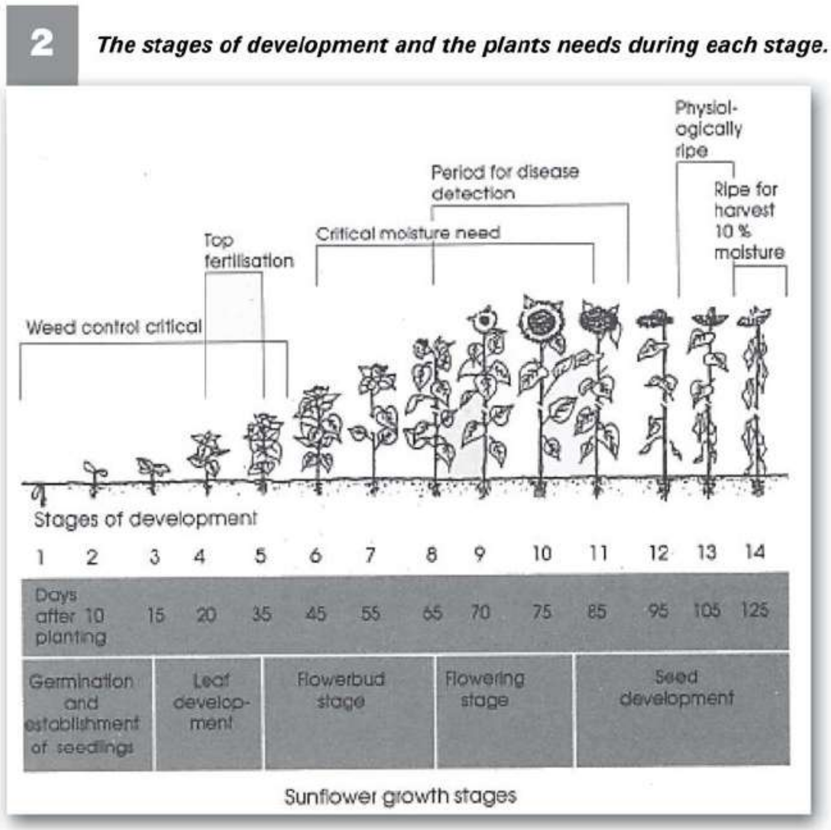
- ✓ **Watering**: Sunflowers have moderate water needs. Water deeply but infrequently, allowing the soil to dry slightly between watering
- ✓ **Timing**: Sunflower seeds can be sown directly into the ground after the danger of frost has passed, typically in late spring or early summer
- ✓ **Spacing**: Plant seeds or seedlings about 6 to 12 inches apart, depending on the variety. Allow enough space between plants to accommodate their mature size.
- ✓ **Pests and Diseases**: Sunflowers can be susceptible to certain pests like aphids, caterpillars, and birds that may feed on the seeds. Keep an eye out for any signs of infestation and take appropriate measures, such as applying organic insecticides or using physical barriers, to protect your sunflowers[27].

Preset Data

- ✓ **Sunlight**: Sunflowers require full sun exposure for at least 6 to 8 hours a day.
- ✓ **Soil**: They prefer well-drained, loamy soil with a pH range of 6.0 to 7.5.
- ✓ **Temperature**: They thrive in warm climates with temperatures ranging between 70°F and 85°F (21°C - 29°C
- ✓ **Humidity**: Sunflowers generally thrive in moderate humidity conditions, with a relative humidity range of 40% to 60%. This range is considered optimal for their growth and development[28].

Figure 5.3 Sunflower

5.3 Sun flower growth stage



Source: Sunflower Production – A Concise Guide (www.kzndrad.gov.za)

Figure 5.4 sun flower growth stages

Figure 5.5 sun flower growing process

5.4 CONCLUSION

- Automatic Solar Energy Green House Controlling and Monitoring system offers an alternate means to meet electricity demand for growing plants.
- Solar energy has great potential for utilization in electricity generation, making the system self-sufficient in energy requirements.
- Site-specific irrigation effectively manages scarce water resources based on soil moisture content and atmosphere temperature.

- The system requires no maintenance and utilizes renewable solar energy, providing an advantage in terms of sustainability.

5.5 Recommendation for Future Work

- In future work we can improve the greenhouse variables accuracy more by adding a Cam with IMAGE PROCESSING feature.
- We can design the system through that we can also diagnose the disease of the plant.
- We can also move it into on IOT side such as our system data is stored in google drive so in the future we can enhance our parameters data into cloud as well

CHAPTER6 References

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