A Project Report on

Implementation of Greenhouse Environment

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

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Savitribai Phule Pune University

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PUNE – 411037

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C E R T I F I C A T E

Certified that this Project report titled 'Implementation of Greenhouse Environment' by Sumit Yadav (11810605), Manish Zine(11810439), Madhuli Pangavhane (11810625), is approved by me for submission. Certified further that, to the best of my knowledge, the report represents work carried out by the student as the Mini project as prescribed by the University of Pune in the academic year 2021-22.

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ABSTRACT

This paper presents a model which is used for monitoring and controlling of Greenhouse Environment. The rapid change of climate, population explosion, and reduction of arable lands are calling for new approaches to ensure sustainable agriculture and food supply for the future. Greenhouse agriculture is considered to be a viable alternative and sustainable solution, which can combat the future food crisis by controlling the local environment and growing crops all year round, even in harsh outdoor conditions. This paper is mainly focuses on 3 parameters that is Humidity ,Temperature and Soil Moisture. These three factors are the most affecting factors for any plant in greenhouse. In this paper we used automation and also at some point manual control also. GSM module , micro-controller and some three sensors along with that are used in this project .

KEYWORDS

- Greenhouse
- Crop Life
- Suitable Condition
- Microcontroller
- GSM module
- Temperature
- Soil Moisture
- Humidity

CHAPTER 1

INTRODUCTION

1.1 PROBLEM DEFINITION

To deign and implement a monitor and control system for a greenhouse environment.
The objectives include:

- To read greenhouse environment parameter(like Soil moister, temperature and humidity) using sensor.
- To control environmental parameters based on read parameter with a microcontroller.
- To display environmental parameter using a LCD.
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OVERVIEW

The world's population is growing fast , industrialization ,climate change , the spreading of environmental pollution, the arable land around the world are decreasing year by year. This leads to significant challenges in food security and also with the decreasing nutrients in food. Therefore, the traditional agriculture industry requires a radical change to ensure ecological and sustainable food supply. Greenhouse agriculture or farming technology is considered to be one of the viable and alternative solutions to provide food security and to ensure socio ecological sustainability in the future.

Greenhouse farming technology was first introduced commercially in The Netherlands and France in the nineteenth century. Greenhouse farming is a house-like structure, constructed with glass or plastic materials to produce various types of crops in any season. The roof is generally covered with material to preserve the required climatic conditions for the plant growth (such as, temperature, humidity, lighting, and so on) and also to safeguard the plants from the pests, diseases and adverse environmental conditions.
The crop agriculture in greenhouse is higher affected by the surrounding conditions. The significant environmental factors for the quality and better productivity of the plants growth are temperature,

relative humidity, moisture soil, and the CO2 amount in greenhouse.

The advantages of these greenhouse farms are that it can help the farmers to produce different types of crops by changing the local environmental conditions according to the plant's requirement (temperature, light, moisture, nutrients). It can prolong the growing season for the cultivation and can provide high quality crops with efficient use of pesticides, manures, water and labors. Greenhouse farms can prevent plants from harsh environmental conditions, such as heavy rainfall or high solar radiation. As the awareness towards organic farming is increasing greenhouse environment is the best solution for growing organic vegetables. In this project microcontroller , GSM module are used for controlling and automation purpose. 2 sensors are used and along with that PCB and other circuit for regulating power.

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1.2 MOTIVATION

In traditional farming, farmers have to visit the farming land regularly to measure the various environmental parameters such as temperature, humidity, light intensity and soil moisture to cultivate the right crops at the right time in the right soil.
Even though this traditional farming system have been used for years, the system is hectic and fail to prove high productivity rate as farmer usually unable to measure all the parameter accurately

1.3 OBJECTIVE

The aim of this research is to design and implement a monitor and control system for a greenhouse environment.

The objectives include:

- To read greenhouse environment parameters (like Soil moisture, temperature and humidity) using sensors.
- To control environmental parameters based on read parameters with a microcontroller.
- To display environmental parameters using an LCD.

CHAPTER 2

LITERATURE SURVEY

Below mentioned are some most relevant papers**.**

Sr No	Paper Title	Technology	Description
1	Greenhouse Monitoring and Control System with an Arduino System	Temperatur e-e sensor, Humidity sensor, Moisture sensor, Arduino, C/C++, Arduino IDE software.	● 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 system that was set to monitor and control the greenhouse environment.
2	IOT Based Greenhouse Monitoring And Controlling System	Temperatur-e sensor, Humidity sensor, Moisture ensor, NodeMCU ESP8266, C/C++, Arduino IDE software	● IOT and NodeMCU ESP8266d Greenhouse Environment Monitoring and controlling project use four sensors to **detect the** Temperature, Light, Humidity and Soil moisture in the Greenhouse. Temperature Sensor is used to detect the temperature inside the greenhouse. Reading from the sensor is sent to the NodeMCU ESP8266 and it is also controlled by wireless connectivity using the app / website, etc.
3	Greenhouse monitoring and control system based on wireless Sensor Network	Temperature-e sensor, Humidity sensor, Moisture sensor, NodeMCU ESP8266, GSM, Gas sensor and vent control, Light control, C/C++, Arduino IDE software	● The purpose of this paper is to use the Wireless Sensor Network in greenhouse monitoring and control. The system is build to read different parameters in greenhouse like temperature, humidity, light, moisture and harmful gases. The system core is Arduino compatible technology and the WSN based on Wi-Fi is used for short distance communication and GSM

			for global system communication. A GUI panel is designed using LabView software to monitor and control the sensor node components and devices. All the parameters in the system could be adapted according to the plant type and climate requirements. The system is tested in the lab, and a field test could be performed for field verification.

CHAPTER 3

TECHNOLOGIES USED

- **Monitoring atmosphere:**

One of the most important components of smart greenhouse farming is to monitor the climatic conditions or the environment inside farms. The real-time monitoring can help the farmers to take preventive measures for the adverse conditions and protect the plants from diseases**.**

- **ATmega328P:**

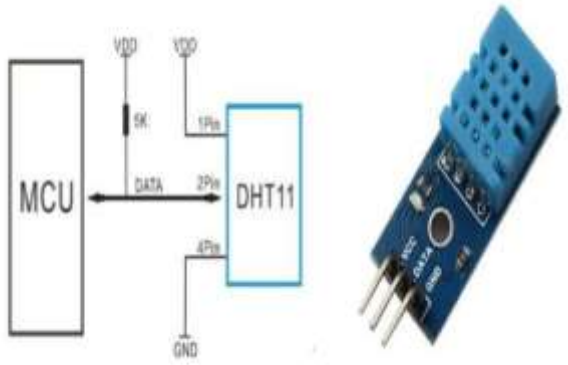
ATmega328 is an Advanced Virtual RISC (AVR) microcontroller. It supports 8-bit data processing. ATmega-328 has 32KB internal flash memory. ATMEGA(328) Microcontroller used in this project is ATMEGA328. Which is again a basic of this family. The reason behind using this controller is it has inbuilt analog to digital converter . It has high compatibility to use with Arduino Uno to program.

- **GSM (800):**

GSM 800L

SIM800L GSM/GPRS module is a miniature GSM modem, which can be integrated into a great number of IoT projects. This module can be used to accomplish almost anything a normal cell phone can; SMS text messages, Make or receive phone calls, connecting to internet through GPRS, TCP/IP, and more. The module supports quad-band GSM/GPRS network, meaning it works pretty much anywhere in the world.

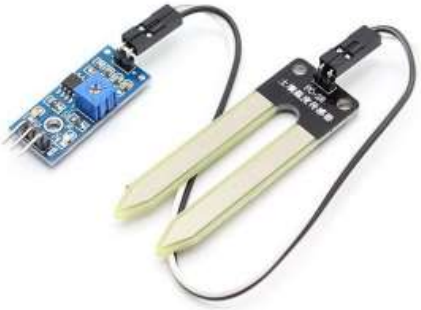
Temperature and Humidity Sensor (DHT11):



DHT11

Humidity sensor is used for sensing the vapors in the air. The change in RH (Relative Humidity) of the surroundings would result in display of values.

Moisture sensor :



Soil Moisture Sensor

The two copper leads act as the sensor probes. They are immersed into the specimen soil whose moisture content is under test. The conductivity of soil depends upon the amount of moisture present in it. It increases with increase in the water content of the soil that forms a conductive path between two sensor probes leading to a close path to allow current flowing through.

Fan(12V):

FAN

This Fan operated on 12 V DC supply and is used for Temperature control in this project.

DC Motor:

DC Motor

DC motor is used as a representative of motor pump in this project because this is a prototype. There are two types of pumps available in the market such as submersible and immersible. Submersible type of motors can be used in the Hydroponics System.

LED:

LED is used instead of a bulb for controlling humidity.
Humidity can be controlled in a closed environment by turning on and off of a LED.

Arduino IDE and GSM Programming:

To program the microcontroller arduino ide is used in this project . With the help of different liabraries we have developed a code for communication in between the GSM module and microcontroller.

All sensors and their controlling elements are communicated and controlled by the microcontroller itself.

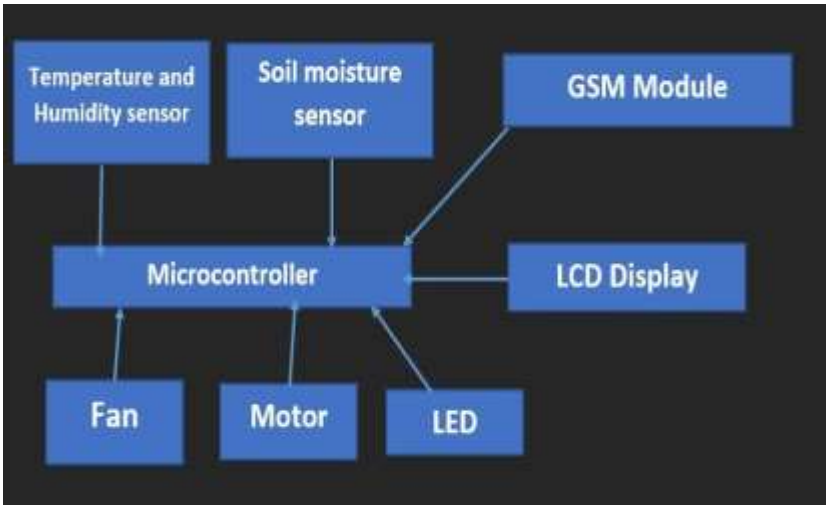
Soil Moisture Monitoring:

Monitoring of Soil Conditions Soil moisture is an essential element in all types of farms (traditional or greenhouse) . This is because plants or crops A block diagram of soil moisture monitoring system. are all dependent upon the moisture level of the roots in the soil. The information about soil moisture can help the farmers to comprehend the conditions and make decisions. Soil moisture evaluates the water content of the soil. Studies showed that almost 80% of the crop is damaged due to over irrigation which helps to rot the plant roots and makes the root more fungal prone. Also, if the water level is insufficient, plants may die out due to the insufficient nutrients and oxygen levels. Hence, monitoring the soil moisture level is a crucial part of the agriculture industry.

CHAPTER 4

METHODOLOGY AND ANALYSIS

Soil moisture is an essential element in all types of farms (traditional or greenhouse). This is because plants or crops are all dependent upon the moisture level of the roots in the soil. The information about soil moisture can help the farmers to comprehend the conditions and make decisions. Soil moisture evaluates the water content of the soil. Studies showed that almost 80% of the crop is damaged due to over irrigation which helps to rot the plant roots and makes the root more fungal prone. Also, if the water level is insufficient, plants may die out due to the insufficient nutrients and oxygen levels. Hence, monitoring the soil moisture level is a crucial part of the agriculture industry.
Two factors are fully automated and one can be controlled by using SMS.



Block Diagram

As mentioned above this is the block diagram of the system that is proposed in this paper . Controlling elements for soil moisture , humidity and temperature are DC motor , LED , fan respectively. Soil moisture sensor will sense the water content that is present in the soil and according to that it will turn off the motor . If the water content is less then the DC motor will be on and if the water is present the motor will remain off. Controlling of FAN can be done both manually from Mobile and also automatically. Different plants need more or less water according to how we can adjust the set point and also we can control it by using SMS. We can give certain commands to the motor so that the motor will work accordingly.

The below mentioned code is of the GSM and other controlling units . With the help of different libraries such as software serial and others.

```
#include <LiquidCrystal.h>

LiquidCrystal lcd(A5, A4, A3, A2, A1, A0);
#include "DHT.h"

char str[100];
int i=0;
DHT dht;
#define mo 3
#define rly1 12
#define rly2 13
#define led 11
#include <SoftwareSerial.h>
#define DEBUG true


int temp1=0,i1=0;
//int led=13;
int temp=0;
//char str[15];




byte degree_symbol[8] =
                  {
                    0b00111,
                    0b00101,
                    0b00111,
                    0b00000,
                    0b00000,
                    0b00000,
                    0b00000,
                    0b00000
```

Code(1)

Above mentioned code is giving pin number and the sensor node as theiroutput.Relay 1 is connected to pin number 12 and likewise.

.

```
volatile unsigned long duration=0;
//unsigned char i[5];
unsigned int j[40];
unsigned char value=0;
unsigned answer=0;
int z=0;
int b=1;
int s1=0;
void setup()
{
 dht.setup(2);
  pinMode(mo, INPUT);
   pinMode(rly1, OUTPUT);
    pinMode(rly2, OUTPUT);
     pinMode(led, OUTPUT);
lcd.begin(16, 2);
Serial.begin(9600);


attachInterrupt(0, increment, RISING);
lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("WELCOME TO GREEN");
  lcd.setCursor(0,1);
 dht.setup(2);
  lcd.print("HOUSE MONITORING");
   delay(1000);

Serial.println("AT");
delay(4000);
Serial.println("AT+CNMI=2,2,0,0,0");
  delay(2000);
  Serial.println("AT+CMGF=1");
  delay(1500);
 lcd.clear();
```

sketch_jan14a.ino

```
80  void loop()
81  {
82
83
84  delay(dht.getMinimumSamplingPeriod());
85
86    float humidity = dht.getHumidity();
87    float temperature = dht.getTemperature();
88  lcd.clear();
89   lcd.print("Temp = ");
90   lcd.setCursor(0,1);
91   lcd.print("Humidity = ");
92   //lcd.createChar(1, degree_symbol);
93   lcd.setCursor(9,0);
94   lcd.write(1);
95   lcd.print("C");
96   lcd.setCursor(13,1);
97   lcd.print("%");
98  lcd.setCursor(7,0);
99  lcd.print(temperature, 1);
100 lcd.setCursor(11,1);
101 lcd.print(humidity, 1);
102 delay(20);
103
104
105 {
106
107 if(temperature>40)
108 {
109
110  lcd.clear();
111   lcd.print("HIGH TEMP LEVEL");
112    delay(100);
113 lcd.clear();
114   lcd.print("TURNING ON DEVICE");
115    delay(100);
116  digitalWrite(led,HIGH);
```

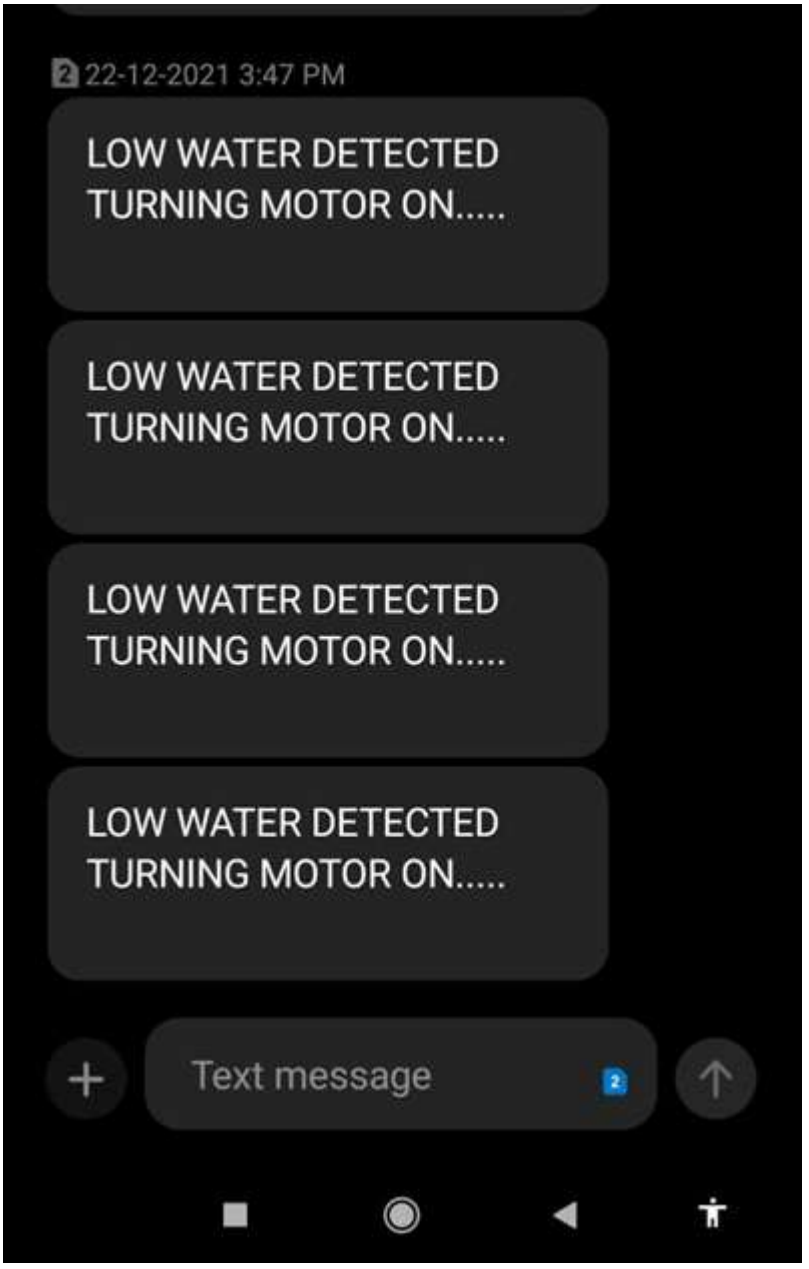
CHAPTER 5

TESTING AND RESULTS

5.1 Project Setup

5.2 SMS Sent

5.3 SMS Received



CHAPTER 6

FUTURE SCOPE

These are some of the major challenges facing the greenhouse farming:
• Low cost and reliable solution for the monitoring of plant growth, including all the plant traits (height, leaf decease, fruit/grain/leaf dimension and etc.) and quality (protein, sugar and etc.).
• Low cost and reliable sensor solution for the monitoring of local climate surrounding individual crops or most part of a large plant.
• Low cost and reliable sensor solution for the monitoring of soil conditions (chemical compositions).
• A unified data transmission protocol. The interoperability and generalized standards for data annotation, visualization and decision should be considered. This would require the coordination between major industry associations.
• Secure data transmission and storage. Integrating blockchain technology with the IoT empowered smart greenhouses provides a viable solution for this .
• The development of an "expert system" to facilitate farmers in the decision making process, this needs to integrate the environment data and the crop growing data using artificial intelligence.

CHAPTER 7

CONCLUSION:

As discussed in this review paper, although IoT empowered smart greenhouse farming offers countless current and potential benefits, the technology has also advanced remarkably in recent years. It is believed that major efforts from the researchers, engineers and farmers are needed in order to improve the crop yield at lower cost, particularly if we envision the future smart greenhouse farming as a "menu selection" process similar to the cooking.

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