Implementation of Greenhouse Environment

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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 , Microcontroller , GSM module ,Temperature , Soil Moisture , Humidity etc.

I. INTRODUCTION

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 labours. 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.

II. THEORY

A. 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.

ATmega328P

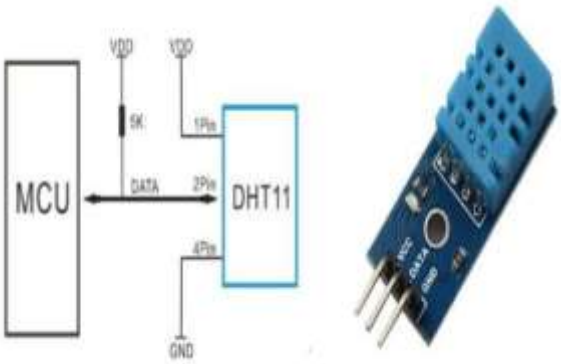
ATmega328 is an Advanced Virtual RISC (AVR) microcontroller. It supports 8-bit data processing. ATmega-328 has 32KB internal flash memory.

B. 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.

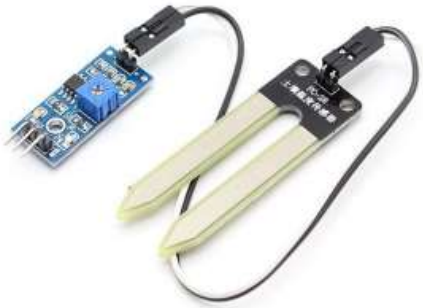
C. Temperature and Humidity Sensor (DHT11)



DHT11

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

D. 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.

E. Fan(12V)

FAN

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

F. DC Motor

DC Motor

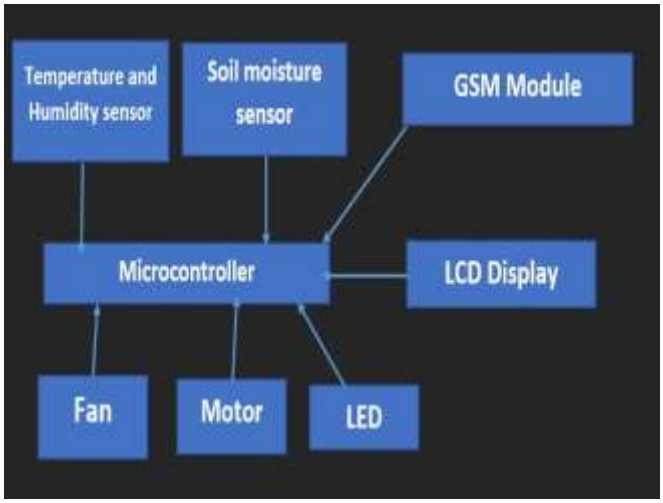
DC motor is used as a representative of motor pump in this project because this is a prototype. There are two types of pumps available in the market such as submersible and immersible. Submersible type of motors can be used in the Hydroponics System .

G. 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.

Proposed System



Block Diagram

As mentioned above this is the block diagram of 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 on 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 by both manually from Mobile and also automatically. Different plant need more or less water accoding to that we can adjust the set point and also we can control it by using SMS.

SMS

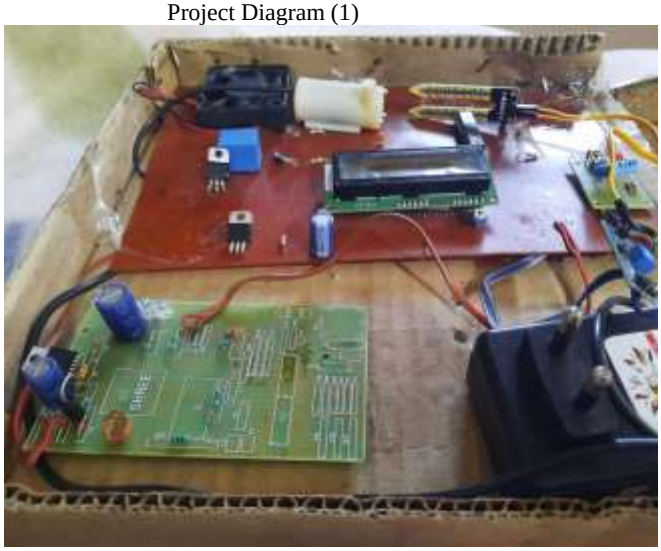
.

The above screenshot was of the message that system sends to the given number. We can give certain commands to the motor so that the motor will work accordingly.

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.

Project Diagram (1)



Project Diagram(2)

Humidity can be controlled by using a bulb in the actual green house environment , here a LED is used for showcasing purpose . Setpoint is setup by a room temperature and according to that the system will respond. Temperature can be controlled by using a exhaust fan one setpoint is been given to the system and according to that the fan will be turned on and off.

```
#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)

```
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();
```

Code(2)

```
void loop()
{


delay(dht.getMinimumSamplingPeriod());

  float humidity = dht.getHumidity();
  float temperature = dht.getTemperature();
 lcd.clear();
  lcd.print("Temp = ");
  lcd.setCursor(0,1);
  lcd.print("Humidity = ");
  //lcd.createChar(1, degree_symbol);
  lcd.setCursor(9,0);
  lcd.write(1);
  lcd.print("C");
  lcd.setCursor(13,1);
  lcd.print("%");
 lcd.setCursor(7,0);
 lcd.print(temperature, 1);
 lcd.setCursor(13,1);
 lcd.print(humidity, 1);
 delay(20);


{

if(temperature>40)
{

 lcd.clear();
  lcd.print("HIGH TEMP LEVEL");
   delay(100);
 lcd.clear();
  lcd.print("TURNING ON DEVICE");
   delay(100);
  digitalWrite(led,HIGH);
```

Code(3)

```
sketch_jan14a.ino

160
161  if(humidity>65)
162  {
163
164   lcd.clear();
165    lcd.print("HIGH HUMI LEVEL");
166     delay(100);
167   lcd.clear();
168    lcd.print("FAN IS ON");
169     delay(100);
170     digitalWrite(rly1,HIGH);
171
172
173  }
174
175
176  if (digitalRead(mo)==0)
177  {
178    temp1=1;
179
180  }
181  else
182  {
183   //temp1=1;
184    // digitalWrite(rly2,LOW);
185
186  lcd.clear();
187    lcd.print("LOW WATER CONTENT");
188     delay(100);
189  lcd.clear();
190    lcd.print("PUMP IS ON");
191     delay(100);
192     digitalWrite(rly2,HIGH);
193  SendMessage();
194  temp1=0;
195  delay(2000);
```

Code(4)

```
121  if (temp==1)
122
123
124  {
125  temp=0;
126  lcd.clear();
127  lcd.print("SMS MOTOR ON");
128  digitalWrite(rly2,HIGH);
129  delay(1000);
130  }
131
132  if (temp1==1 && s1==1)
133
134
135  {
136  temp1=0;
137  s1=0;
138  lcd.clear();
139  lcd.print("SMS MOTOR OFF");
140  digitalWrite(rly2,LOW);
141  delay(1000);
142  }
143
144  if(temperature<40)
145  {
146
147
148   digitalWrite(led,LOW);
149
150  }
151  if(humidity<65)
152  {
153
154
155   digitalWrite(rly1,LOW);
156
```

Code(5)

```
void increment() {


 while(Serial.available())
 {
   char ch=(char)Serial.read();
   str[i++]=ch;
   if(ch == '*')


   {
     temp=1;
     lcd.clear();
     lcd.print("Message Received");
     s1=0;
     delay(1000);
   }
if(ch == '#')


   {
     s1=1;
     lcd.clear();
     lcd.print("Message Received");
     delay(1000);
   }




 }}
```

Code(6)

LCD is used to display the current status of the system.

Significance and Scope

Automatically control environmental conditions within greenhouse allowing any type of plants to be grown all year round. Eliminates risk of greenhouse not being maintained at specific environmental conditions due to human error. Minimize labour costs involved in maintaining a greenhouse. Customer able to define specific greenhouse conditions. "Plug-And-Play" product.

Other projects describes the design of a greenhouse monitoring & controlling system based on IOT using Arduino. Agriculture projects even in urban areas are on a rise in recent times, in unique forms technological progress makes the agricultural sector grow high . IOT also can be a option to this system.

Advantages

- Total automation of greenhouses / nurseries / bio tech parks.
- Can be used domestically.
- Easy to use, install, operate & troubleshoot.
- Useful for small scale farmers &greenhouse owners.
- Low cost setup.

Conclusion

Here, proposed design is implemented with Microcontroller for greenhouse monitoring, controlling temperature , humidity and soil moisture with the help of GSM and sensors.

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