CROP SURVEILLANCE AND IRRIGATION SYSTEM

Project report submitted in partial fulfillment of the requirements for the degree

of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

BY

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MAY ,2017

DECLARATION

I hereby declare that the work reported in the B-Tech thesis entitled **"Crop Surveillance and Irrigation System"** submitted at **Jaypee University of Information Technology, Waknaghat India,** is an authentic record of my work carried out under the supervision of **Dr. RAJIV KUMAR.** I have not submitted this work elsewhere for any other degree or diploma.

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SUPERVISOR'S CERTIFICATE

This is to certify that the work reported in the B-Tech. thesis entitled "**Crop Surveillance and Irrigation System**", submitted by **Sahil Sood, Akshay Chauhan, Rishabh Gautam** at **Jaypee University of Information Technology, Waknaghat, India,** is a bonafide record of their original work carried out under my supervision. This work has not been submitted elsewhere for any other degree or diploma.

(Signature of Supervisor)

Dr. Rajiv Kumar

Associate Professor

May 2, 2017

ACKNOWLEDGEMENT

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TABLE OF CONTENTS

Abbreviations

BSC	Base station controller
BTS	Base transceiver station
EEPROM	Erasable programmable read-only memory
EIR	Equipment identity file register
FTDI	Future technology devices international
GSM	Global system for mobile communication
HLR	Home location register
ICSP	In-circuit serial programming
IMSI	International mobile subscriber identity
ISP	Internet service provider
LTE	Long term evolution
MIPS	Microprocessor without interlocked pipeline stages
MSC	Main switching centre
NTC	Negative temperature coefficient
PWM	Pulse width modulation
RISC	Reduced instruction set computing
RX	Receive
SIM	Subscriber identity module
SMS	Short message service
SPI	Serial peripheral interface
TDMA	Time division multiple access
TTL	Transistor-transistor logic
TX	Transmit
USART	Universal Synchronous/Asynchronous Receiver/Transmitter
USB	Universal serial bus
VLR	Visitor’s location register

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

Soil plays the most important part in crop production. Without having the knowledge of the current condition of the field it will be difficult to get the expected output from the fields the only solution a farmer has left with is to monitor the fields by physically going and wasting their time in fields just to check whether the soil conditions are favorable according to crop requirement or not. In this manner in the realm of web ranchers ought to likewise utilize facilities for soil checking. We are attempting to build up an answer which will check different elements like dampness, mugginess, temperature of the fields without physically going there. Also we will try to control the irrigation through our device. This project tries to make controlled environment agriculture. This project has attempted to present an efficient smart farm system. It has merged automation into several aspects of the farm. It includes an automated temperature and moisture control system. Pump is controlled based on the moisture level reading. Ultrasonic sensor is used to find the water level of reservoir. GSM module is additionally used to know about the alerts of moisture and water level in reservoir.

CHAPTER 1

1.INTRODUCTION

1.1 LITERARY REVIEW
&
BRIEF INTRODUCTION

The task of rapidly increasing yield is compounded by the present and probable impacts of climate change. Deviations in rainfall and temperature especially in exterior areas are likely to shrink production and make production more unpredictable. Contemporary estimates suggest global population will be raised from a current 7 billion to more than 9 billion people in 2050 according to UNESCO, 2012. Given both food intake trends and population growth it is the need of future generation to increase the production by 60 times by 2050 . Hence, farming in developing countries need to experience important revolution if it is to meet the growing and interconnected challenges of food anxiety and climate change. We are attempting to build up an answer which will check different elements like dampness, mugginess, temperature of the fields without physically going there. Also we will try to control the irrigation through our device. This project tries to make controlled environment agriculture. This project has attempted to present an efficient smart farm system. It has merged automation into several aspects of the farm. It includes an automated temperature and moisture control system. Pump is controlled based on the moisture level reading. Ultrasonic sensor is used to find the water level of reservoir. GSM module is additionally used to know about the alerts of moisture and water level in reservoir.

1.2Block Diagram

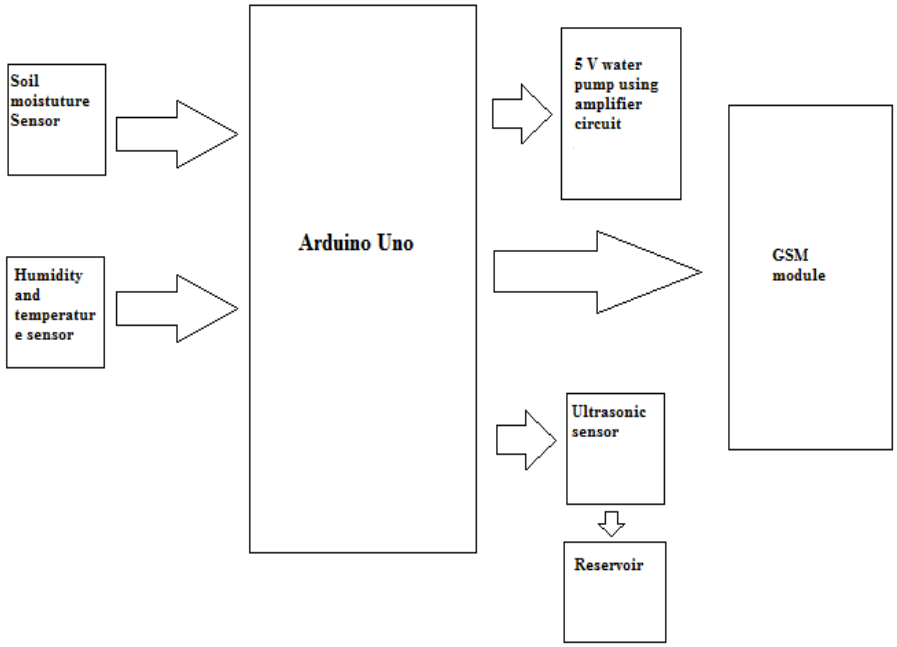


Figure 1.3 Block Diagram

In this block diagram we can see the sensors are connected with Arduino and then through amplifier it is connected to water pump. And GSM module is used for sending alerts to the user.

CHAPTER 2

2. HARDWARE DESCRIPTION

2.1 Components Used in This Project

- Arduino UNO
- ATMEGA328 Microcontroller
- Soil Moisture Sensor
- Humidity and Temperature Sensor
- Mini Water Pump
- Breadboard
- Drip Irrigation Kit
- GSM module
- Ultrasonic sensor
- Resistor
- Transistor
- 5V Power Adaptor

2.1.1 ARDUINO UNO

The Arduino Uno is a microcontroller board centered on the ATmega328. It is a complete microcontroller development platform. A USB connection or simple AC to DC adapter can power the board. Use the FTDI USB to serial driver chip is not employed in Uno making it different from the preceding boards. It features the Atmega8U2 encoded as a USB to serial converter.

Table 2.1.1: Arduino specifications

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

Arduino has fourteen digital pins that are able to offer input and can be used for providing output. 6 of them are for PWM output and other 6 are for analog inputs. It also has one slot for USB connection, crystal oscillator. There is a button for resetting. One power jack and ICSP header are also present in board.

POWER

The power source is selected by design. If power is delivered through external power source then it can be stimulated from AC to DC adapter or battery.

The power pins are as following:

VIN. 5V of information voltage is given through this pin using a voltage source.

5V. This voltage is required for functioning of microcontroller. On board regulator or a USB connection or any other 5V DC source can be used for powering the board.

3V3. A 3.3-volt supply generated by the on-board regulator. Maximum allowable current draw is 50 mA.

GND. Ground pins.

Fig. 2.1.1 Arduino UNO

CAPACITY

A blaze memory of 32 KB in Atmega328 is for stacking the code. By devouring 2 KB of SRAM and 1 KB of EEPROM, it is equipped for synchronous perused and compose with the EEPROM library. The resolution providing 1024 different values that vary from ground to five volts is offered by 10 bits of Uno's 6 analog inputs

AREF. Reference voltage for the analog inputs. Used with analog Reference().

Reset. Set LOW to reset the microcontroller.

CONTRIBUTION AND YIELD

A maximum of 40 mA of current can be drawn from every pin on applying 5V and 14 digital pins on the Uno can be utilized as an info or yield, utilizing pin Mode (), computerized Write (), and computerized Read () capacities. Inner draw up resistors of 20 to 50 K Ohms can be separated as a matter of course .

Serial: 0and 1. They are used to transmit and receive data in serial mode. These pins are linked through relating pins of the ATmega8U2 USB to TTL chip.

External Interrupts: 2 and 3. These pins are used to enact a hinder on an increasing or falling edge, an alteration in value or a low value.

PWM: 3, 5, 6, 9, 10, and 11. These pins provide **PWM** output of 8-bit by making use of analog write function.

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). Sequential exterior interface communication is handled by these pins.

LED: 13. Digital pin 13 is linked to an LED ,turns **ON** at high and **OFF** on low.

Dimensions of Arduino

Measurements of Arduino The extraordinary sizes of the Arduino Uno are of 2.1 inches wide and 2.7 inches in length with a USB connector and power jack bundling off the board.

2.1.2 ATMEGA328 MICROCONTROLLER

Atmel 8 bit AVR RISC built microcontroller has 32KB ISP flash memory with read and write simultaneous competence, 2KB of SRAM, 1KB of EEPROM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer (counters) with compare modes, serial programmable USART, internal and external interrupts, 6 channel 10 bit analog to digital converter , SPI serial port , a byte-oriented 2-wire serial interface, programmable watchdog timer with internal oscillator, and five software selectable power saving modes. Data up to 1MIPS per MHz are accomplished by implementation of influential directions in a single clock cycle, matching both the power consumption and processing speed. The device operates between 1.8 to 5.5 volts.

Table 2.1.2 ATMEGA 328 specifications

PARAMETERS	VALUE
Flash	32 Kbytes
RAM	2 Kbytes
Pin Count	28
Max. Operating Frequency	20 MHz
CPU	8-bit AVR
# of Touch Channels	16
Hardware QTouch Acquisition	No
Max I/O Pins	26
Ext Interrupts	24
USB Interface	No
USB Speed	No

2.1.3 Soil Moisture Sensor

Soil moisture sensors are used to amount the volumetric content of water in soil. Since the through gravimetric assessment of free soil moisture needs removing, drying, and weighting of a sample, soil moisture sensors will measure the volumetric water content by using some other property of the soil, such as electrical resistance of soil, dielectric constant, or interaction with neutrons, as a substitution for the moisture content. The relation among the measured property and soil moisture should be adjusted and calibrated accordingly as it may vary subject to environmental factors such as soil type, temperature, electric conductivity. Portable probe instruments may be used by farmers or gardeners.

Figure 2.1.3 Soil Moisture Sensor

This is a simple water sensor, that can be utilized to detect soil moisture. The output of this sensor will be high for high moisture value in some sensors or may be vice versa according to sensor's configuration. It can also be used in module plant watering device, and then the plants in your garden requires no need people to manage.

1. Modifiable sensitivity by adjusting the digital potentiometer
2. Twin output mode that is digital and analog. Analog interfacing may be used for accurate output.
3. A soil probe can be placed in the soil to be observed.
4. With power indicator.

5. Having LM393 comparator chip (stable).

The soil moisture sensor can easily be interfaced to any microcontroller by its digital pin if we want the output to be digital such that to put on and off the water pump according to the water content.

Table 2.1.3 Technical parameters of soil sensor

Vcc	3.3v to 5v
Gnd	GND
DO	Digital output interface(0 and 1)
Soil Probe Dimension	6 x 2 cm
Panel PCB Dimension	3 x 1.5 cm
AO	Analog output interface
Net weight	21 g

2.1.4 Humidity and Temperature Sensor

DHT11 temperature and humidity sensor is a combined sensor that give a reading of a of the temperature and humidity in digital form at console. Through dedicated digital modules that collect the temperature and humidity sensing, the reliability and long term stability is ensured. A resistive intellect of wet machineries and the NTC temperature measurement devices are interfaced with a high-performance 8-bit microcontroller.

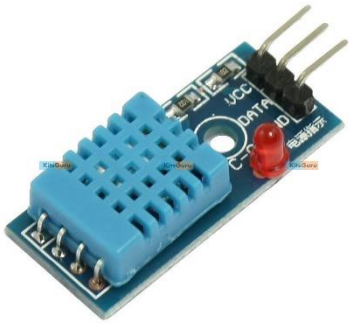


Figure 2.1.4 Humidity and Temperature Sensor

Cheap in cost, relative humidity and temperature measurement using thermistor, long term constancy, brilliant quality, instant response, long range signal broadcast, strong anti-interference skill, digital signal output and exact calibration are its features.

This sensor measures humidity in form of relative humidity. DHT11 sensor has two electrodes between which the electrical resistance will be measured according to the ambience. There is a substrate which absorb vapours and when it does so the ions will be released which will result in the enhancement of conductivity between electrodes (these electrodes are over the substrate). This change in resistance is calibrated in such a way that it becomes equivalent to relative humidity.

Whereas temperature is measured by thermistor fitted in it.

Table 2.1.4 Technical parameters of humidity sensor

Power supply Output signal	3 -5.5 v Dc Digital signal via single-bus
Sensing element	Polymer resistor
Measuring range Humidity hysteresis	Humidity 20-90%RH ; temperature 0-50 C +-1%
Long term Stability	+-0.5%
Sensing period	2s

2.1.5 Ultrasonic Sensor

Ultrasonic sensor is a device which can be used to measure distance of any objects. This sensor measures distance with the help of sound waves. It sends a high frequency sound wave from one of the opening and then it will calculate the time this wave takes to reflect from the object and come back to the second opening of sensor.

As the speed of sound is 341 meters/second and the time between reflection from object and sending of pulse is known by the sensor. Then by using this information the distance of the object will be determined by using the following formulae:

Distance=Time * Speed of sound/2

Where, time=duration between sending and receiving of pulse

And Speed=341 m/s which is divided by 2 because wave travels both ways during sending and reflection

Figure 2.1.5 Ultrasonic Sensor

Ultrasonic sensor can detect distance from range of 2 cm to 400 cm with ranging efficiency up to 3mm. It has effectual angle less than 15 degrees. It works at a 5V power supply.

This sensor has been used in "Crop Surveillance and irrigation system" to detect the water level of the reservoir. With the help of this one can know if the water level is below threshold mark (can be set according to reservoir depth) or above threshold. If the water level is below

threshold, then a warning can be sent or a motor can be started to refill the reservoir from water resource.

Table 2.1.5 Technical Parameters of ultrasonic sensor

Electrical Parameters	Values
Working Voltage	5V DC
Working Current	15 mA
Working Frequency Max Range Min Range	40Hz 4m 2cm
Measuring Angle	15 degree
Trigger Input Signal	10 micro seconds TTL pulse
Dimension	45*20*15mm
Output Echo Signal	Output TTL level signal, proportional With range

2.1.6 GSM module

GSM stands for global system for mobile communication which uses time division multiple access. Finland was the first country which has used GSM and till now almost every part of the world uses GSM. GSM is a second generation mobile network telecommunication system. It does not include third generation mobile telecommunication or 4G LTE.

In GSM module SIM card can be added like mobiles. After inserting a SIM, it can be used for connecting two SIM's via network for data sharing.

Fig 2.1.6.1 GSM module

GSM module's uses are following

- Adding, reading and searching in phonebook saved in SIM.
- Making or rejecting voice calls.
- To send or receive data from Arduino or computers in form of SMS.

AT commands are needed to be sent from computers or Arduino to build to build up connection among module and computers.

We have used GSM module to send the information that is being collected by all the sensors we have used to notify the farmer. So that he/she knows the current status of fields and reservoir i.e. whether reservoir is filled or going to be empty.

Now let us see how GSM module works.

When we insert SIM card in a GSM module then it becomes ready to use. Whenever GSM module is asked to send a message it first searches for a network on which it is registered. To Find network base transceiver station(BTS) sends it frequency correction channel at regular intervals to make sure that it will find the frequency for downlink reception. This will also adjust its frequency oscillator for uplink transmission and it will pick up the strongest received signal. Then synchronization channel(SCH) will help it to synchronize to timeslot zero that is being sent out by BTS.This SCH has a TDMA frame number and a base station identity code containing basic information about the operator which can be compared with information of SIM card. After this GSM module will know whether correct network is chosen or not. After this it will enter in the cellular network from where base station controller (BSC) will find a channel which sends the recipients mobile number to main switching centre (MSC).Here the subscribers details will be validated on basis of its two databases which are VLR(Visitors location register) and EIR(Equipment identify register).VLR has all the details such as home country code, network operator ID and mobile phones unique ID of all the users which are currently using the MSC's services. Then it will see in EIR if the device has been stolen or cloned. Then after authentication MSC will tell device that the connection can continue and asks BSC to assign encryption and voice channels in case of calls.

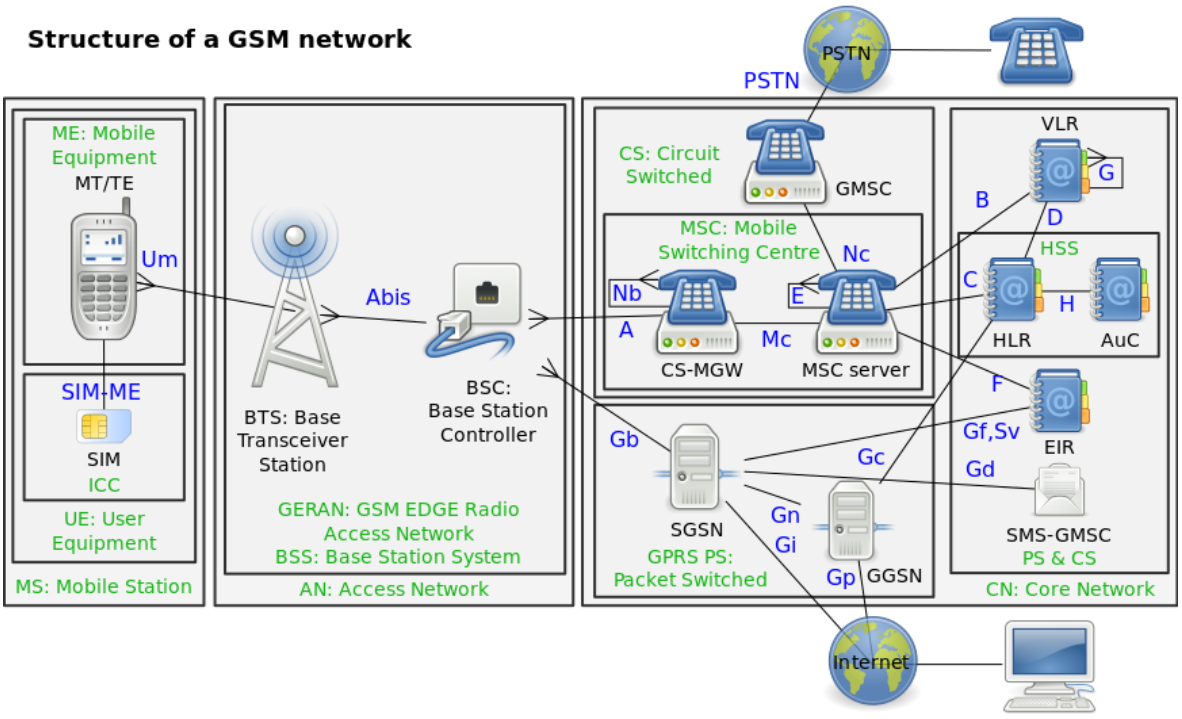


Fig 2.1.6.2 Working of GSM module

Then HLR (home location register) uses the receiver's phone number to find associated IMSI and current location of receiver. After finding this information they are forwarded to the related MSC's which generates a MSRN (mobile station roaming number) code and then pass it back to HLR to the awaiting MSC. Then call will successfully rooted across the network and then the serving MSC will examine its own VLR to find receiver's area code. Once this information is found then the MSC will broadcast the receiver's IMSI to all bear station in that area if a matching device recognize this page then ringtone in receiver's phone will start and call is made.

CHAPTER 3

3. Design Overview

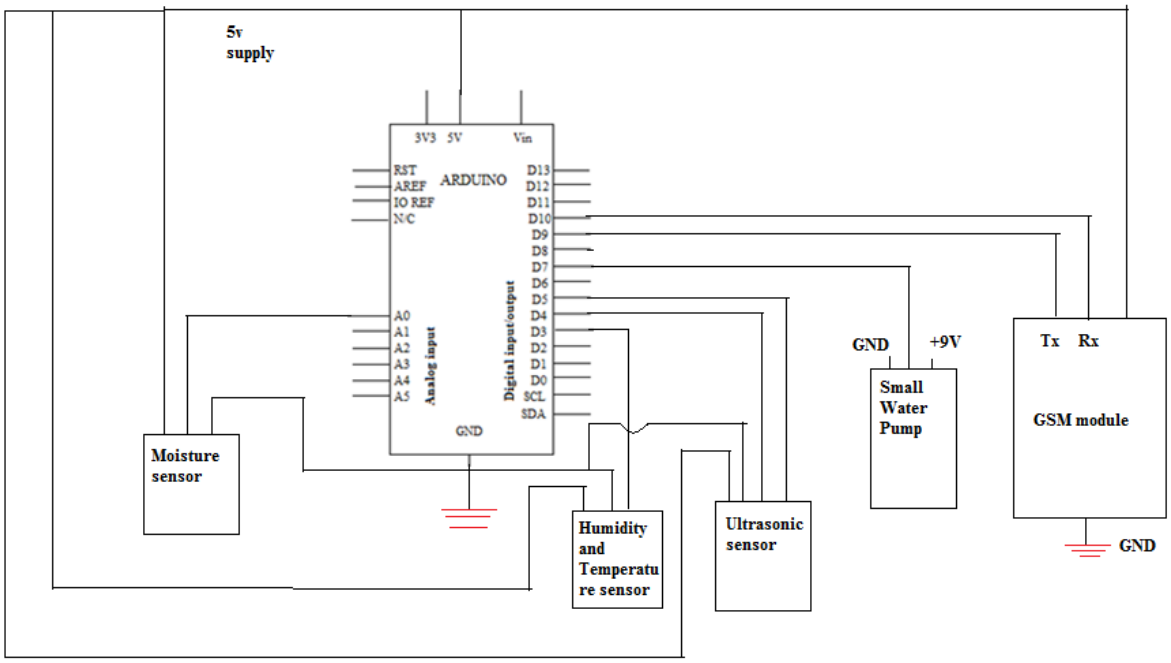


Figure 3.1 Circuit diagram

Soil dampness sensor is associated with analog pin 0 and it is associated with 5 volt VCC and ground GND of Arduino. Dampness sensor is associated with advanced pin number 7 and it is likewise associated with 5 volt VCC and GND of Arduino. From pin number 13 smaller than usual water pump is associated through 1 kilo ohm resistor and a transistor which will work under regular producer setup and go about as a speaker. The readings of both the sensors will be shown on Arduino IDE programming's screen.
As soil moisture will give readings and if these readings are above threshold limit set by the user in code. Then 13th pin will become high and it will complete the circuit and pump will start working. The ultrasonic sensor is connected to pin number 4,5 and as soon as the water level will decrease or increase it will turn on LED or we can use a motor connected to natural resource to fil up the reservoir.

The GSM module Sim 800's TX and RX pins are connected to pin number 9,10 respectively and the required voltage has been provided. This can be used to send alert messages to the user of the moisture content and the water level of the reservoir.

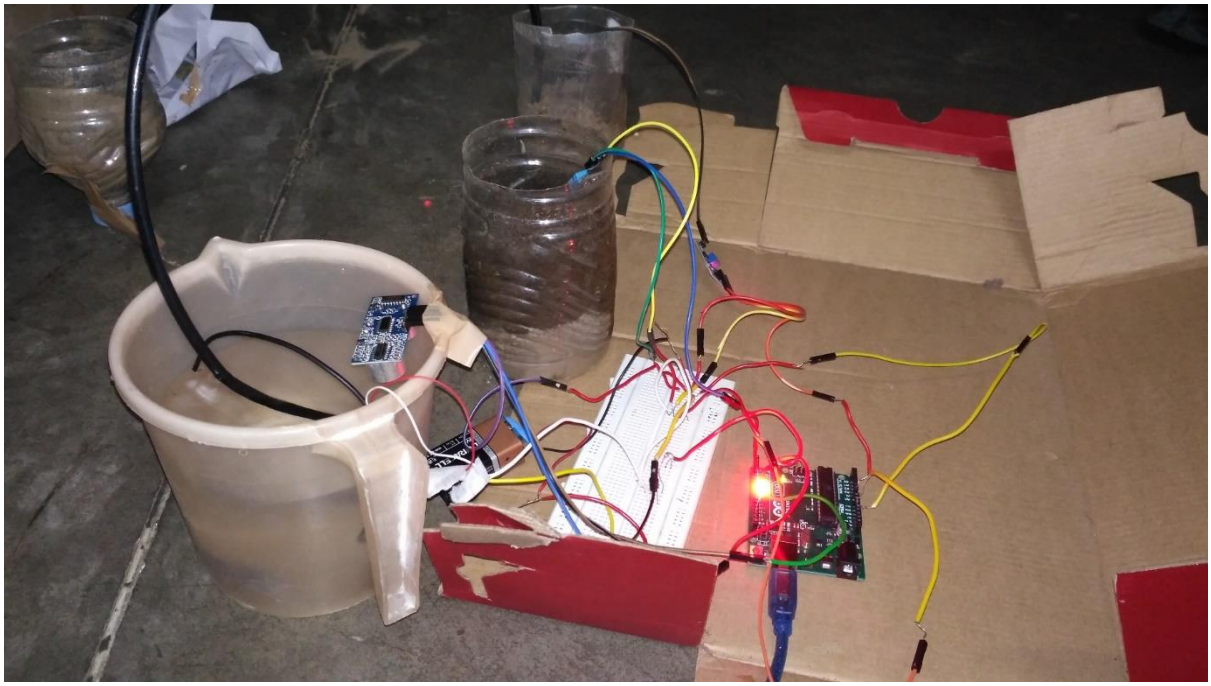


Figure3.2 Practical Circuit

CHAPTER 4

4. Algorithm and Flowchart

4.1 Algorithm

1. Define **DHT11_PIN 3** ,**echopin 9** ,**trigpin** 8 and initialize **MOISTURE**=0, **THRESHOLD**=750, **maximumRange** = 55.

2. Set the baud rate of GSM Module and Serial Monitor (Arduino).

3. Set pin13, pin7, trigpin, as output.

4. Set echopin as INPUT.

5. \\ For sending text

   Set the GSM Module in Text Mode.
   Put the Mobile Number.
   Text to be sent.
   ASCII code for ctrl+z.

6. \\ For ultrasonic sensor

   Set trigpin low.
   Set trigpin high.
   Calculate and Print Distance.

7. Read value of Humidity and Temperature (from pin 3).

8. Print Humidity and Temperature.

9. Read value of Moisture (from pin0).

10. Print MOISTURE.

11. Is MOISTURE < THRESHOLD.

    If Yes Start the pump.

    Send message to user.

    Else

    Stop the pump.

12. Is Distance >= 25.

    If Yes turn on the LED

    Print ("going to be empty”)

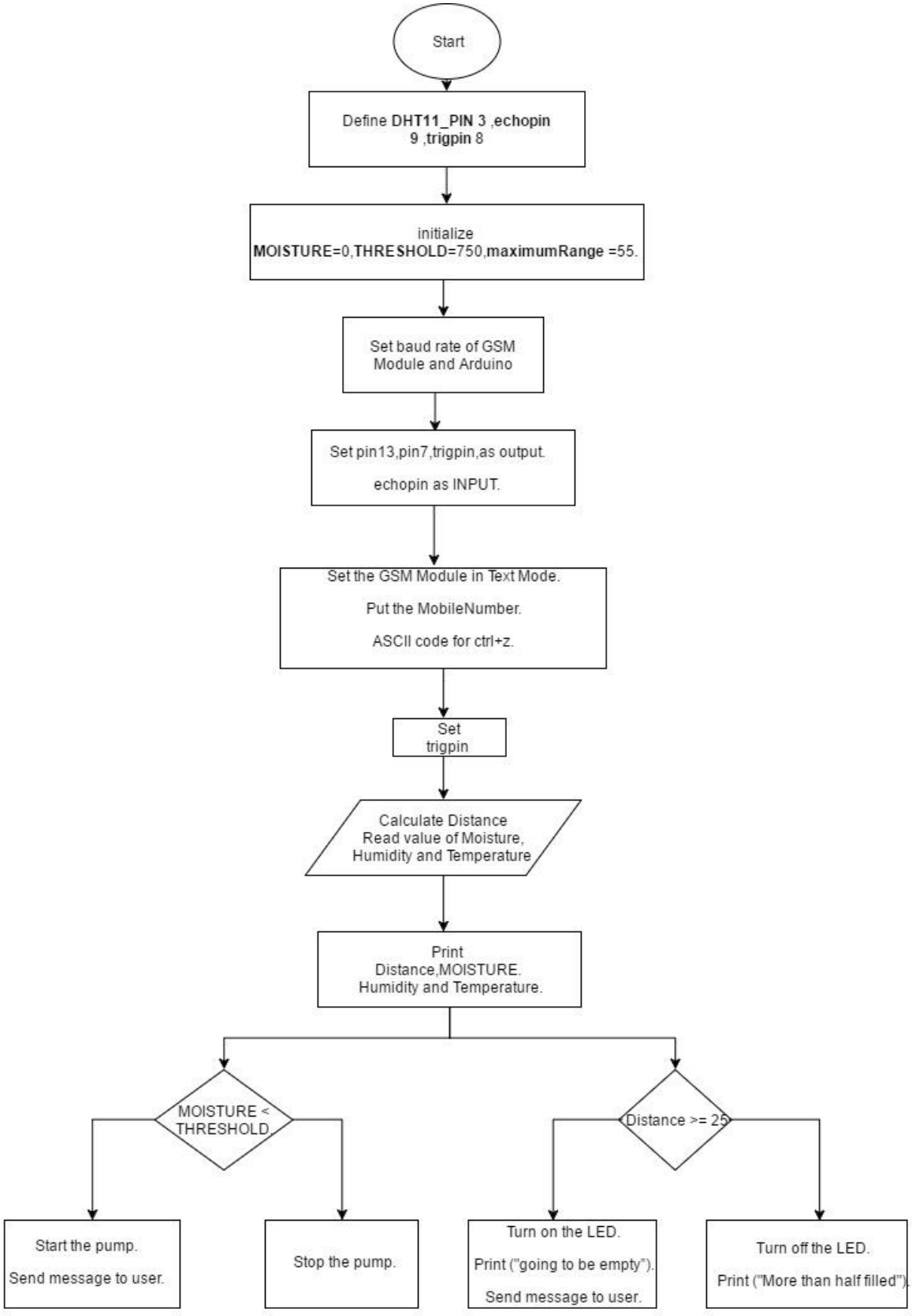
    Send message to user.

    Else turn off the LED

    Print ("More than half filled")

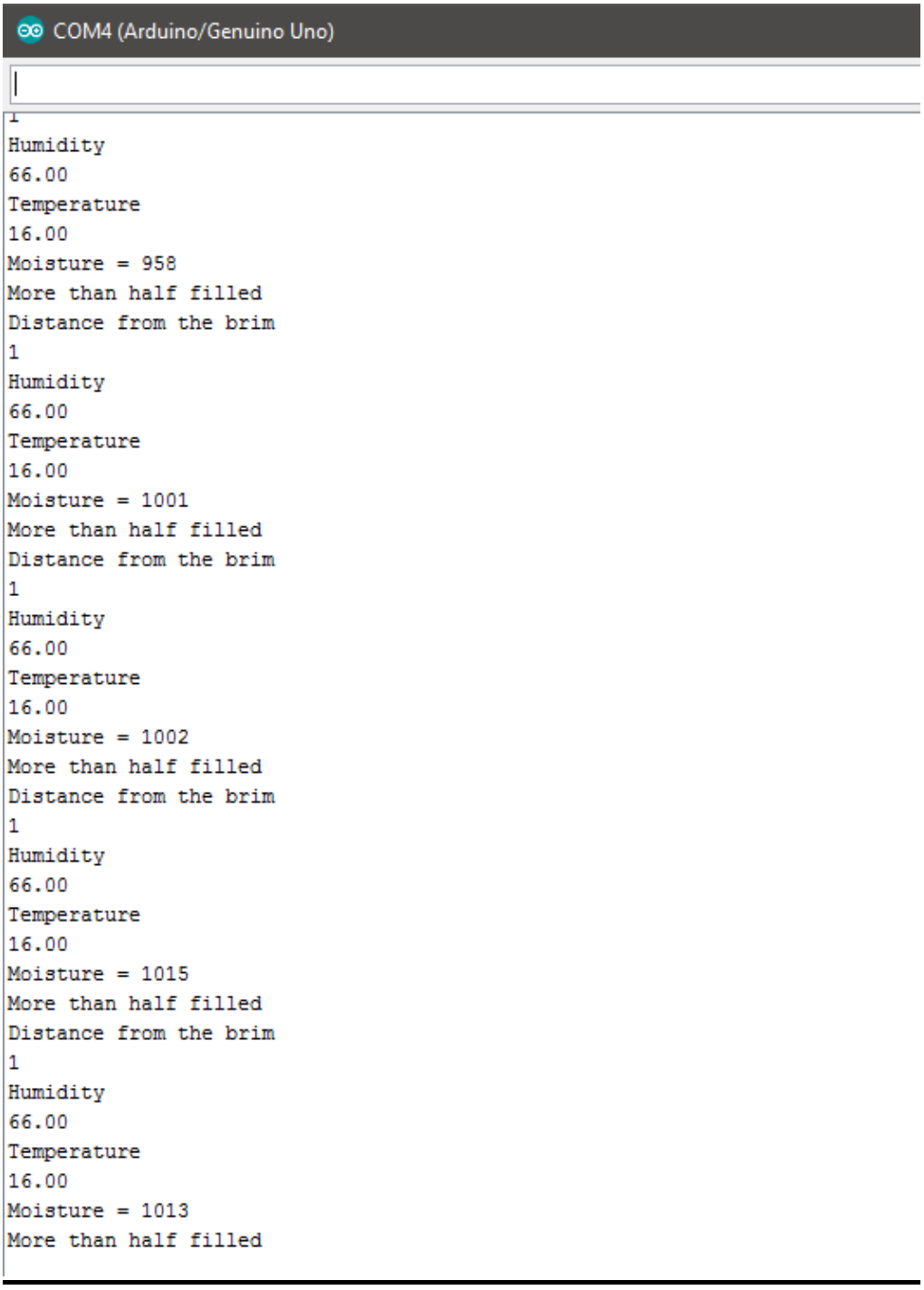
13. Delay

4.2 Flow Chart



5. Result & conclusion

Table 5.1 Result



As the soil moisture sensor we have used will give values according to the resistance of the soil, higher the moisture lower will be the value shown on the console and vice versa.

At higher values as shown in console indicates the moisture is low and at this stage pump starts working.

Also with the help of ultrasonic sensor the result will be shown as “More than half filled” when water level is sufficient in reservoir and “Reservoir going to be empty” if water level is not sufficient. The GSM module will send us alert message in both the cases i.e. if moisture is low and if water content is low.

5.1 Conclusion

Crop surveillance and irrigation system is capable of creating a controlled environment agriculture system where the variables such as soil moisture, humidity, temperature can be monitored. Subsequently, these variables can be controlled for maximum yield of the crop. In addition to this, all the data recorded by the sensors is translated for the user and made available on his/her mobile phone via trusted mobile communication networks. This employs the use of GSM since it's available with every user. Ease of use, widespread network, cheap availability are some other factors that support this mode of communicating the information to the user. This system can be further integrated with sensors to monitor light, pH of the soil etc. and control the same using controlling elements such as fans, bulbs for heat and light. Furthermore, a feature of remote control through SMS commands over the GSM networks will put all the control in the user's hand.

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Appendix

Data sheet of GSM module

Operating Modes

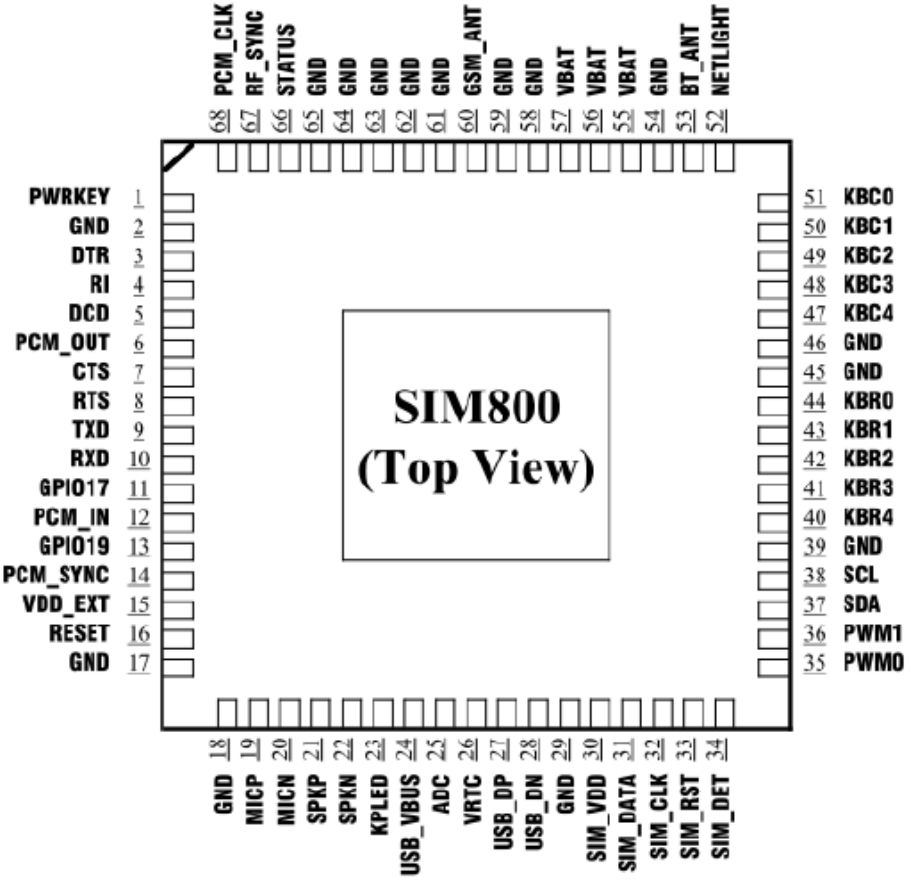
The table below summarizes the various operating modes of SIM800.

Overview of operating modes

Mode	Function	
Normal operation	GSM/GPRS SLEEP	Module will automatically go into sleep mode if the conditions of sleep mode are enabling and there is no on air and no hardware interrupt (such as GPIO interrupt or data on serial port). In this case, the current consumption of module will reduce to the minimal level. In sleep mode, the module can still receive paging message and SMS.
	GSM IDLE	Software is active. Module registered to the GSM network, and the module is ready to communicate.
	GSM TALK	Connection between two subscribers is in progress. In this case, the power consumption depends on network settings such as DTX off/on, FR/EFR/HR, hopping sequences, antenna.
	GPRS STANDBY	Module is ready for GPRS data transfer, but no data is currently sent or received. In this case, power consumption depends on network settings and GPRS configuration.
	GPRS DATA	There is GPRS data transfer (PPP or TCP or UDP) in progress. In this case, power consumption is related with network settings (e.g. power control level); uplink/downlink data rates and GPRS configuration (e.g. used multi-slot settings).
Power off	Normal Power off by sending the AT command "AT+CPOWD=1" or using the PWRKEY. The power management unit shuts down the power supply for the baseband part of the module, and only the power supply for the RTC is remained. Software is not active. The serial port is not accessible. Power supply (connected to VBAT) remains applied.	
Minimum functionality mode	AT command "AT+CFUN" can be used to set the module to a minimum functionality mode without removing the power supply. In this mode, the RF part of the module will not work or the SIM card will not be accessible, or both RF part and SIM card will be closed, and the serial port is still accessible. The power consumption in this mode is lower than normal mode.	

Package Information

Pin Out Diagram



Pin Description

Pin description

Pin name	Pin number	I/O	Description	Comment
Power supply				
VBAT	55,56,57	I	SIM800 supplies 3 VBAT pins, and the power range is from 3.4V to 4.4V. Power supply should provide sufficient current so that the module can work normally; the peak current is nearly 2A.	Zener diode is Strongly recommended to anti surge on VBAT.
VRTC	26	I/O	Power supply for RTC	It is recommended to connect VRTC to a battery or a capacitor (e.g. 4.7uF).
VDD_EXT	15	O	2.8V power output	Keep floating if unused.
GND	2,17,18,29,39,45,46,54,58,59,61,62,63,64,65		Ground	GND for VBAT recommend to use 62, 63, 64, 65 pin .
Power on/off				
PWRKEY	1	I	PWRKEY should be pulled low at least 1 second and then released to power on/down the module.	Internally pulled up to VBAT.
Audio interface				
MICP	19	I	Differential audio input	Keep floating if unused.
MICN	20			
SPKP	21	O	Differential audio output	
SPKN	22			
PCM interface				
PCM_OUT	6	O	PCM interface for audio	Keep floating if unused.
PCM_IN	12	I		
PCM_SYNC	14	O		
PCM_CLK	68	I		
Keypad interface				
KBC4	47	I	Support up to 50 buttons (5*5*2)	Keep floating if unused. (KBC0 can not be pulled down).
KBC3	48	I		
KBC2	49	I		
KBC1	50	I		
KBC0	51	I		
KBR4	40	O		

KBR3	41	O		
KBR2	42	O		
KBR1	43	O		
KBR0	44	O		
GPIO				
GPIO17	11	I/O	Programmable general purpose input and output.	
GPIO19	13	I/O		
NETLIGHT	52	O	Network status	Can not multiplex with GPIO function.
STATUS	66	O	Power on status	
Serial port				
DTR	3	I	Data terminal ready	Keep floating if unused.
RI	4	O	Ring indicator	
DCD	5	O	Data carrier detect	
CTS	7	O	Clear to send	
RTS	8	I	Request to send	
TXD	9	O	Transmit data	
RXD	10	I	Receive data	
USB interface				
USB_VBUS	24	I	Debug and firmware upgrading	Keep floating if unused.
USB_DP	27	I/O		
USB_DN	28	I/O		
ADC				
ADC	25	I	10 bit general analog to digital converter	Keep floating if unused.
PWM				
PWM0	35	O	Pulse-width modulation, multiplex with GPIO22.	Keep floating if unused.
PWM1	36	O	Pulse-width modulation, multiplex with GPIO23.	
I2C				
SDA	37	I/O	I2C serial bus data	Internal pulled up to 2.8V via 4.7KΩ
SCL	38	O	I2C serial bus clock	
SIM interface				
SIM_VDD	30	O	Voltage supply for SIM card. Support 1.8V or 3V for SIM card	All signals of SIM interface should be protected against ESD with a TVS diode array.
SIM_DATA	31	I/O	SIM data input/output	
SIM_CLK	32	O	SIM clock	
SIM_RST	33	O	SIM reset	
SIM_DET	34	I	SIM card detection	
Antenna				
GSM_ANT	60	I/O	GSM antenna port	Impendence must be controlled to 50Ω.
BT_ANT	53	I/O	Bluetooth antenna port	Impendence must be controlled to 50Ω.
RF synchronization				
RF_SYNC	67	O	RF burst synchronous signal	Do not pull up
Other signal				
RESET	16	I	Reset input(Active low)	
KPLED	23	I	Drive keypad backlight	

CODE

```
#include<dht.h>
#include <SoftwareSerial.h>
SoftwareSerial mySerial(9, 10); // RX, TX
dht DHT;
#define DHT11_PIN 3
#define echopin 5 // echo pin
#define trigpin 4// Trigger pin
const int MOISTURE = 0;
const int THRESHHOLD = 750;
int maximumRange = 55;
long duration, distance;
void setup()
{
mySerial.begin(9600);
Serial.begin(9600);
pinMode(13, OUTPUT);
pinMode(7, OUTPUT);
pinMode (trigpin, OUTPUT);
pinMode (echopin, INPUT );
}void LedState(int state)
{
  digitalWrite(13,state);
}void loop()
{   digitalWrite(trigpin,LOW);
delayMicroseconds(2);
digitalWrite(trigpin,HIGH);
delayMicroseconds(10);
duration=pulseIn (echopin,HIGH);
distance= duration/58.2;
delay (20);
Serial.println("Distance from the brim");
Serial.println(distance);
```

```
int chk=DHT.read11(DHT11_PIN);
Serial.println("Humidity");
Serial.println(DHT.humidity);
Serial.println("Temperature");
Serial.println(DHT.temperature);
 int moisture = analogRead(MOISTURE);
 Serial.print("Moisture = ");
  Serial.println(moisture);
  if(moisture > THRESHHOLD)
  {    digitalWrite(7,HIGH);
SendMessage1();
  }  else
  {digitalWrite(7,LOW);}
  if (distance >= 25 ){
Serial.println("going to be empty");
LedState(HIGH);
SendMessage2();
}else if (distance <=10) {
Serial.println("More than half filled");
 LedState(LOW);
} delay(2000);}}
Void SendMessage1()
{
mySerial.ptintln(“AT+CMGF=1”);
  mySerial.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
  delay(1000);  // Delay of 1000 milli seconds or 1 second
  mySerial.println("AT+CMGS=\"+91xxxxxxxxxx\"\r"); // Replace x with mobile number
  delay(1000);
  mySerial.println("Moisture is low");// The SMS text you want to send
  delay(100);
   mySerial.println((char)26);// ASCII code of CTRL+Z
  delay(1000);
}
```

```
Void SendMessage2()
{
mySerial.ptintln(“AT+CMGF=1”);
  mySerial.println("AT+CMGF=1");    //Sets the GSM Module in Text Mode
  delay(1000);  // Delay of 1000 milli seconds or 1 second
  mySerial.println("AT+CMGS=\"+91xxxxxxxxxx\"\r"); // Replace x with mobile number
  delay(1000);
  mySerial.println("Reservoir going to be empty-Please refill");// The SMS text you want to send
  delay(100);
   mySerial.println((char)26);// ASCII code of CTRL+Z
  delay(1000);
}
```

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