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GSM Technology Based Controlling of Intelligent Irrigation Water System

Abstract—**Agriculture, the principle livelihood of thousands and thousands relies upon mostly on the ordinary deliver of water. With speedy depleting clean water resources, the want of the hour is effective utilization of water. Till currently farmers were irrigating the use of water while and anyplace needed by using manually switching on or off the motor pumps. This required constant tracking of the water supply and also there have been problems of electricity supply now not being available throughout day instances. With the creation of cutting-edge techniques like drip water irrigation or even fertilizer deliver being accomplished together with water, we wished automation strategies. Far off monitoring and control had been introduced because of non-availability of cheap human resources. Now it's far being brought in all places for efficient usage of water. Creation water is an important for agriculture motive and has a considerable impact on yield and first-class of plants, as scarcity of water become the worldwide problem, usage of it at some stage in irrigation will become the concern aspect in modern-day scenario. Boom in populace and demand of food outcomes in fast increase in food manufacturing era. Automation of agriculture process is the want of the hour for effective usage of water sources for increasing the financial yield and financial viability. In place of the manual supply of water, utilization of automation effects in elevated yield and powerful usage of water. We are featuring using sensors to test the humidity of the soil for switching at the motor whilst required. Literature survey the designed machine obtains the temperature, air humidity, daylight density and co2 density with automated precision irrigation gadget inside**

the contemporary greenhouse environment. The results of the device in increase of transpiration pace of crops.

Keywords: ***Automation, embedded, water, pumps, fertilizer***

I. INTRODUCTION

Agriculture performs the important function within the economy and improvement of the United States like India. In our (U.S.A) the farmers were using manual manage

Techniques for irrigation. Land is irrigated only at the normal durations/seasons. On this procedure, few plant life within the sector acquire greater water and for few other region flora water reaches past due because of which the vegetation get dried. There may be a need within the residential/industrial irrigation enterprise for an irrigation controller that responds to soil moisture sensors in man or woman zones as a way of keeping water. An ideal controller must be "consumer friendly", easy to application and requiring a minimum quantity of keys or push-buttons to operate the controller. It have to additionally allow irrigation to take region in zones wherein watering is needed, while bypassing zones in which ok soil moisture is indicated- to add flexibility, it need to be viable to selectively deactivate any of the moisture sensors to thereby override the amendment to the controller performance caused by sensor inputs. The pesticide sprinkling mechanisms on this gadget sprays the pesticide mixture in the ratio deserved by way of the plant life. Moreover, the device should be easy to trouble shoot in the event of faults in any of the plurality of zones.

II. SYSTEM OVERVIEW

Using the soil moisture level sensor, the system measures the moisture content of the soil and accordingly takes decision when to supply water. As a result, the first pump, gets activated. The system also checks the water level in the reservoir before supplying water from the main tank. If in case, the water of the tank is below the lowest level, at first the system fills the tank from the

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reservoir with the help of a second pump. When the water level in the tank just touches the highest level, the system stops the second pump and checks for the water level at the highest level. Once it receives the confirmation of the water level, it supplies water to the crop with the help of the first pump. The moisture range of the concerned crop will be pre-programmed in the system. As soon as the moisture reading goes below the specific range, the system delivers water to the concerned crop until the moisture of the soil reaches the moisture content required by the concerned crop. Simultaneously, the farmer always has the power of manually over riding the system, for instance if he wishes not to irrigate the cropeven if the moisture content of the soil is below par value as required by the crop, he can just send a message to the system via GSM module, specifying "NO" , thereby stopping the entire system.

III. HARDWAREDETAILS

A. Arduino UNO R3 Arduino is an open-source physical processing which is based on a microcontroller board and an incorporated development environment for the board to be programmed. It takes in a few inputs, for instance, switches or sensors, and monitors a few multiple outputs, for example, lights, engine and others. Arduino is a cross-platform app as its programs can run on Windows, Macintosh and Linux operating systems (OS) contrary to most microcontrollers' frameworks which run only on Windows. It is a very sophisticated physical processing stage focused around a straightforward microcontroller board, and an environment for writing programs for the board. Inexpensive - Arduino boards are moderately cheap as compared to other microcontroller boards. The cheapest version of the Arduino module can be designed by hand, and even the preassembled Arduino modules cost around $50. Cross-platform - The Arduino programs runs in multiple operating systems like Windows, Macintosh OSX, and Linux. So we conclude that Arduino has an advantage over most microcontroller boards which are constrained to only Windows. Straightforward, clear programming method - The Arduino programming environment is easy to use for beginners, yet sufficiently diverse for cutting edge customers to adventure as well. For educators, it is favorably involved around the Processing programming environment, so users finding ways to understand the programming algorithms and syntax in that environment will be accustomed with the nature of Arduino. Open source and extensible programming - The Arduino program language is available for development by veteran engineers. The lingo can be accessed through C++ libraries or header files and people expecting to understand the specific purposes of different interests can shift from Arduino to the AVR C programming language on which it is based. Basically, one can incorporate AVR-C code clearly into one's Arduino programs if he/she wants to do so. Open source and extensible hardware - The Arduino is solely based on Atmel's Atmega8 and Atmega168 microcontrollers. The plans for the modules are circulated under a Creative Commons license, so experienced circuit designers can make their own particular interpretation of the module, work on it, extending and improving it. Slightly inexperienced customers can make variations to the breadboard of the module, keeping in mind the main objective to perceive how it capacities and save money and timecommunication. GSM Module consists of mobile the station, Base station and Network subsystem. Here the GSM Module is used to send SMS alerts and also helps the user to manually override the system.

(i) ARDUINO:

Arduino is an open-source hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. Its hardware products are licensed under a CC BY-SA license, while software is licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially from the official website or through authorized distributors.Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ('shields') or breadboards (for prototyping) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs. The microcontrollers can be programmed using the C and C++ programming languages,

(ii) GSM MODULE

TTL SIM800 GSM module. The SIM800 is a complete Quad-band GSM/GPRS Module which can be embedded easily by customer or hobbyist. SIM900 GSM Module provides an industry-standard interface; the SIM800 delivers GSM/GPRS

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850/900/1800/1900MHz performance for voice, SMS, Data with low power consumption. The design of this SIM800 GSM Module is slim and compact. It is easily available in the market or online from amazon.

The SIM800L module supports quad-band GSM/GPRS network, available for GPRS and SMS message data remote transmission. The SIM800L communicates with microcontroller via UART port, supports command including 3GPP TS 27.007, 27.005 and SIMCOM enhanced AT Commands.

(iii) RESISTOR

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

(iv) RELAY

The main purpose of a relay is switching. Relay is a device which provides connection between two or more points or device in response to the input given to the relay. The other way of using of relay provides isolation between the controller and the device as we know devices may work on AC as well as on DC.

(v) DIODE (IN4007)

In electronics, a diode is a two-terminal electronic component that conducts primarily in one direction (asymmetric conductance), it has low (ideally zero) resistance to the flow of current in one direction, and high (ideally infinite) resistance in the other. A semiconductor diode is a crystalline piece of semiconductor material with a p-n junction connected to two electrical terminals.

(vi) SUBMERSIBLE MOTOR

A submersible motor is a device which has a hermetically sealed motor close-coupled to the pump body. The whole assembly is submerged in the fluid to be pumped. The main advantage of this type of pump is that it prevents pump cavitation, a problem associated with a high elevation difference between pump and the fluid surface. Submersible pumps push fluid to the surface as opposed to jet pumps having to pull fluids. Submersibles are more efficient than jet pumps.

(vii) SOIL MOISTURE SENSOR

NTC thermistor temperature sensor module is low price, small size module. It's miles very touchy to ambient temperature. It's miles normally used to discover the temperature of the surrounding environment. Through potentiometer adjustment, it is feasible to change the temperature detection threshold. The temperature detection range of the module is among 20 and 80 ranges Celsius. Usually, the 4 wire method of thermistor dimension is the most correct due to the fact there's efficaciously no modern flowing in either of the measurement cable wires and therefore no introduced resistance due to the cable wires. Soil moisture sensor the soil moisture sensor consists of probes which can be used to degree the volumetric content material of water. The two probes permit the contemporary to skip thru the soil after which it receives the resistance fee to degree the moisture price. Whilst there's more water, the soil will behavior more energy which means that there could be much less resistance. Therefore, the moisture level may be better. Dry soil conducts power poorly, so while there can be much less water, then the soil will conduct less electricity because of this that there might be greater resistance. Consequently, the moisture level will be decrease. That is an smooth to apply virtual soil moisture sensor. Just insert the sensor inside the soil and it may measure moisture or water level content material in it. It offers a virtual output of 5v while moisture stage is high and 0v while the moisture stage is low inside the soil. The sensor includes a potentiometer to set the favored moisture threshold. While the sensor measures more moisture

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than the set threshold, the virtual output is going high and an led shows the output. When the moisture in the soil is less than the set threshold, the output stays low. The virtual output may be connected to a micro controller to sense the moisture level. The sensor additionally outputs an analog output which can be related to the ADC of a micro controller to get the precise moisture level in the soil.

(viii) SYSTEM DESCRIPTION

The whole circuit has been constructed keeping accuracy, time saving and cost in mind. The whole system is automated. The moisture sensor reads the moisture of the soil and sends the data to the microcontroller, which is the Arduino here. The feasible moisture level/range, of the concerned crop is pre-programmed in the Arduino. As soon as the Arduino receives data, from the moisture sensor, outside the normal level/range, the Arduino sends SMS alert to the owner of the crop, with the help of the GSM module. After the alert, the Arduino, with the help of the relay module, switches on the first pump, which is constructed here by a DC motor, and supplies the crop water until the reading from the moisture sensor reaches the normal level/range. If the water in the tank is below the low level, which is being measured by the water level circuit, the signal is sent to Arduino, which further sends an SMS alert to the owner of the crop, with the help of the GSM module. After the alert, the Arduino, with the help of the relay module, switches on the second pump, which includes another DC motor, and fills the tank with water from the reservoir. When the water reaches the highest level in the tank, which is measured by the water level circuit, the Arduino gets the signal and again sends SMS alert to the owner of the crop. After SMS alert, the Arduino switches off the second pump, with the help of the relay module. Then the Arduino switches on the first pump, with the help of the relay module and supplies water to the concerned crop. The moisture sensor always checks the moisture of the soil. So the moment, the moisture of the soil lowers, the system operates. As a result, the crop will always get water supply when needed. Furthermore suppose the farmer doesn't want to irrigate the crop at the current moment. Our system has another facility of manually over riding where the Arduino on receiving the string "NO" from the GSM module exits the loop and the system is stopped. The entire process continues every 5 minutes.

IV. CODE

```
#include<SoftwareSerial.h>
SoftwareSerial Serial1(2,3);
#include<LiquidCrystal.h>
LiquidCrystal lcd(14,15,16,17,18,19);
int led=13;
int flag=0;
String str="";
#define motor 11
#define sensor 7

void setup()
{
  lcd.begin(16,2);
  Serial1.begin(9600);
  Serial.begin(9600);
  pinMode(led, OUTPUT);
  pinMode(motor, OUTPUT);
  pinMode(sensor, INPUT_PULLUP);
  lcd.print("Water Irrigaton");
  lcd.setCursor(4,1);
  delay(2000);
  lcd.clear();
  lcd.print("Bytroners");
  lcd.setCursor(0,1);
  lcd.print("Welcomes You");
  delay(2000);
```

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```
  gsmInit();
  lcd.clear();
  lcd.print("System Ready");
}
void loop()
{
    lcd.setCursor(0,0);
    lcd.print("Automatic Mode    ");
    if(digitalRead(sensor)==1 && flag==0)
    {
      delay(1000);
      if(digitalRead(sensor)==1)
      {
        digitalWrite(led, HIGH);
        sendSMS("Low Soil Moisture detected. Motor turned ON");
        lcd.begin(16,2);
        lcd.setCursor(0,1);
        lcd.print("Motor ON");
        digitalWrite(motor, HIGH);
        delay(2000);
        flag=1;
      }
    }
    else if(digitalRead(sensor)==0 && flag==1)
    {
      delay(1000);
      if(digitalRead(sensor)==0)
      {
        digitalWrite(led, LOW);
        sendSMS("Soil Moisture is Normal. Motor turned OFF");
        digitalWrite(motor, LOW);
        lcd.begin(16,2);
        lcd.print("Motor OFF");
        lcd.setCursor(0,1);
        lcd.print("Motor OFF");
        delay(2000);
        flag=0;
      }
    }
}
void sendSMS(String msg)
{
  lcd.clear();
  lcd.print("Sending SMS");
  Serial1.println("AT+CMGF=1");
  delay(500);
  Serial1.print("AT+CMGS=");
  Serial1.print("");
  Serial1.print("+919xxxxxxxxx");    // your number
  Serial1.print("");
  Serial1.println();
  delay(500);
  Serial1.println(msg);
  delay(500);
```

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```
  Serial1.write(26);
  delay(1000);
  lcd.clear();
  lcd.print("SMS Sent");
  delay(1000);
  lcd.begin(16,2);
}
void gsmInit()
{
  lcd.clear();
  lcd.print("Finding Module..");
  boolean at_flag=1;
  while(at_flag)
  {
    Serial1.println("AT");
    while(Serial1.available()>0)
    {
      if(Serial1.find("OK"))
      at_flag=0;
    }
    delay(1000);
  }
  Serial1.println("ATE0");
  lcd.clear();
  lcd.print("Finding Network..");
  boolean net_flag=1;
  while(net_flag)
  {
    Serial1.println("AT+CPIN?");
    while(Serial1.available()>0)
    {
      if(Serial1.find("READY"))
      net_flag=0;
      break;
    }
    delay(1000);
  }
   Serial1.println("AT+CNMI=2,2,0,0,0");
   delay(1000);
   Serial1.println("AT+CMGF=1");
   delay(1000);
   Serial1.println("AT+CSMP=17,167,0,0");
   lcd.clear();
   Serial1.flush();
}
```

V. OBSERVATION AND RESULTS

A semi-automated version of this system was constructed using a single pump which supplied water to the plant when soil moisture went below the required moisture level. A Liquid Crystal Display (LCD) display was used for displaying the output. A buzzer was also used for alerting the user. A GSM module was also connected. As the system needs to be fully automated and cost-effective, the LCD display and the buzzer have been replaced by a GSM Module and a pair of pumps. For each and every action, the user will receive SMS Alerts. The second pump has been installed to refill the storage tank, from a reservoir, when the

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water level in the tank comes to lowest level. Therefore the user will no longer need to check the water level in the tank at regular intervals and switch on the pump manually. The irrigation the use of soil moisture sensors and microcontroller is an specific instrument that may robotically feed flora with water consistent with their need without farmer's interference. Design of an sensible irrigation device will manage flow of water into the sphere and sprinkle the pesticide aggregate uniformly within the preferred ratio deserved by means of the plants automatically, for this reason keep turf. The system contains of soil moisture sensors to understand the repute of the water degree in the farm; solenoid valves for controlling water drift to the farm; sprinklers for spraying of the pesticide aggregate; and a controller for the records processing and to control all of the operations.

(i) SYSTEM ARCHITECTURE AND FRAMEWORK:

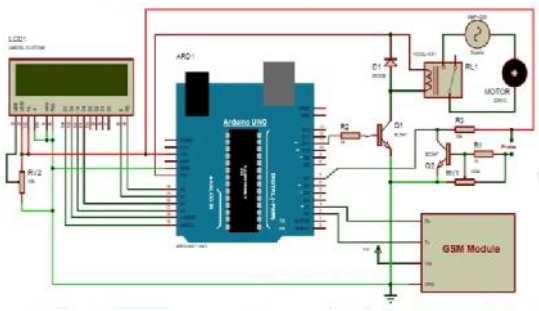

Fig.1 Circuit diagram (*System architecture*)

(ii) IRRIGATION CONTROL

The Irrigation Control system working starts from user messaging depends up on the SMS content the operation will be performed by the Microcontroller(Arduino), if the message is status then the controller will capture the all the sensors and it will send details to the user and motor on/off then the motor will be on/off. The main advantage of the system is solar power supply and knowing the weather conditions in the area. When the system gets powered up then the system will be wait for the user SMS, and captures the all the sensors details and compares with the normal weather conditions if the any one of the sensor will exceeds its limit then automatically the message sent to the authorized person and the operation of the motor will be depends up on the user command.

(iii) BLOCK DIAGRAM

The main blocks of this circuit diagram are Micro controller (Arduino), LCD Display, PC, Regulated power supply (RPS), Led indicator, Soil moisture sensor Voltage regulator LM317, DC Motors and Dc motors drivers, and GSM module SIM800 TTL family.

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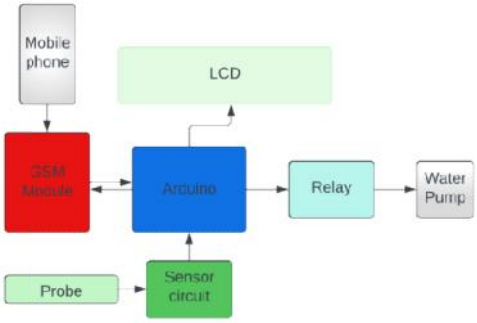

Fig.2 Block Diagram

(iv) OBJECTIVE:

The main objective of our project is to work for Farming where various new technologies to yield higher growth of the crops and their water supply. We are going to check the temperature, humidity, and soil moisture. The paper is all about automated control features with latest electronic technology using microcontroller which turns the pumping motor ON and OFF on detecting the dampness content of the earth and GSM phone line. It works automatically and hence reduces the man power. Irrigation is the artificial application of water to the land or soil. It is used to assist in growing of agricultural crops.

(v) ADVANTAGES OF THE PROPOSED SYSTEM

The proposed system provides real time information on the field irrigation. Here the water is supplied based on the actual needs for the crops. This automated irrigation system is cost reduction and resource optimization. It improves the environment quality and increases the irrigation. It also reduces water logging and water shortages.

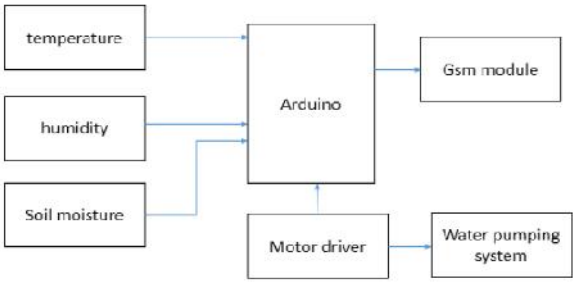

Fig.3 Circuit flow

VI. WORKING

The circuit includes Arduino Uno that is mind of the mission. A 9 v relay is utilized to turn on / off the water pump. Two dc jacks so one can power the Arduino and gsm module. Running of this gsm primarily based automated irrigation machine is

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pretty easy. To begin with, it is a very automatic device and there's no need of manpower to manipulate the system. Arduino is used for controlling the entire procedure and gsm module is used for sending alert messages to person on his cell smartphone. If moisture is found in soil above the threshold cost then there is conduction between the 2 probes of soil moisture sensor and Arduino pin d7 remains low.

When Arduino reads low signal at d7, then it sends sms to person about “soil moisture is ordinary. Motor turned off” and water pump remains in off state. Now if moisture found in soil beneath the brink stage then pin d7 becomes excessive. Then Arduino reads the pin d7 and activates the water motor and also sends message to consumer about “low soil moisture detected. Motor turned on”. Motor will automatically flip off whilst there is enough moisture inside the soil. Gsm module is used for sending sms to the consumer. A LM317 voltage regulator is used to energy the SIM800 gsm module. It’s running voltage score is three. 8V to four. 2V. beneath is the circuit diagram of strength supply given to the ttl SIM800 GSM module.

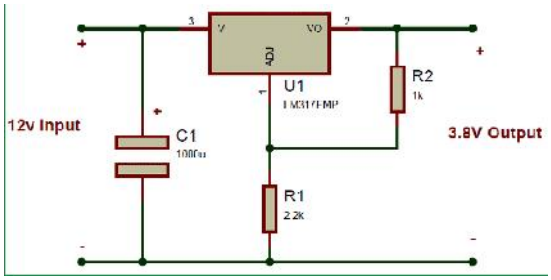

Fig. 4Circuit Diagram of Voltage Regulator

VII. CONCLUSION

Irrigation play a crucial function for monetary in any developing countries like India. Through the years, professionals concerned in irrigation carried out manual technique of irrigation. The manual technique has lots of drawbacks and is pretty unreliable for irrigation of huge regions. Irrigation has direct impact on price and production of final product. This gadget objective to get rid of the traditional manual technique of irrigation which wishes to be progressed over the time. This prototype has many advantages which make it a terrific opportunity to the current tactics because it facilitates the farmers to help them in daily desires of the tracking and controlling the sector environmental parameters with minimal fee and consumer friendliness. This project has been made in order to reduce the work load of the farmers and increase the efficiency of the irrigation process. With the help of this system, the water tank will be automatically filled with water, when empty, from reservoir, without any manual work. The whole world, nowadays, is mainly aiming towards fully automated systems with less human labor. This project has also been aimed at that sector. The problem of water wastage during irrigation has also been solved. Dry areas where water supply is limited, those areas can also be perfectly irrigated by the use of this system. Moreover, components of the system are also reliable, low cost and easily affordable. This system has not only meant for farmers only. It can be used in greenhouse plants also. In this world of advancement, money and time saving are two important factors to be kept in mind. This project also saves time and money by quick hassle-free work and affordable cost.

VIII. FUTURE SCOPE

A number of future scopes are to be had that may be used with this painting to improve the efficiency and effectiveness of the machine; the following guidelines may be placed into consideration. The concept of using iot for irrigation can be applied with this gadget. Other activities in farming along with livestock management, fireplace detection and climate manage can be brought with this gadget. This device can be improvised by way of adding a webscaper that could expect the weather and water the plants/vegetation hence. If rain is forecasted, much less water is set free for the flora

This system is available for a specific crop as a specific level of moisture is programmed in the Arduino. So it cannot be used for different crops at different occasions. For this, machine learning algorithm can be used, so that it can sense the moisture level of the crop dynamically and maps it with the required column of the data set for the required crop where alongside each value of moisture required sun intensity and temperature of the climate is specified. The authors of this paper also plan to modify the

algorithm in order to give the user of the product more control i.e., along with the String specifying "NO" the user can also specify the amount of time the system should be in sleep mode and with "Yes' command the system reactivates. Also only the solution for water deficit is described in the paper. What if there is excess accumulation of water around the crop. The authors of the paper are currently working on the method to solve this problem.

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