CHAPTER 1

INTRODUCTION

In today's world of technological advancement the main motto of human beings is to bring ease to life using automation in every possible field. The spectrum of automation has a wide spread beginning from our own houses to the universe. Automation is preferred due to the advantages such as negligible manual work & précised accuracy.

One such boon of advancement to the world of science is the dual tone multi frequency technology. In DTMF technique every digit is represented by two non-integral frequency ranges one is higher and one is lower. As both frequencies are non-integral multiples of each other, it results in correct decoding at the decoder site, even in the presence of non–linearity of filters or harmonics.

In this project we look forward to telephonic signalling approach using Dual tone multi-frequency technique in controlling of water flow through solenoid valve. At present the farmers or gardeners have to water or monitor the plants & crops manually. Due to this there may be wastage of water due to excessively watering the crops or plants & fertility of soil can also reduce. To avoid all such problems we have designed our **'DTMF based control of flow of water through solenoid valve using soil moisture sensor'** system.

This system can also be used for domestic purposes like controlling backyard & terrace garden watering system, different taps at our home when we are out of our house. On the other hand importance of DTMF based watering system has great impact in places where water and rain scarcity is highly predominant for example in desert areas. In this case, a farmer can make proper water management and controlling based on the weather, environmental and seasonal conditions.

In irrigation, this system is very significant. Advantage of this technique is that water is supplied to soil by sensing its moisture content. In this, water is supplied only when the moisture content is below the required level. Due to which a large quantity of water is saved. This also helps in water harvesting as water is utilized and not wasted.

CHAPTER 2

Literature Survey

Background-

Since olden times watering of plants was a manual job. Due to improper watering there aroused lack of nourishment to the crops. In some cases watering was done excessively while in the region where there was scarcity of water plants were feed with negligible water. This led to poor yield & low quality. The same scenario was present with garden watering too.

The farmers have been using the conventional irrigation techniques like watering through wells & Canals. Water was supplied generally to lower leaves and stem of the plants along with the soil. This process sometimes consumed more water than requires or sometimes the surface becomes saturated, unable to absorb more water and often stays wet, long after watering process was completed and the area becomes like quagmire. Sometimes the water reaches late due to which crops are destroyed because such condition promoted infections when leaves got dried. Slowed growth rate, occurred due to the water deficiency.

Available Systems-

As development occurred different irrigation systems which helped in easing the manual work of farmers & gardeners to some extent. These systems were-

1) Ditch Irrigation-

Ditch Irrigation is a rather traditional method, where ditches are dug out and seedlings are planted in rows. Siphon tubes are used to move the water from the main ditch to the canals.

2) Terraced Irrigation –

This is a very labour-intensive method of irrigation where the land is cut into steps and supported by retaining walls. The flat areas are used for planting and the idea is that the water flows down each step watering each plot. This allows steep land to be used for planting crops.

3) Drip Irrigation -

This is known as the most water efficient method of irrigation. Water drops right near the root zone of a plant in a dripping motion. If the system is installed properly you can steadily reduce the loss of water through evaporation and runoff.

4) Sprinkler System-

This is an irrigation system based on over head sprinklers, sprays or guns, installed on permanent risers. You can also have the system buried underground and the sprinklers rise up when water pressure rises, which is a popular irrigation system for use on golf courses, hockey& football stadiums & also parks.

5) Rotary System-

This method of irrigation is best suited for larger areas, for the sprinklers can reach distances of up to100 feet. The word “Rotary” is indicative of the mechanical driven sprinklers moving in a circular motion, hence reaching greater distances. This system waters a larger area with small amounts of water over a long period of time.

Need of our system-

All the systems that are available currently are partially manual or else timer operated but they do not take in consideration the changing conditions of environment that result in varied soil patterns. Our system operates on the outcome received from soil moisture thus indicating the user when to turn on the solenoid valve through DTMF control.

In current trend various such system are under development process few of them namely are-

1) Using GSM technique controlling water pumps & motors.
2) Using Remote control technology.
3) Using soil moisture sensor.

But out of all of them DTMF is mostly preferred hence we chose to work with the DTMF technique & soil moisture sensors combined.

DTMF Technique-

Dual-tone multi-frequency signalling (DTMF) is an in-band telecommunication signalling system using the voice-frequency band over telephone lines between telephone equipment and other communications devices and switching centres. DTMF was first developed in the Bell System in the United States, and became known under the trademark Touch-Tone for use in push-button telephones supplied to telephone customers.

The Touch-Tone system using a telephone keypad gradually replaced the use of rotary dial and has become the industry standard for landline and mobile service. Other multi-frequency systems are used for internal signalling within the telephone network.

DTMF is a signalling system for identifying the keys or better say the number dialled on a pushbutton or DTMF keypad. The early telephone systems used pulse dialling or loop

disconnects signalling. This was replaced by multi frequency (MF) dialling. DTMF is a multi frequency tone dialling system used by the push button keypads in telephone and mobile sets to convey the number or key dialled by the caller. DTMF has enabled the long distance signalling of dialled numbers in voice frequency range over telephone lines. This has eliminated the need of telecom operator.

DTMF keypads are laid out on a 4x4 matrix, in which each row represents low frequency and each column represents high frequency. With DTMF, each key pressed on a phone generates two tones of specific frequencies. One tone is generated from a high-frequency group of tones, while the other is from a low-frequency group. DTMF systems use eight different frequency signals transmitted in pairs to represent 16 different numbers, letters and symbols. The resultant tone is convolution of two frequencies.

Frequency (Hz)	**1209**	**1336**	**1477**	**1633**
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

Soil Moisture Sensor-

The Soil Moisture Sensor uses capacitance to measure the water content of soil (by measuring the dielectric permittivity of the soil, which is a function of the water content). Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity.

Drawbacks of currently available systems-

As quoted earlier the systems that are in use currently do not take in consideration natural factors like soil moisture, temperature, humidity etc. Also in domestic application watering to garden is still done manually leading to deficiency of water to the plants when we are out of the house or travelling for a long period of time.

Advantages of our system over it-

Our system uses one of the important environmental factor that is soil moisture to decide whether the supply of water is to be given or not at specific time to the plants & crops. Moreover it is advantageous as it can be used from anywhere & is not restricted to a particular zone of operation. Also it is handy & makes ease so that can be used by the farmers, gardeners & even domestically.

Applications-

1) Crop Irrigation.

2) Gardens & Botanicals watering.

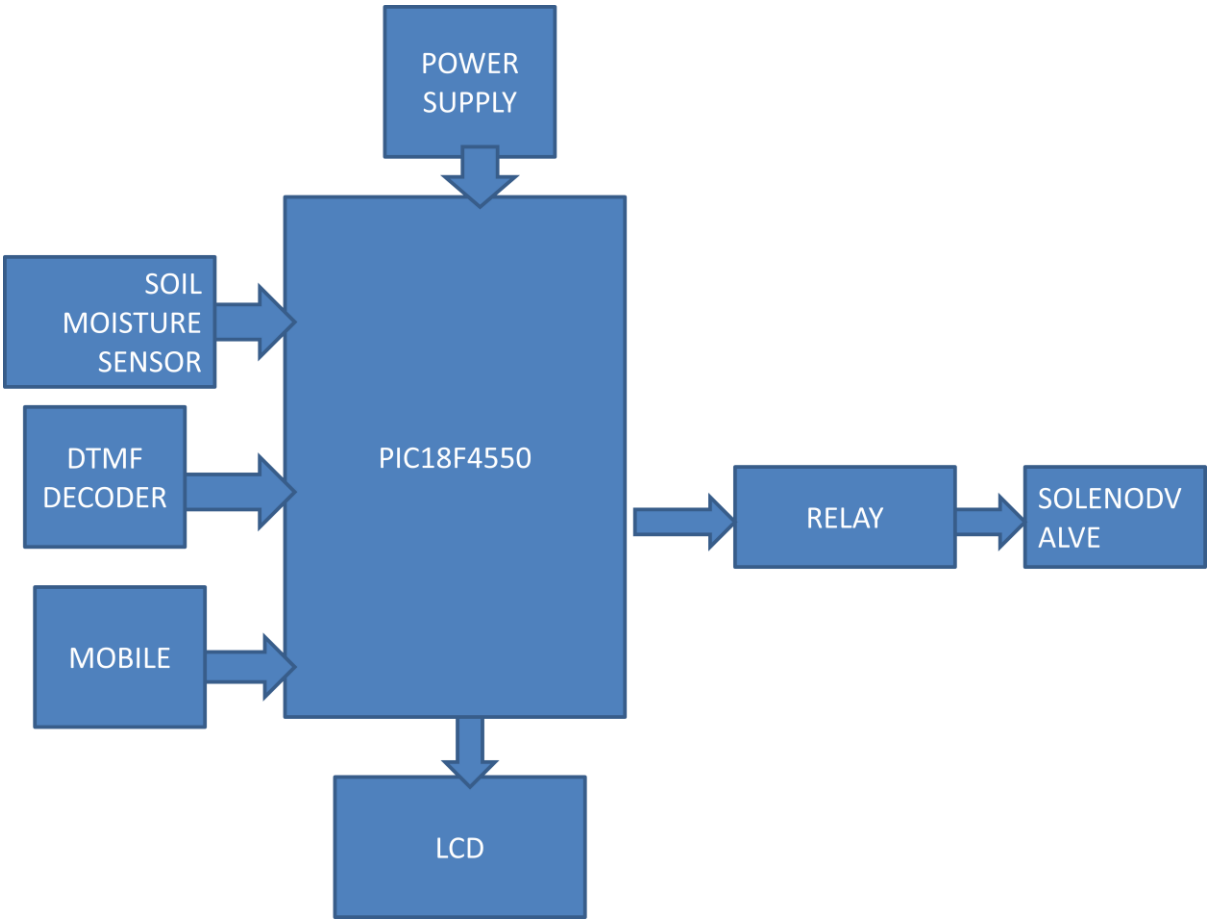
3) Nursery watering.

4) Domestic purposes.

Chapter3

System Design

Block diagram-



Explanation-

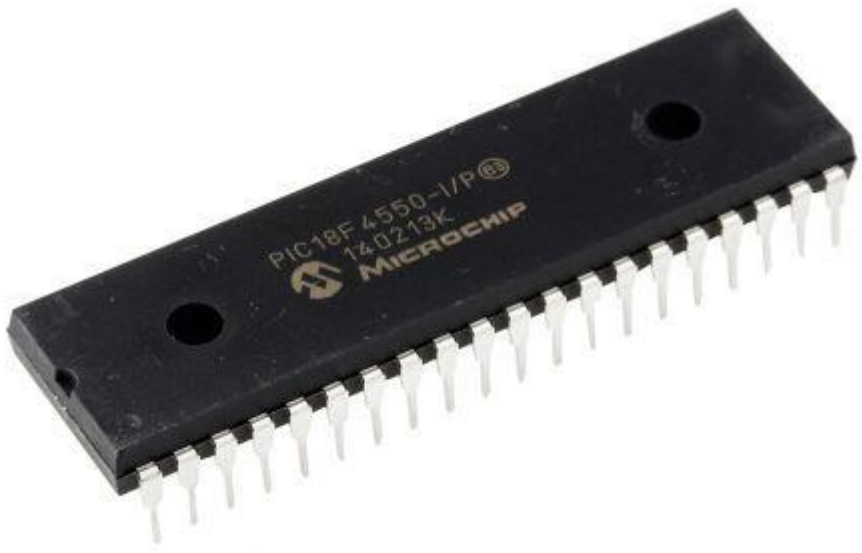
- Soil moisture sensor-

  Soil moisture sensor is used to test the moisture of soil, when the soil is having water shortage, the module output is at high level, else the output is at low level. By using this sensor one can automatically water the flower plant, or any other plants requiring automatic watering technique. Module triple output mode, digital output is simple, analog output more accurate, serial output with exact readings.

- DTMF MT8870-

This circuit detects the dial tone from a telephone line and decodes the keypad pressed on the remote telephone. The dial tone we heard when we pick up the phone set is call Dual Tone Multi-Frequency, DTMF in short. The name was given because the tone that we heard over the phone is actually make up of two distinct frequency tone, hence the name dual tone. The DTMF tone is a form of one way communication between the dialer and the telephone exchange.

- Microcontroller-



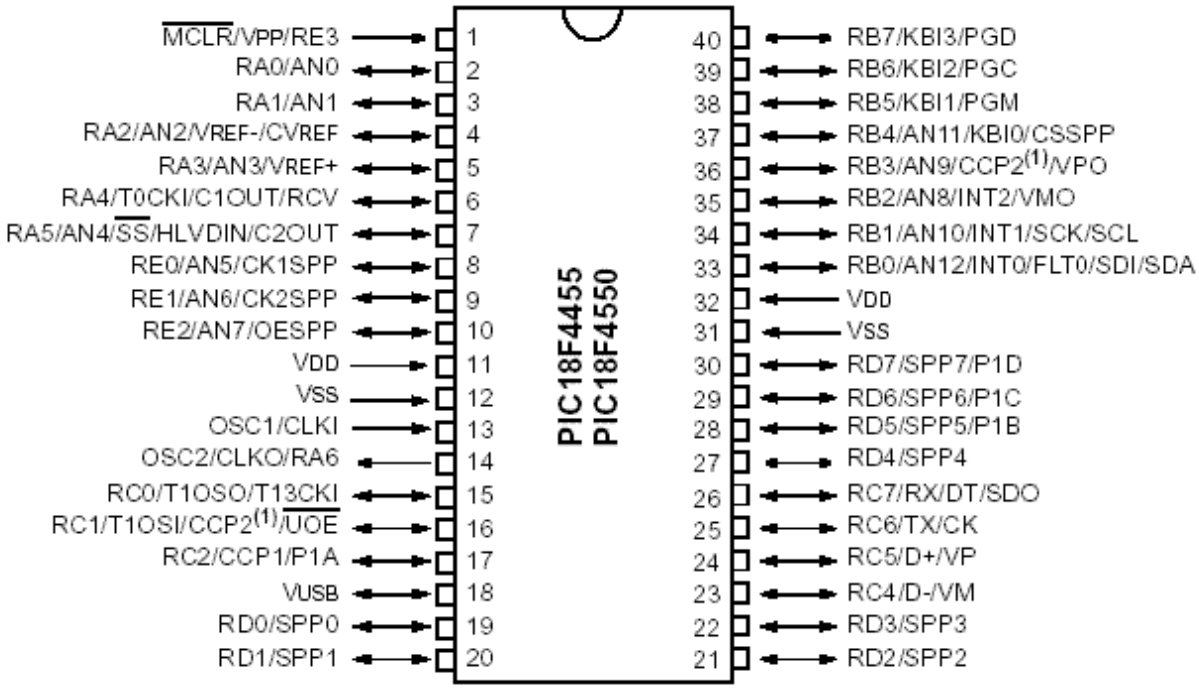
Microcontroller is the brain of the circuit. We have used pic18f4550 microcontroller. It takes the soil moisture output as input and accordingly closes or opens the solenoid valve and also interrupts dtmf signals for opening and closing of valve.

LCD- We have used 16*2 LCD displaying our soil moisture readings.

Power supply- power supply is used to power the circuit. We have provided 5v of supply for our circuit.

FEATURES OF COMPONENTS:

Pic18f4550 microcontroller-



PIC Features:

-High- Performance RISC CPU

-Source code compatible with the PIC16 and PIC17 instruction sets

-USB V2.0 Compliant with up to 12 Mb/s at Full Speed

-DC- 48 MHz External Clock Modes

-16- bit wide instructions,8-bit wide data path

-Priority levels for interrupts

-256 Bytes EEPROM for interrupts

Peripheral Features:

-High current sink/source 25mA/25mA

-Three 16-timer/counter

-One 8-bit timer/counter with prescaler

-Two Capture/Compare Modules

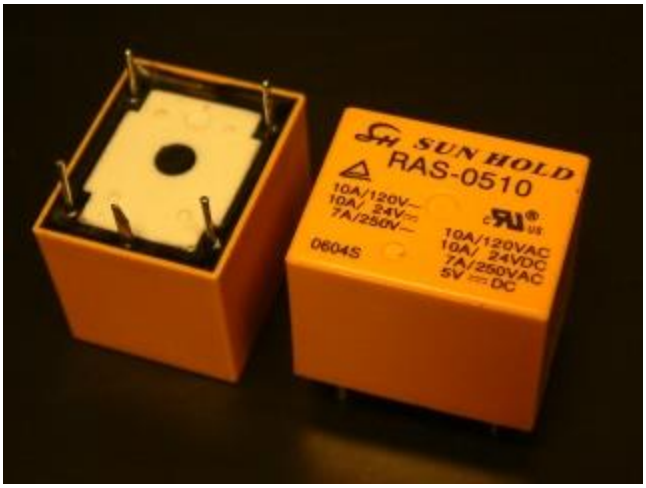
-Power- On Reset

-Power- up Timer(PWRT) and Oscillator Start-Up Timer(OST)

-1,000 erase/write cycles Enhanced Flash Program Memory

-1,000,000 typical erase/write cycles EEPROM Data Memory

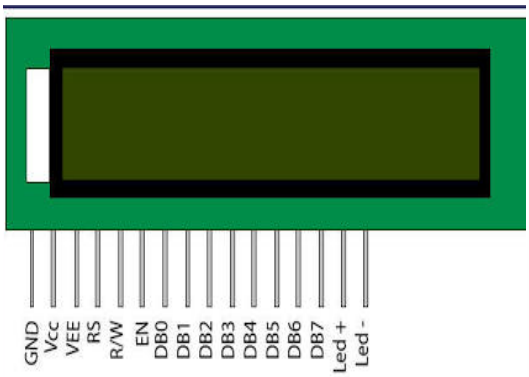
2. Relay-



FEATURES:

- NOMINAL VOLTAGE-5V
- COIL RESISTANCE-69 OHMS
- POWER CONSUMPTION-0.36W
- NOMONAL CURRENT-72mA
- PULL IN VOLTAGE (vdc)-75% MAX
- DROP OUT VOLTAGE-10%MIN
- MAX ALLOWABLE VOLTAGE-130%

LCD



An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in various devices and circuits.These modules preferred over seven segments and othermultisegment LEDs. The reason being :LCDs are economical, easily programmable, have no limitation of displaying special & even custom characters(unlike in seven segments),animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lnes. In this LCD each character is displayedin 5x7 pixel matrix.this LCD has 2 registers namely,Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display.The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

PIN DESCRIPTION

Pin No	Function	Name		
1	Ground (0V)	Ground		
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc		
3	Contrast adjustment; the best way is to use variable resistor such as a potentiometer. The output of the potentiometer is connected to this pin. Rotate the potentiometer knob forward and backwards to adjust the LCD contrast.	Vo / VEE		
4	Selects command register when low, and data register when high	RS (Register Select)		
5	Low to write to the register; High to read from the register	Read/write		
6	Sends data to data pins when a high to low pulse is given; Extra voltage push is required to execute the instruction and EN(enable) signal is used for this purpose. Usually, we make it en=0 and when we want to execute the instruction we make it high en=1 for some milli seconds. After this we again make it ground that is, en=0.	Enable		
7	8-bit data pins	DB0		
8		DB1		
9		DB2		
10		DB3		
11		DB4		
12		DB5		
13		DB6		

14		DB7		
15	Backlight VCC (5V)	Led+		
16	Backlight Ground (0V)	Led-		

Solenoid-

Valve type- 2 way normally closed

Action- direct lift diaphragm

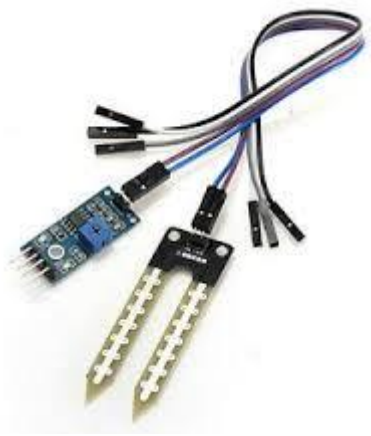
Operating pressure- 0 to 150 psi

Coil power- 20W

Service- Air Gas Liquid Vacuum

Operating temperature-14-176 F

Soil moisture-



Operating voltage- +5v regulated

Soil moisture- digital value is indicated by out pin

WORKING -

There are 2 modes of working-

1. Automatic operation.

1. In automatic operation the soil moisture continuously monitors the moisture content in the soil.
2. Most soil moisture sensors are designed to estimate soil volumetric water content based on the dielectric constant (soil bulk permittivity) of the soil.
3. The dielectric constant can be thought of as the soil's ability to transmit electricity.
4. The dielectric constant of soil increases as the water content of the soil increases.
5. This response is due to the fact that the dielectric constant of water is much larger than the other soil components, including air.
6. Thus, measurement of the dielectric constant gives a predictable estimation of water content.

7. Readings are provided to microcontroller which continuously monitors the moisture content in the soil.

8. If the readings are above 40 the microcontroller turns on the solenoid valve through relay which provides Water to the sprinkler.

9. As the moisture content goes on increasing due to sprinkling of water the soil moisture sensor senses this increase in moisture of soil.

10. If the soil moisture comes below 20 the solenoid valve closes.

11. The water going to the sprinkler stops.

12When again the soil starts to dry and as moisture content of soil decreases the same procedure is repeated.

MANUAL-

1. If any button is pressed on the mobile phone keypad, then it will generate two frequencies.
2. These tones are called row are column frequencies.
3. Normally row frequencies are low frequencies and column frequencies are high frequencies.
4. These column frequencies are slightly louder than the row frequencies to compensate for the high-frequency roll off of voice audio systems.
5. Then these frequencies are given as input to DTMF decoder MT8870.
6. This DTMF decoder converts the analog input into binary digits and this signal is further given to pic microcontroller18f4550
7. Microcontroller according to received binary data will turn the solenoid open or close with the help of relay circuit.
8. Relay is used for switching the solenoid open or close.
9. Eg-

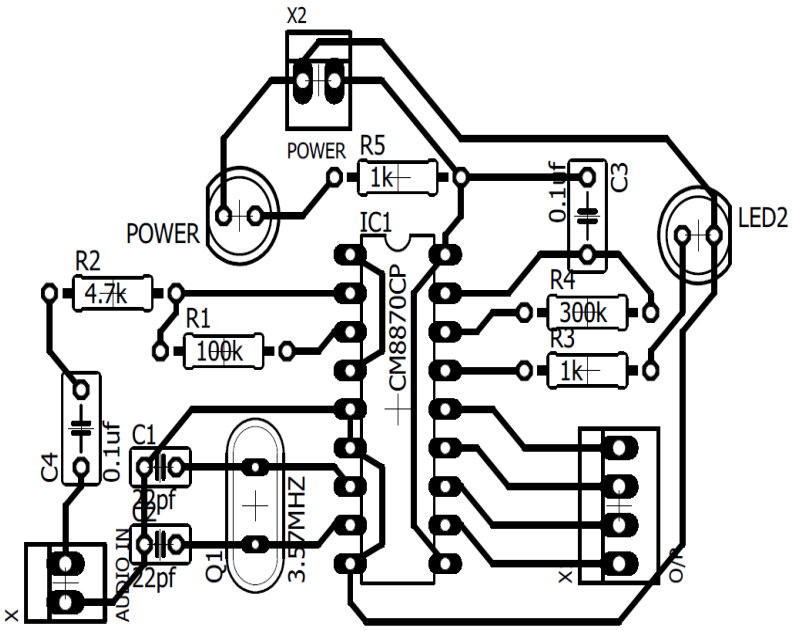
   A) If 5th key is pressed on dialpad of mobile the 2 frequencies i.e

   770 (lower frequency) and 1336 (higher frequency) gets selected.

   Then these 2 frequencies will be converted into binary by DTMF MT8870 IC. Output of DTMF will be given to pic 18f4550 and solenoid will be opened.

   B) Then when 6^{th}key is pressed the same procedure takes place as above and at microcontroller output solenoid will be closed using relay.

DTMF PCB Layout



Chapter 4

Software implementation

Software required for this project is MPLAB

5.1 MPLAB-

Microchip produces over 900 different development tools, including an integrated development environment, compilers, debuggers, programmers and software and development boards for specific applications. Most of our software tools have free download versions available and a free trial. Our comprehensive line of development tools are designed to work with or as a part of the MPLABX IDE environment and are engineered to be compatible with all of Microchip's many devices. This development ecosystem fits together seamlessly with a user-friendly interface for your project.

Algorithm-

For automatic process-

1. Initialise the system
2. Observe the moisture of the soil on lcd if it is dry turn on the solenoid valve through relay
3. If moisture is displayed of wet soil turn off the solenoid valve through relay
4. End

For manual process (using DTMF)-

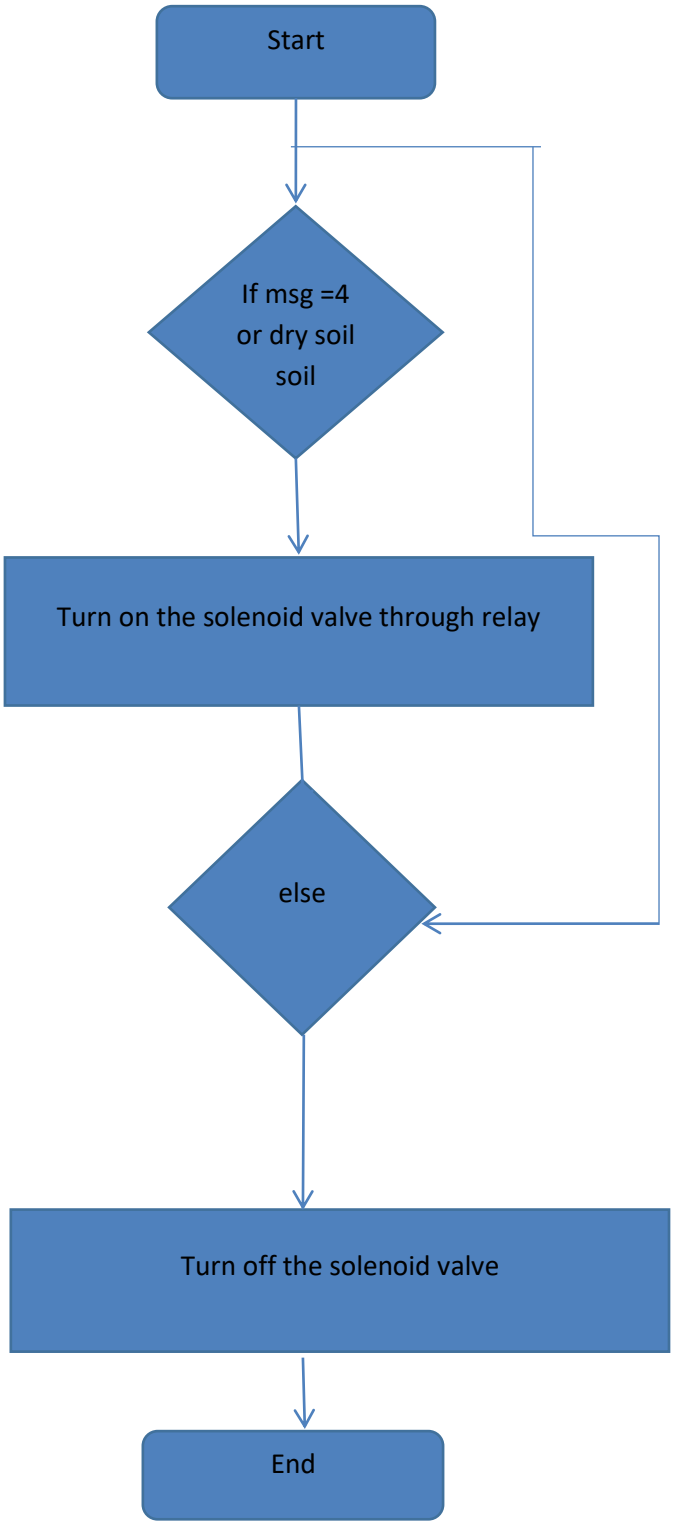
1. Initialise the system

2. If moisture of the soil is set to x and it represent dry soil message is send through DTMF decoder by pressing any set key suppose 4 then turn on the solenoid.

3. If moisture of the soil is set to y and it represent wet soil message is send through DTMF decoder by pressing any set key suppose 5 then turn off the solenoid .

4. End

Flow chart-


Start
If msg =4
or dry soil
soil
Turn on the solenoid valve through relay
else
Turn off the solenoid valve
End

Conclusion-

As India is a country depending on primary sector & to develop it is must for the economical growth of the country. Our system will ensure proper watering of crops giving a better yield as well as save water too hence adding our bit to betterment of nation. Also we are contributing our bit towards our planet by saving an essential resource that is water.

References

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