DTMF Based Watering System Depending On Sensing Soil Moisture Content

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Abstract: In this paper a system is described in brief that can be used to ease the work of watering crops that of farmer. Using this technique the farmer can operate the water pump from any faraway place. For this the system is designed in two modes that are automatic mode & manual mode. It makes use of Dual Tone Multi Frequency (DTMF) technique for this purpose. The microcontroller used in the system is PIC family's PIC18F4550. Moreover to make a decision about when to water the crop we need some parameters. There are various parameters like temperature, humidity, soil moisture etc. Out of all the parameters here soil moisture sensor is used in the design of this system. Using such automatic watering systems or irrigation systems we can avoid both extreme conditions that is drying up of crops due to lack of water & also over watering of crops that leads to crop damage & also wastage of water.

Index Terms - DTMF, Microcontroller, Soil moisture sensor, Pump

I. 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. Now a day's every possible field is approaching to full automated operation. Various sectors such as manufacturing industries, service industries, hospitals, hotels & many more are speedily marching towards automation. But in India the backbone of economy is the primary sector that is still on a large scale dependent on traditional methods. Due to which there is lack of development which in turn affects the yield & other resources that contribute to primary sector. Thus it is very necessary to work for bringing about automation in agriculture section. Many people are simultaneously working for it. Thus while developing this system there was a thought to develop a system that will help the farmer by automatically controlling irrigation remotely using cost effective components.

This system uses Dual tone multi frequency technique to operate the water pump situated in fields & farms. The farmer gets a judgement about when to water a plant depending upon the value shown by the soil moisture sensor on the LCD display. This system can be attached to various irrigation techniques in use like drip & sprinkle irrigation also the requirement of the water can be predefined according to the need of the respective crop. 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.

In this paper section II will be literature survey, section III explains block diagram and system's working in short, section IV shows flow chart, algorithm of the system the last i.e. section V concludes the topic & gives information on application & advantages of this concept.

II. LITERATURE SURVEY-

[1] The author in this paper has come up with a electronic circuit that can be used for controlling a number of pumps using dtmf technology. This circuit can be said as a newly designed dtmf decoder instead of the on which we use in currently. The design is tested using MULTISIM simulation software.

[2] This paper describes a system that simply uses DTMF technology to remotely switch ON & OFF the relay driver circuit ULN2003A. It consist of very less hardware components i.e. transformer, voltage regulator, dtmf decoder, microcontroller (AT89S5). It is a proposed system & is initially implemented only on softwares such as MULTISIM simulation software.

[3] Depending upon the soil moisture content of the soil this system will operate the water pump. In this system the author proposes to use Arduino board with ATmega328 controller to carry out the operations of the system such as detecting soil moisture & displaying it. The functioning of motor will be decided on the values given by the soil moisture sensor.

[4] The paper explains us about different types of irrigation systems such as ditch, drip, sprinkler & rotary irrigation systems that are in use currently. Also specifies the need of how necessary it is to automate irrigation system. Here the authors have made use of hardware components such as Microcontroller (8051), power supply, analog to digital converters, dtmf decoder, motor, temperature & humidity sensor. As 8051 is a basic controller & doesn't consist of ADC externally it is needed to be used and so due various such reason there is increase of circuitry & cost too.

[5] The author of the paper has designed a system which uses Arduino, dtmf technique & soil moisture sensor for automation of irrigation. In the system instead of driving motor they have just indicated their output using a bulb which glows depending on the set value of soil moisture.

[6] This paper throws a light on different irrigation systems such as ditch, drip or sprinkler irrigation that are currently in use. It also lets us know the need of automation in the field of agriculture & irrigation section.

[7] This paper explains us in detail about dtmf technology & also about dtmf decoder & dtmf receiver. It gives a complete idea of working of dtmf technique.

[8] Authors of this paper have very well explained about dtmf keypad, frequencies used in dtmf technique & also about MT8870 decoder IC.

III. BLOCK DIAGRAM & WORKING-

3.1 Block diagram –
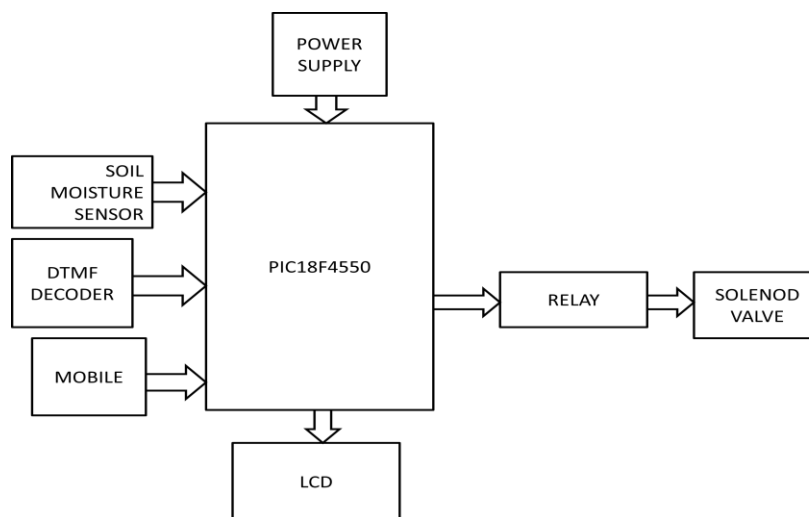
3.2 Working- The system operates in two modes automatic mode & in manual mode. The working of system is provided in two modes so as to ensure that if any one fails other one can be opted. In manual mode the controls are provide to the user & this mode can be used when user is in the position to pay attention to the values displayed by the soil moisture sensor. Depending upon which the user makes decision of turning off or on the valve. Whereas the automatic mode eases the use as once the user sets the system in this mode depending on the value of soil moisture & requirement of the crop the system itself turns on or off the solenoid valve. The flow of control in the system goes on as show in the block diagram. The dtmf decoder decodes depending upon the input received from the mobile keypad which is further given as input to pic controller. The power supply is provided to dtmf decoder as well as pic controller. The soil moisture sensor output is also fed as input to controller. Controller displays the soil moisture value on the LCD. Also operates the solenoid valve through relay & submersible pump. As the solenoid valve needs water with certain pressure, to obtain that submersible pump is used. As the system is prototype to connect mobile phone with dtmf decoder audio jack & audio plug in is used.

3.3 Components used –

    3.3.1 PIC Microcontroller - Brain of the system is a controller or processor. Here PIC18F4550 is used to carry out all the operations of the system.
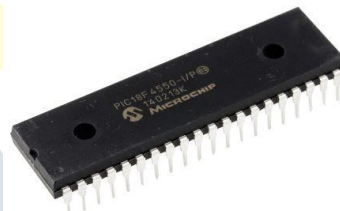
    3.3.2 DTMF Decoder (MT8870) - DTMF decoder is a circuit used to detect the key pressed on the keypad of the user. MT8870 is a decoder IC used to decode the audio signal received after pressing a key.

    3.3.3 Soil moisture sensor- Soil moisture sensor is used to test the moisture of soil. The sensor in this system uses capacitance sensor i.e. is a frequency domain sensor for detection of moisture content in the soil.
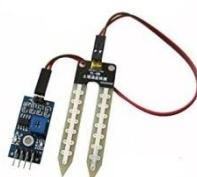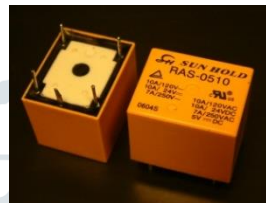

    3.3.4 LCD - Here 16x2 LCD is used to display the readings obtain from the soil moisture sensor.

3.3.5 Solenoid Valve – A two way normally closed solenoid valve is used in this system.

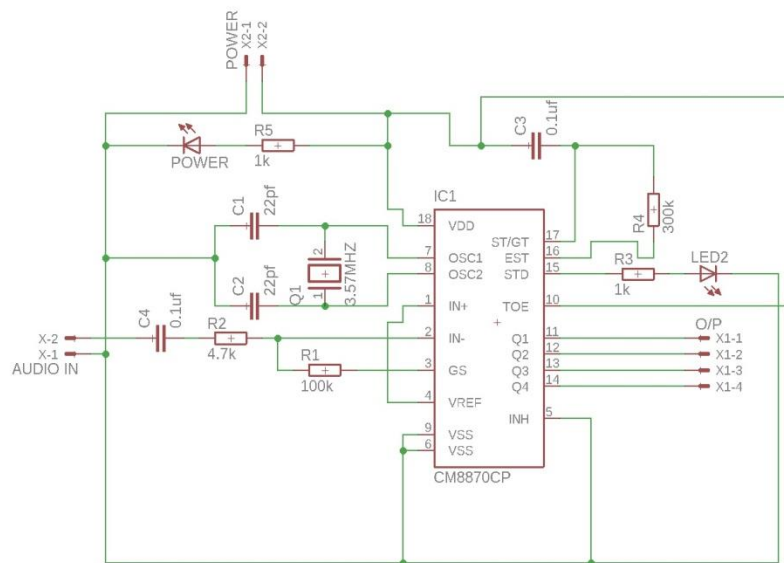**3.3.6 Relay** − A 5v relay is used in the system.

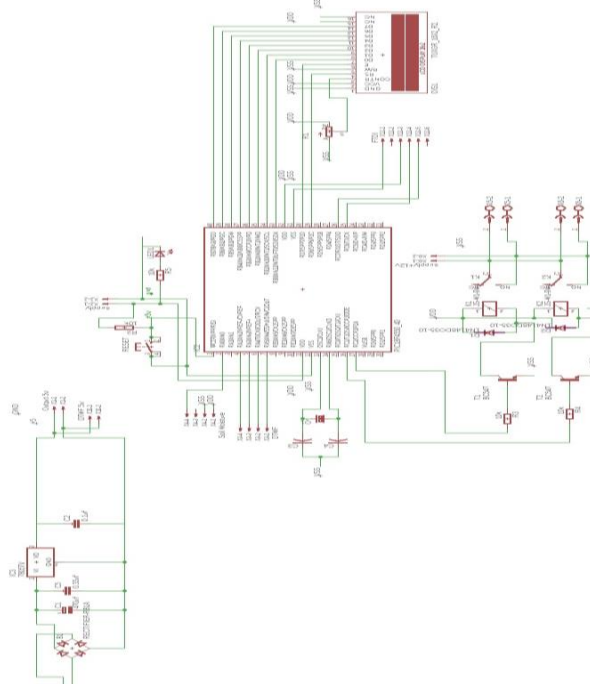**3.3.7 Power Supply -** 5v power supply is designed to drive the circuit

3.3.8 Submersible Pump - To make the solenoid valve work here a submersible pump is used.
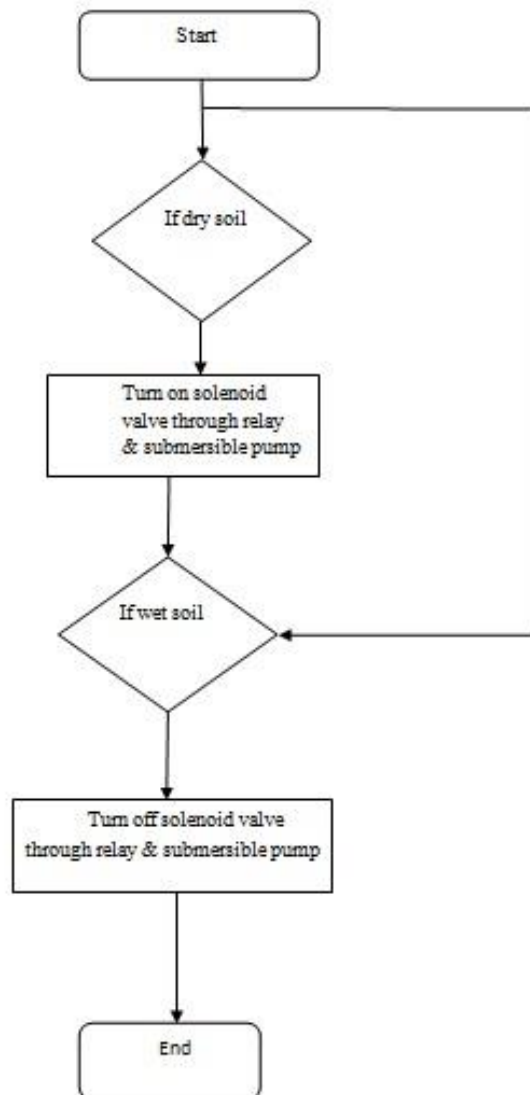
3.4 Circuit Diagrams-

3.4.1 DTMF Decoder circuit-

3.4.2 Circuit Diagram of system-

IV. FLOW CHART & ALGORITHM

4.1 Flow chart-

4.2 Algorithm-
   4.2.1For automatic process-
      4.2.1.1 Initialize the system by pressing the assigned key for automatic mode.

      4.2.1.2 System detects the moisture of the soil & displays on LCD.

      4.2.1.3Depending upon the sensed value the system decides whether to turn on or turn off the solenoid valve.

      4.2.1.4 End.

   4.2.2 For manual process-
      4.2.2.1 Initialize the system.

      4.2.2.2 If the moisture contain is low press the dtmf keypad key that will turn on the solenoid valve.

      4.2.2.3 When we get wet soil moisture value we have to press the key assigned to turn off the solenoid valve.

      4.2.2.4 End.

V. ADVANTAGES, APPLICATION & CONCLUSION -

5.1 Advantages - This 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.

5.2 Applications –
     5.2.1 Crop Irrigation.
     5.2.2 Gardens & Botanicals watering.
     5.2.3 Nursery watering.
     5.2.4 Domestic purposes.

5.3 Conclusion - This system can be very useful & cost efficient. Moreover it can operate in manual as well as automatic mode depending on the user's choice. In manual mode it facilitates the users by providing control to them whereas in automatic mode it operates completely on the value fed to the system by the soil moisture sensor & as programmed by the user.

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