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DTMF Based Irrigation Water Pump Control System

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Abstract

Because of advancement in technology it became easy for human beings to ease their work and at the same time complete the work with less human force, less time and with better results. In this project we look forward to telephonic signaling approach using Dual tone multi-frequency technique in controlling the various electrical loads such as irrigation water pumps situated in inaccessible areas. The present work is based on the principle of Dual tone multi-frequency (DTMF) signal received from any mobile phone to switch on-off the desired electrical loads such as in our farms, in factories, tube wells, irrigation water pumps etc. In our agricultural fields the tube wells are spread away from one another and thus operating them becomes very hectic as the person has to run from one place to another to operate the loads. Similar thing happens in our households also. Keeping this thing in mind a system has been designed so that it can ease the farmer as well as save time using the DTMF technology to control the loads remotely. Keywords: DTMF, microcontroller, decoder, Irrigation system, pumps.

Keywords: *8051 micro controllers, voltage regulator, Relay drivers and DTMF*

1. Introduction

The basic idea behind this project is to control the functioning of the agricultural load using wireless technology. In this project we will have two cell phones; one will be handed to the farmer which can send the digital signal to other mobile phone which is normally held in automatic answering mode at the load ends. At the receiving ends cell phone codes are inputs to the microcontroller, which preprogrammed to identify the command signal coming from the users ends, which is interfaced through relays & relay drivers according to the desired commands from users end. The cell phones at load site are usually DTMF decoded. DTMF will decode the keywords coming from user's site into digital codes of corresponding frequency which finally fed as input to the microcontroller. This gives farmers an ability to press the keypad of the cellphone and can switch on or off the water pumps installed at different positions of the land as per the desired of the farmers. A DTMF decoder & controlling circuit receives the input commands and control the on–off mode of the connected electrical motor pump. This circuit designed is easily available using the various electrical and electronics circuit components. This act as a sign of relief for the areas which comes under draught region, where there is scarcity of rain water such as in Rajasthan. In such areas, a farmer can make better use of limited water and controlling based on weather conditions, environmental conditions. This also helps in water harvesting as water is utilized and not wasted.

2. Hardware Description

To turn basic the idea of automatic irrigation water pump into realistic state hardware circuit along with software programming is required. The major hardware components used in the project are as follow:

2.1 Transformer

The voltage required by the controlling circuit is of the order up to 20V which is available at the output of step down transformer (240/12v). Apart from lowering or raising the voltage, transformers also provide the isolation to low power circuits from high voltage side.

2.2 Voltage regulator 7805 IC

The LM7805 IC is required here to stabilize the fluctuating output of step down transformer to 5V constant. The series LM78XX/LM78XXA of voltage regulator is of 3 terminals and available in many constant output voltage levels (0-24V). Key Features- o/p current (0-1000mA), o/p voltages (5-24v) with short circuit and overload protection

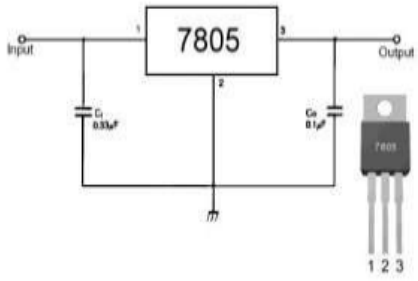


Figure 1. LM7805 IC

2.3 MT8870D DTMF decoder

MT8870D is the principle component in the fabrication of this project. DTMF Decoder decodes the dual frequency codes sent by the users from mobile phone and converted signal is fed into the micro controller for required actions.

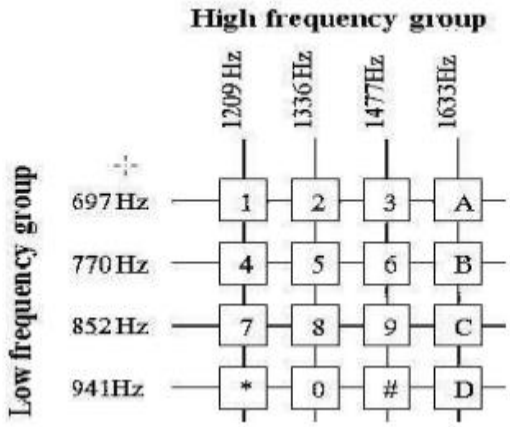


Figure 2. DTMF frequency range

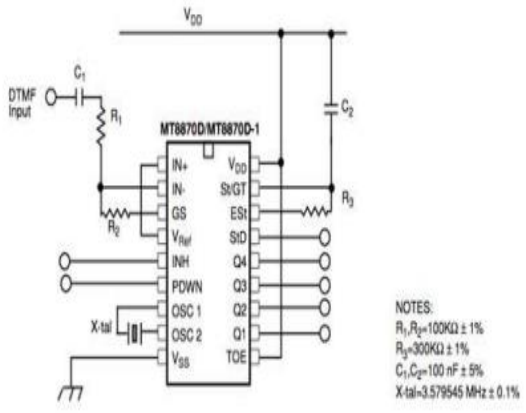


Figure 3. DTMF Decoder IC

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.

2.4 AT89S52 microcontroller

The Microcontroller is the brain of the electronic and controlling circuit. Here in our project as per the requirement we used 8-bit AT89S52 microcontroller. The key feature of the controller is high performance, cost effective to our control applications, energy efficient, easily programmable with C language, 8Kb Flash Memory, RAM 256 bytes, 32 I/O lines, ease of interfacing with computers.

2.5 ULN 2003A relay driver

The driver used to run relay circuit is ULN2003A. It is connected at the output ports of microcontroller. This driver has the advantage of handling voltage up to 50v and current to max of 500mA. They are very suitable for turning on high power appliances such as pumps, motor, lightening etc. with isolation to lower power site components.

3. Proposed Methodology

The project works on the principle of DTMF tone command so received from any phone to remotely switch any electrical load such as agricultural pump, domestic and industrial loads etc. In industries, the loads are spread over a large area and thus, operating these loads is a very tiresome and difficult task. In agricultural fields also, pumps and other loads are connected over a large area and hence it is difficult for the farmer to operate all the loads and similarly for house hold loads. Keeping these problems in mind, the proposed system has been designed which uses DTMF technology to control the loads remotely. A cell phone is interfaced to a DTMF decoder in the system from its audio output socket for receiving tone commands. The receiving cell phone codes are converted into digital commands by using a DTMF Decoder which will identify the frequency of the key and convert that frequency to its equivalent digital code which is then fed to a microcontroller (8051 family). As per the commands sent from the sender's mobile, the microcontroller will send signals through a buffer to actuate the respective loads by turning the relays ON/OFF. These relays are actuated by a relay driver IC interfaced to the microcontroller. Further this project can be enhanced by using a GSM modem, where the loads can be controlled by sending an SMS. This will eliminate the need of answering

the call for the system to work.

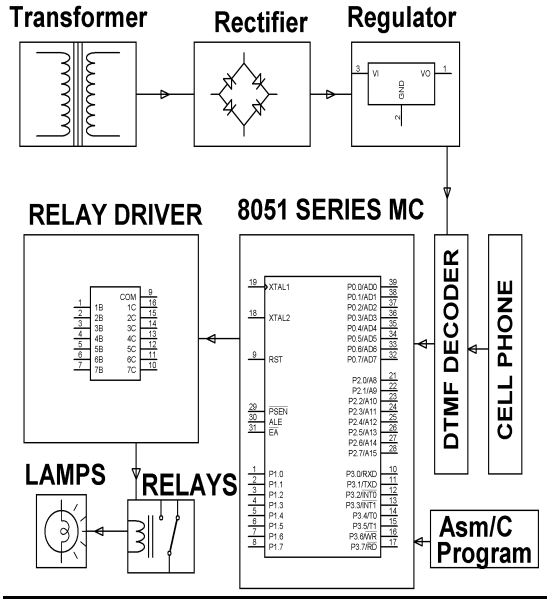


Figure 5. Block diagram

3.1. Future scope

This project is a transform from the natural irrigation technique which was followed by the farmers to the automatic irrigation which for sure has benefitted in the less wastage of water and lessens the hard work of the farmers in farms. In future we can plan to add sensors in given project to monitor (i) the humidity level of the soil and (ii) the temperature of the land site which is increased obviously due to fire out in crops, so that healthy measures can be taken immediately to save the farmers from the burden of crops damage. Also, this system is used for the home automation, industrial load controlling. The automation system using DTMF and cell phone can be implemented for departmental cabins.

4. Hardware Implementation

This section describes the hardware implementation of the proposed model. Figure 6 show that the initial condition of the hardware circuitry in which wed utilized all the hardware components to assemble them into an application of DTMF based irrigation water pump control for agricultural applications.

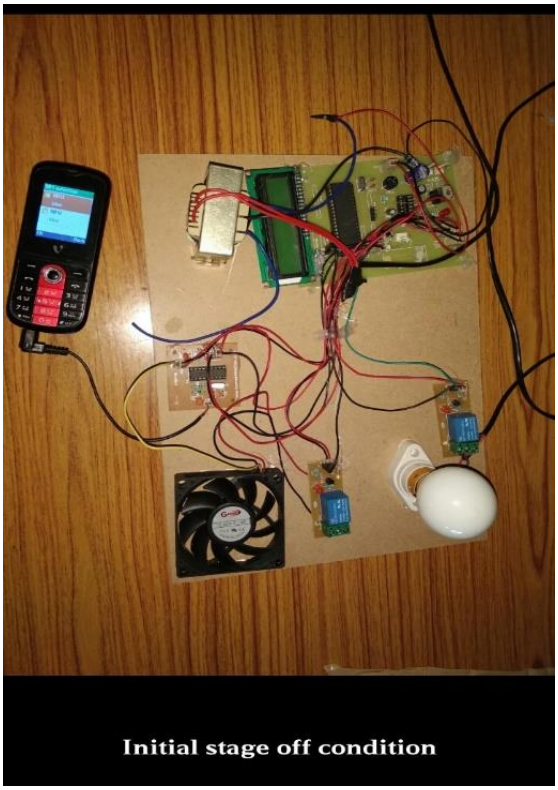


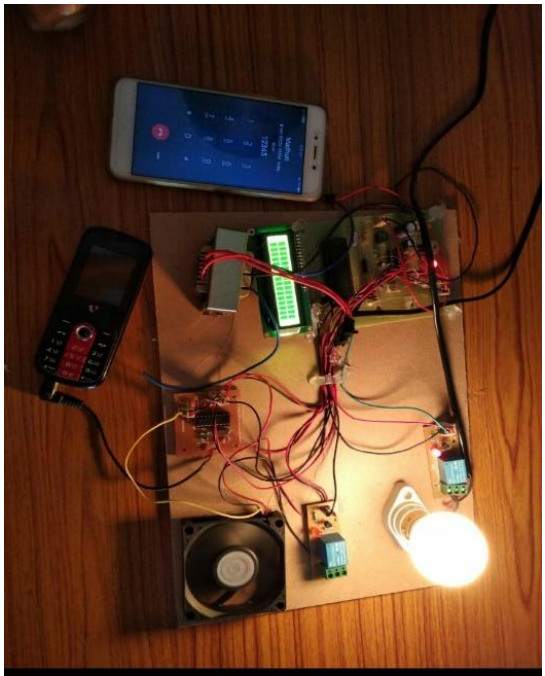
Figure 6. Hard ware implementation of proposed system

Firmware implementation deals in programming the microcontroller so that it can control the operation of the IC's used in the implementation. In the present work, we have used the Proteus design software for PCB circuit design, the Keil µv4 software development tool to write and compile the source code, which has been written in the C language. The Flash magic programmer has been used to write this compile code into the microcontroller.

Software Tools Required

- Proteus
- Keil µVision4
- Flash Magic

Proteus is used for drawing the schematic diagram, it is mentioned above. Keilµv4, Flash magic are the two software tools used to program microcontroller.
Below figure demonstrates the on condition of loads like fan and bulb when a number 5 pressed on keypad.



When pressed 5 in keypad, both load1 and load2 is in ON condition.

5. Conclusion

This project investigates and proposes the controlling of remotely or inaccessible positioned agricultural motor water pumps based on the DTMF technique. This proposed system is designed using discrete components, gates, op-amps. The functionality and working of the entire project circuit is tested and run using simulation software (like MULTISIM) and the complete operational motor switching mode is successfully achieved using the given circuit under consideration. The present project works successfully demonstrated the controlling of remotely located irrigation water pumps for agricultural site without going and visiting the site again and again. With this project, system results in achieving adequate water managements due to which there is almost no wastage of water, saves men power, saves time, more efficient. Further advancements can be done on the practical execution of the proposed irrigation system and to further improve the performance of the system, the feedback closed loop control system will be introduced, where feedback signal is acquired automatically from the agricultural sites using sensors.

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