Fabrication of Remote Control Device to Switch AC Motor

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Abstract—*In this paper we discuss details about fabricating a remote control unit which can switch an AC motor very easily from long distances. The aim of this review paper is to investigate a cost effective solution that will provide switching of machine in industry remotely. The motivation is to facilitate the users to automate their industry having access everywhere. The system offers easy availability due to development of a low cost system. The system is using mobile for making the work of switching machines very easier. The paper takes an analytical approach to accomplish distant communication using DTMF, which provides access to machineries remotely.*
This paper as is not inclusive of, may serve as a reference to all future analysis on DTMF technology.

1. INTRODUCTION

The nature's most spectacular creation is human brain. The main feature of the human brain is its capability to sense the hurdles and respond accordingly. Men always want to transplant their ability to the robots or technology so that they sense the problem as well as respond accordingly. The use of cell phones have been increasing rapidly in our day to day lives.

Distant communication is as important in industries as they are diurnally. This proposal is based on mobile technology which involves distant communication. Using mobile communication we can also switch the heavy machines in industries and can secure the machines from accessing by other person. Hence, it provides safety as well as accessibility.

In this proposal an analytical approach is taken to use the DTMF technology. DTMF is the abbreviation for dual tone multi-frequency and it aims to reduce the complexity involved in long distance communication.

The objective of this review paper is to take on all proposals and technologies involving distant communication to switch an AC motor and its application in different industries.

2. DOPETAILS EXPERIMENTAL

2.1. Procedure

Suppose if all the machines are controlled by a particular individual in an industry, he regulates all the functions involving switching the machineries. This authorized individual enters a protected password using his cell phone to carry out any task. When it is urgent to turn on any single machine and he is not present, then a call can be made to that individual requesting him to turn on the machine remotely and he would be able to turn them on through anywhere by just dialling the password.

Switching centre is called using DTMF technology via voice frequency band. DTMF assigns a specific frequency (consisting of two separate tones) to each key which can easily be identified by the electronic circuit. The signal generated by the DTMF encoder is the direct submission of two sine (cosine) waves of dissimilar frequencies, in real time of the amplitudes i.e., pressing 5 on the keypad will send a tone made by adding 1336 Hz and 770 Hz to the other end of the mobile. The signal after its identification is then sent to the operator which decodes the signal and further actions are performed.

2.2. Materials

Components required for the project are:

- DTMF Decoder
- Cell Phone
- Microcontroller
- Power Supply
- Voltage Regulator
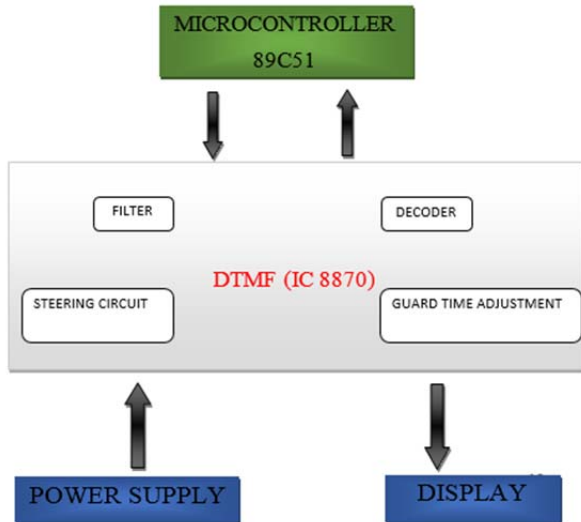- AC motor
- LEDs
- Step Down Transformer
- Relays

Fig. 1: Block Diagram for the System

A. DTMF Decoder

DTMF is the abbreviation for Dual Tone Multi-Frequency. DTMF decoder is a kind of sensing unit. It consists of IC 8870 which senses signals obtained from mobile phone whenever the circuit receives call.This IC provides interface between controller and mobile phone whenever a key is pressed in a distant cell phone. The frequency of the key is read by the decoder IC 8870 which further provide the controller with the information about the pressed buttons.

B. Cell Phone

A cell phone or mobile phone is a kind of telephone which can make and receive calls over a radio frequency carrier when the user is present in the region of telephone signals. Cell phone in this project acts as a remote to switch the motor.

C. Microcontroller

Microcontroller is a small, on-chip computer which consists of a core processor, in built memory and programmable I/O peripherals.

D. Power Supply

This section is used to provide continuous and essential supply of power. It consists of RLMT connector, bridge rectifier, electrolytic and ceramic capacitors.

E. Voltage Regulator

Voltage regulator offers a voltage output of amplitude that is pre defined which stays constant even if there are changes brought upon input voltages and initial conditions.

F. AC Motor

AC motor is a category of electric motor which is driven by AC current. It has a stationary part, stator, having coils with alternating current passing through it and a rotor, generating roaating magnetic field.

G. LEDs.

There can be number of switches involved in the project. Each switch has a LED which indicates the switching process. If LED light blinks on, it means the switch is on and vice versa.

H. Step Down Transformer

We use step down transformer to step down the voltage from 220 to 9 volt ac. The AC signal output from the transformer is further connected to the rectifier circuit for AC to DC conversion. Transformer's current rating is 750 mA.

I. Relays

In order to enable a circuit to be isolated from the system only under faulty circumstances, protective relays are used. Usually it is open circuit relay. The relay is normally present with 4 terminals, out of which two are connected to relay winding and remaining two are connected to the circuit to be controlled. It has characteristics involving sensitivity, speed, selectivity.

3. FUNCTIONAL DESCRIPTION

The MT8870D/MT8870D-1 monolithic DTMF receiver has comparatively smaller size, lower power consumption and higher performance. MT8870D consists of a filter section, which splits the high and low frequency group tones, followed by a digital counting section which validates the frequency and period of the received tones before passing the corresponding code to the output bus.

A. Filter Section

Separation of the low-group and high group tones is achieved by applying the DTMF signal to the inputs of two band pass filters, the bandwidths of which correspond to the low and high group frequencies. The filter section records at 350 and 440 Hz for exceptional dial tone rejection. Output from every filter is sent to a mono order capacitor filter section which even the signals prior to limiting. Limiting is achieved by high-gain comparators present with hysteresis to prevent detection of unwanted signals. Comparators' output deliver full rail logic swings at the frequencies of the incoming DTMF signals.

B. Decoder Section

Following the filter section we have a decoder section which determines the frequencies of the tones coming from the filter and verifies that they correspond to standard DTMF frequencies. A complex combination protect tone simulation by extraneous signals signals (such as voice) while providing tolerance to small frequency variations and deviations and ensures resistance to talk-off and tolerance to the interfering frequencies and noise. When the decoder identifies the

presence of two distinguish tones (this is referred to as the signal condition) the Early Steering (Est.) output will go to an active state. Est. adopts an inactive state with any loss in signal.

Table 1: DTMF low and high frequency and binary coded output

| Button	Low DTMF frequency (Hz)	High DTMF frequency (Hz)	Binary coded output			
			Q1	Q2	Q3	Q4
1	697	1209	0	0	0	1
2	697	1336	0	0	1	0
3	697	1477	0	0	1	1
4	770	1209	0	1	0	0
5	770	1336	0	1	0	1
6	770	1477	0	1	1	0
7	852	1209	0	1	1	1
8	852	1336	1	0	0	0
9	852	1477	1	0	0	1
0	941	1336	1	0	1	0
*	941	1209	1	0	1	1
#	941	1477	1	1	0	0

C. Steering circuit

Before registering the decoded tone pair, receiver checks for a valid signal duration (referred to as "character-recognition-condition"). This checking process is performed by an external RC time constant. A logic high on Est causes VC to rise as the capacitor discharges. Providing signal conditioning is maintained (while Est remains high) for the validation period (tGTP), VC reaches the threshold (VTh) of the steering logic to register the tone pair, thus latching its corresponding 4-bit code into the output port/latch.At this instant, the GT output is activated and drives VC to VDD. GT continues to be high as long as Est remains high, indicating that received tone pair has been registered. While rejecting signals too short to be considered valid, the signal is also tolerated by the receiver only if too short. These very short signals are considered not as an interruption but as a pause. This capability along with the capability of selecting the steering time constants permits the designer to meet high requirements accordingly.

D. Guard time adjustment also permits the designer to modify system parameters such as talk-off and noise immunity.

E. Buzzer Section

This section has a buzzer to indicate and a current limiting resistance. The buzzer operates in the range of 20-25mA. The buzzer is driven 5v voltage but it can operate between 3V-24V. The current limiting resistance is measured by means of the ohm's law. Buzzer is used for checking the software condition and demonstrating specific condition.
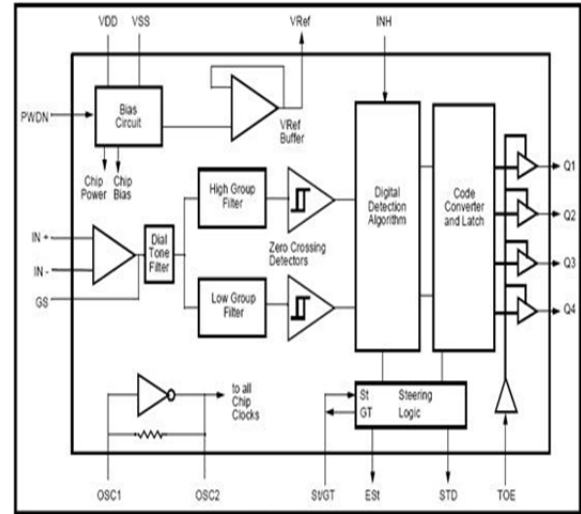
Fig. 2: Functional Circuit Diagram for the System

4. RESULTS AND DISCUSSION

The DTMF signal generated by the mobile phone was successfully decoded. Using the decoded output and use of proper program for the microcontroller the system was used to control output of four relays. The output has been shown by an LED blink. There are ten LEDs connected to the microcontroller output, two of them are connected to AC motor via Darlington pairs. The system is immune to external noise and ring tones of the receiver mobiles. There is a slight probability that the system turns ON and OFF due to ambient noises like voice, sound arising from door latches etc. But this aspect has not practically wounded the working of the system as of time. This project presents a method to control the domestic system using the DTMF signal produced by telephonic communication instrument when the user pushes the buttons of the handset linked to the system. This control method uses the commercial mobile communication links for data transmission. This allows the user to control the system remotely using DTMF tone sent by cell phone.
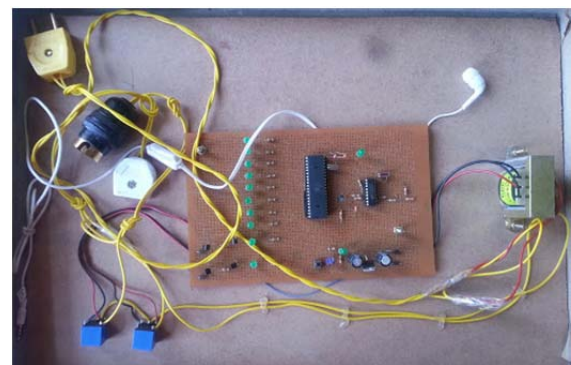
Fig. 3: Circuit of the System

5. CONCLUSION

The remote control device to switch AC motor has been effectively studied and was configured. The DTMF signal is generated by means of a distant controlling device i.e. mobile phone was successfully decoded. The decoded output and the program fetched to the microcontroller are used to operate the output of 4 relays connected further. The output is shown via blink of a LED. The system is made immune to external noises and ring tones of the receiver mobile. There is a probability that the system could be affected ambient noises like sound arising from door latches etc. But these aspects have not barged in the working of the prototype as of now.

The fabricated remote control would be highly effective to serve domestic purposes from anywhere. It would be quite beneficial for saving electricity at low cost and minimum efforts. Further modifications and study would prohibitively increase the chances to give even more advantageous results.

6. ACKNOWLEDGEMENT

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