DTMF BASED BORDER SECURITY SYSTEM

Project Report submitted in partial fulfillment of the requirement for the degree of

Bachelor of Technology.

in

Electronics and Communication Engineering

Under the Supervision of

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Certificate

This is to certify that project report entitled "DTMF BASED BORDER SECURITY SYSTEM", submitted by Japjeev Singh Anand (091104), Jay Prakash Pandey (091102) and Satinder Pal Kaur (091108) in partial fulfillment for the award of degree of Bachelor of Technology in Electronics and Communication Engineering to Jaypee University of Information Technology, Waknaghat, Solan has been carried out under my supervision.

This work has not been submitted partially or fully to any other University or Institute for the award of this or any other degree or diploma.

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ABSTRACT

In this project the robot is controlled by a mobile phone that makes a call to the mobile phone attached to the robot. In the course of a call, if any button is pressed, a tone corresponding to the button pressed is heard at the other end of the call. This tone is called DTMF (dual-tone-multiple-frequency).The robot perceives this DTMF tone with the help of the phone stacked in the robot. The received tone is processed by the microcontroller with the help of DTMF decoder (MT8870). The decoder decodes the DTMF tone into its equivalent binary digit and this binary number is sent to the microcontroller. The microcontroller is programmed to take a decision for any given input and outputs its decision to motor drivers in order to drive the motors in forward direction or backward direction or turn. The mobile phone that makes a call to mobile phone stacked in the robot act as a remote. So this robotic project does not require the construction of receiver and transmitter units.

CHAPTER1: INTRODUCTION

We have designed a circuit that that works on DTMF (Dual-tone multi-frequency signaling) . In this we are giving input from GSM mobile phone. Input is given by pressing keys and tone is generated .Each tone has a particular frequency that goes to DTMF decoder .DTMF decoder decodes the frequency and sends it to the microcontroller .Now we have LEDs in the circuit .As soon as decoder decodes the frequency LED glows and microcontroller performs the corresponding function according to the key tone pressed. IC L293D is used to drive the motors.

Dual-tone multi-frequency signaling (DTMF) is used for telecommunication signaling over analog telephone lines in the voice-frequency band between telephone handsets and other communications devices and the switching center. The version of DTMF that is used in push-button telephones for tone dialing is known as Touch-Tone. It was developed by Western Electric and first used by the Bell System in commerce, using that name as a registered trademark.

That is, a DTMF signal is one that consists of only the sum of two pure sinusoids at valid frequencies. The matrix below shows which two frequencies produce what tone.

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

Anyway, in DTMF, the tone '8' is represented with the sum of 852 Hz and 1336 Hz sinusoids. It is understood that the energy of the sinusoids present in the generated tone should exceed the energy present at any other frequencies by 30dB. Also, the DTMF frequencies are effectively divided into two subsets. One contains the lower four frequencies, and the other contains the upper four. Each DTMF tone is defined by the presence of exactly one of the frequencies from each of those subsets.

Any frequency within 1.5% of the DTMF frequency should be detected. Frequencies with 3.5% error should never be detected. Inside the 1.5% - 3.5% range is don't care. DTMF signals lasting 40ms should always be detected. Signals less than 23ms should never be detected. Inside the 23ms-40ms range is don't care. DTMF signals that are interrupted for 10ms or less should not detect two separate signals. Twist is caused by a non-uniform power loss across the frequency spectrum. Normal twist is when low frequency power is greater than high frequency. Reverse twist is obviously the reverse condition. The detector must be reject 8db and 4db for normal and reverse twist respectively.

1.1 OVERVIEW

More than 25 years ago the need for an improved method for transferring dialing information through the telephone network was recognized. The traditional method, Dial pulse signaling, was not only slow, suffering severe distortion over long wire loops, but required a DC path through the communications channel. A signaling scheme was developed utilizing voice frequency tones and implemented as a very reliable alternative to pulse dialing. This scheme is known as DTMF (Dual Tone Multi Frequency), Touch-Tone or simply, tone dialing. As its acronym suggests, a valid DTMF signal is the sum of two tones, one from a low group (697-941Hz) and one from a high group (1209-1633Hz) with each group containing four individual tones.

Before DTMF was introduced, telephone networks were dependent on pulse dialing. In pulse dialing the pulses are generated by rapidly connecting and disconnecting the telephone connection. Typically, each number corresponded to the same number of clicks, thus 1 was represented by one click, 2 by two clicks and so on. The numbers were dialed with a short gap between each digit in order to avoid the digit bleeding into the next digit. Pulse dialing had the disadvantage that it was limited to the local exchange connections and required an operator for connecting long distance calls. It was also easy to trick the phone system by tapping the hook which is pushed down when the telephone is hung up.

Research on DTMF was initiated by Bell labs in the late fifties in an attempt to allow tone signals for long distance dialing. DTMF was being developed as a future of

electronic telecommunications as opposed to the mechanical telecommunication networks that were prevalent at that time.

1.2 HISTORY

DTMF was introduced on November 18, 1963 under the trademark of 'Touch Tone' by Bell Systems. The first Touch Tone telephone was the Western Electric model 1500 with ten buttons, which was introduced on the same year. Using audio tones for signaling was not new and the Multi-Frequency signaling (MF) which was used by telephone exchanges for communicating with each other using in-band signaling was already around. Multi-frequency signaling uses a combination of two pure sine wave frequencies for signaling.

Both CCITT and Bell System devised various MF signaling protocols. The in-band signaling between exchanges was based on a 16 digit keypad, which a telephone operator used to input the next leg of the destination telephone number for connecting to the downstream telephone operator. This semi-automated signaling and switching technology had the twin advantage of cost and time effectiveness as it was faster and cheaper to use MF.

The MF technology was a great success among specialists for establishing long distance telephone calls. The Touch Tone was an extension of this technology to the end consumer and was offered as a 'modern way' of placing calls where consumers can dial the destination telephone number directly without having to talk to a telephone operator. AT&T described the product as ""a method for pushbutton signaling from customer stations using the voice transmission path." Engineers who designed the Touch Tone experimented with the keypad layout which would replace the rotary dial on telephone sets and the current layout with 1 in the upper-left and 0 at the bottom was chosen after testing nearly 15 different layouts. During the initial days mechanical switches were used in the keypads to select different taps on tuned coils and the microphone was disconnected every time a key was pressed in order to prevent the background noise from interfering with the DTMF tones that were transmitted. Each button activated two contacts and the system was called dual tone multi frequency because of the two tones and multiple frequencies generated. The tones are then decoded by the switching center to identify which key was pressed.

When it came to selecting the frequencies for DTMF, the engineers wanted a set of frequencies that would not interfere with the MF based switching between telephone exchanges. The initial research team had also thought through the possibility of accessing computers through telephone lines and surveyed several companies to identify their needs for this. The # (hash) and *(star) keys were added based on the inputs received. A set of lettered keys A,B, C and D were also added to facilitate menu selection, though it was later dropped from most phones. However, it was several years before these keys were widely used for suppressing caller IDs or for entering service codes. It was also used by public pay phones that would accept credit cards for sending information from the magnetic strip.

Yet another use for the letter keys was by the military, where it was used to prioritize the calls. The relabeled letters were used to define the priority of the calls before dialing, in order to cut currently active calls, if required so as to allow the more important traffic to flow through uninterrupted. The levels of priority available were Flash Override (A), Flash (B), Immediate (C), and Priority (D), in decreasing order of priority. Pressing any of these keys prioritized the call overriding other calls on the network. For example, if B was pressed before dialing a number, the telephone switch would first look for free lines and if unavailable, try to disconnect any no-priority calls. If that was also unavailable then it would disconnect the D and C priority calls in that order so as to free a line for this call. A Flash Override would stop all other calls on the trunks between the origin and destination of the current call and hence it was limited to the White House Communications Agency. However, this method of precedence dialing is largely obsolete today as military networks today use number combinations to prioritize calls.

Once DTMF was launched, pulse dialing lost its significance. As a result, DTMF controlled switching systems were introduced in telephone exchanges in lieu of the equipment circuits that were used. Customer telephone sets were also upgraded to use DTMF circuits and tone dialing. Several tests were performed during the sixties on the DTMF system and it was made official during that time. Since then, DTMF has been used as the de-facto telecommunications dialing and switching system.

1.3 PRESENT SCENARIO

Conventionally, wireless controlled robots use RF circuits, which have drawbacks of limited working range & frequency range, use of mobile phones can overcome this limitation .Here is a Mobile operated robot circuit which can be controlled by using mobile phone. It can capture audio and video information from the surroundings and can send to a remote station through RF signal.

The Mobile operated camera robot has been designed in such a way that it can fulfill all the needs of military, police and also for personal security. It has countless application and can be used in different environments and scenarios. For instance, at one place it can be used by bomb disposal squad, while at another instance it can be used for handling mines. While another application can be to provided up to date information in hostage situation. The robot is made for purpose by military operation spy robot for navigator in forest. The mobile operated robot is a very small application of DTMF technology. Here, we are showing you the method of using the DTMF to operate robot because the robot is operated by mobile so the range of robot communication is not limited.

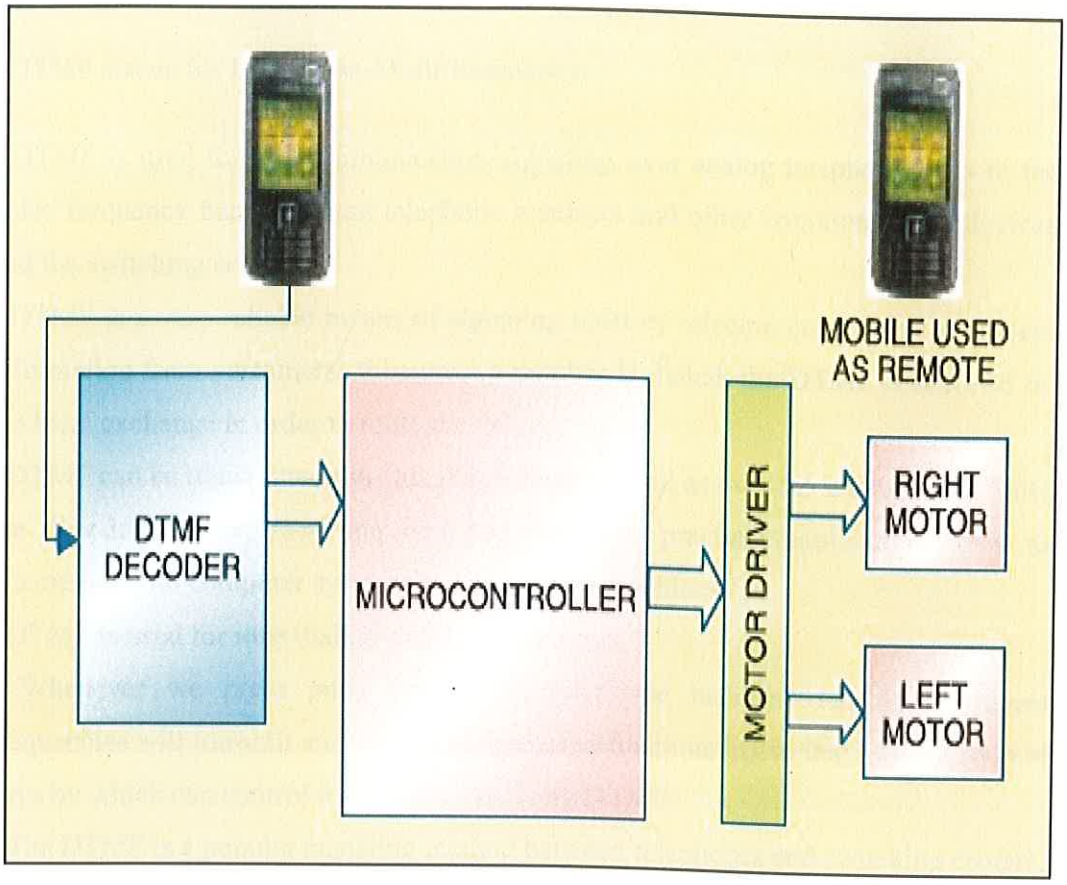
It just depends on the network of mobile and in the present scenario, the mobile network is everywhere

1.4 WORK DISCRIPTION

During the first 6 months of our project we have completed the decoding part of the circuitry and plan to implement the microcontroller and motor controller driver circuit during the next 6 months. For decoding the input from mobile phone we have used IC MT8870. This is an 18 pin IC dedicated for decoding purposes. Next we have used microcontroller 8051 for programming and running the entire system. It is used to take input from decoder and as per the program run the motor controller driver. We have used motor controller driver L293D to run the motors.

1.5 BLOCK DIAGRAM

Here is the block diagram of mobile operated spy robot, which consists of a transmitting mobile unit, DTMF decoder, microcontroller, motor driver and a receiver mobile unit.



1.5.1 WORKING

The robot is controlled by a mobile phone that makes a call to another mobile phone attached to the robot. In duration of this call, if any key is pressed a tone corresponding to the key pressed is heard at the other end called „Dual Tone Multiple frequency (DTMF)

tone. The robot receives these tones with help of phone stacked in the robot.

The received tone is processed by the microcontroller with the help of DTMF decoder IC MT8870. This IC sends a singles to the motor driver IC L293D which drives the motor forward, reverse...etc. The microcontroller output is not sufficient to drive DC motors, a high voltage and high current drivers are required. The L293D is a quadruple high current half H driver designed to provide bidirectional drive currents of up to 600 mA at voltage from 4.5 V to 36V. It will become easier to drive dc motor with such driver

1.6 WHAT IS DTMF

• DTMF stands for Dual-Tone-Multi-Frequency.

• DTMF is used for telecommunication signaling over analog telephone lines in the voice frequency band between telephone handsets and other communication devices and the switching center.

• DTMF is a very reliable means of signaling used by telecom companies to process information from customers. Whenever a number is dialed, the DTMF is decoded by the local exchange in order to route the call.

• DTMF can be transmitted over telephone lines as well as over the internet. The tones are decoded on the receiving end and used for practical applications such as interacting with computer systems and answering machines.

• DTMF is used for tone dialing using push buttons.

• Whenever we press push buttons on telephone handsets two pre assigned frequencies will transmit and we can assign some functionality to that key or group of keys by which can control remote devices using DTMF.

• The DTMF is a popular signaling method between telephones and switching centers.

• DTMF is also used for signaling between the Telephone network and computer networks.

•The DTMF signals are Transmitted over a telephone line.

•Low group: 697 Hz, 770 Hz, 852 Hz, 941 Hz.

• High group: 1209 Hz, 1336 Hz, 1477 Hz,1633Hz.

CHAPTER 2: BACKGROUND MATERIAL

2.1 MICROCONTROLLER 8051

Microcontroller is an IC of family 8051 series. This is really specialized IC having all the features available with 8085 and in addition to that other features like processor core, memory, and programmable I/O peripherals. This type of IC is self sufficient, can work solely without any help from other IC's. This Type of IC's are used in Automobile companies, embedded systems, remote control devices. This type of IC is used to perform function on its own, i.e. Automatic control is handled here. This IC is most advance version of microprocessor which can control other process. This IC has its own memory, I/O controls, interrupts Etc. Microcontroller has inbuilt RAM and ROM and inbuilt timer. It has inbuilt serial port. It has separate memory to store program and data. It consists of many functional pins .In this Boolean operation is directly possible. It takes few instructions to read and write data from external memory.

A designer will use a Microcontroller to

1. Gather input from various sensors
2. Process this input into a set of actions
3. Use the output mechanisms on the Microcontroller to do something useful

The 'general purpose' attribute of a Microcontroller is very significant, and shouldn't be overlooked. A general purpose Microcontroller is a very powerful tool that allows a designer to create a special purpose design. The design becomes partially hardware and partially software. There is great flexibility in the software end, as the designer can create practically unlimited variations on the design by changing the software. A Microcontroller has several major sections that are pretty typical no matter which type or version of Microcontroller you end up using

2.1.1 RAM

RAM means Random Access Memory. It is general purpose memory that can store data or programs. RAM is 'volatile', which means when the power is shut off, the contents of the memory is lost. Most personal computers have several megabytes of RAM. Most microcontrollers have some RAM built into them, but not very much. 256 bytes is a fairly common amount. Some have more, some have less.

A random-access device allows stored data to be accessed directly in any random order. In contrast, other data storage media such as hard disks, CDs, DVDs and magnetic tape, as well as early primary memory types such as drum memory, read and write data only in a predetermined order, consecutively, because of mechanical design limitations. Therefore the time to access a given data location varies significantly depending on its physical location.

Today, random-access memory takes the form of circuits. Modern types of DRAM are not random access, as data is read in bursts, although the name DRAM / RAM has stuck. However, many types of SRAM, ROM, OTP, and NOR flash are still random access even in a strict sense. RAM is normally associated with volatile types of memory (such as DRAM memory modules), where its stored information is lost if the power is removed.

2.1.2 ROM

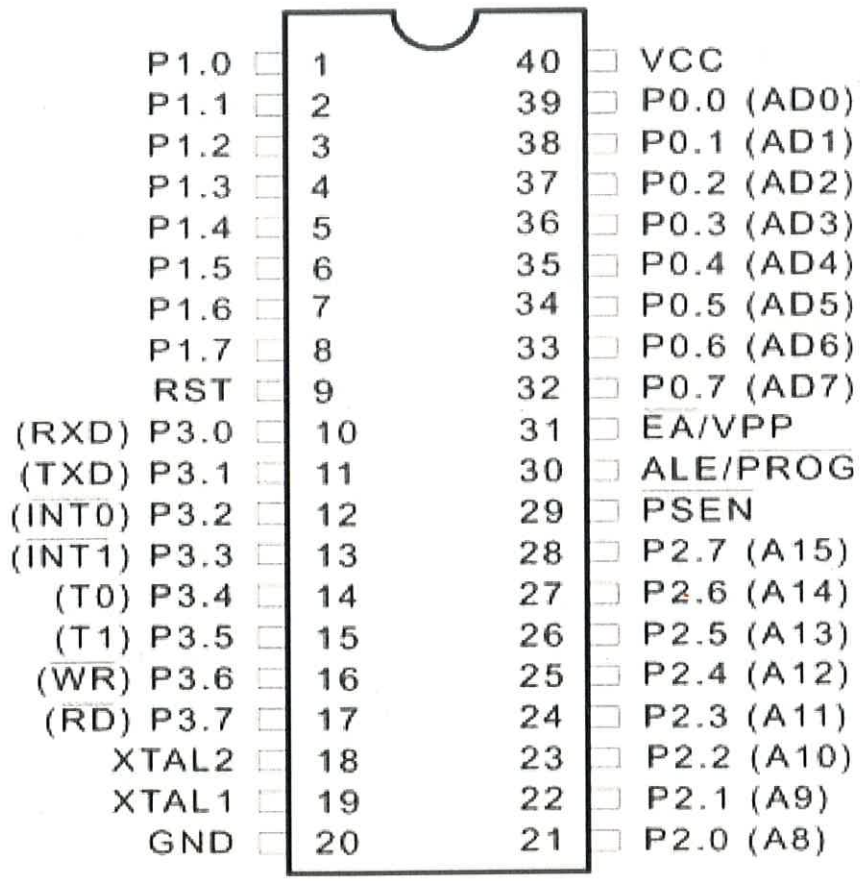
ROM is Read Only Memory. This is typically memory that is programmed at the factory to have certain values. It cannot be changed, but it can be read as many times as you want. ROM is typically used to store programs and data that don't change over time.

In 8051 we have used 4K ROM.

Comparison of 8051 family members:

Features	8051	8052	8031
RAM(bytes)	128	256	128
ROM	4K	8K	0K
Timers	2	3	2
Serial port	1	1	1
I/O pins	32	32	32
Interrupt sources	6	8	6

2.1.3PIN DIAGRAM



2.1.4 PIN FUNCTİONS

ALE/PROG: Address Latch Enable output pulse for latching the low byte of the address during accesses to external memory. ALE is emitted at a constant rate of 1/6 of the oscillator frequency, for external timing or clocking purposes, even when there are no accesses to external memory. (However, one ALE pulse is skipped during each access to external Data Memory.) This pin is also the program pulse input (PROG) during EPROM programming.

PSEN: Program Store Enable is the read strobe to external Program Memory. When the device is executing out of external Program Memory, PSEN is activated twice each machine cycle (except that two PSEN activations are skipped during accesses to external Data Memory). PSEN is not activated when the device is executing out of internal Program Memory.

EA/VPP: When EA is held high the CPU executes out of internal Program Memory (unless the Program Counter exceeds 0FFFH in the 80C51). Holding EA low forces the CPU to execute out of external memory regardless of the Program Counter value. In the 80C31, EA must be externally wired low. In the EPROM devices, this pin also receives the programming supply voltage (VPP) during EPROM programming required.

XTAL1: Input to the inverting oscillator amplifier.

XTAL2: Output from the inverting oscillator amplifier.

Port 0: Port 0 is an 8-bit open drain bidirectional port. As an open drain output port, it can sink eight LS TTL loads. Port 0 pins that have 1s written to them float, and in that state will function as high impedance inputs. Port 0 is also the multiplexed low-order address and data bus during accesses to external memory. In this application it uses strong internal pullups when emitting 1s. Port 0 emits code bytes during program verification. In this application, external pullups are required.

Port 1: Port 1 is an 8-bit bidirectional I/O port with internal pullups. Port 1 pins that have 1s written to them are pulled high by the internal pullups, and in that state can be used as inputs. As inputs, port 1 pins that are externally being pulled low will source current because of the internal pullups.

Port 2: Port 2 is an 8-bit bidirectional I/O port with internal pullups. Port 2 emits the high-order address byte during accesses to external memory that use 16-bit addresses. In this application, it uses the strong internal pullups when emitting 1s.

Port 3: Port 3 is an 8-bit bidirectional I/O port with internal pullups. It also serves the functions of various special features of the 80C51 Family as follows:

Port Pin Alternate Function
P3.0 RxD (serial input port)
P3.1 TxD (serial output port)
P3.2 INT0 (external interrupt 0)
P3.3 INT1 (external interrupt 1)
P3.4 T0 (timer 0 external input)
P3.5 T1 (timer 1 external input)
P3.6 WR (external data memory write strobe)
P3.7 RD (external data memory read strobe)

VCC: Supply voltage
VSS: Circuit ground potential

2.1.5 DIFFERENCE BETWEEN MICROPROCCESSOR AND MICROCONTROLLER

Microprocessor: Example - 8085 IC. This 40 pin IC is used to perform many Arithmetical and logical operations. This IC is used to interface different IC's to perform different tasks. It is a multipurpose, programmable, register based electronic device which reads binary instructions from memory, processes the input data as per instructions and provides output. It does not have inbuilt RAM, ROM or timer. In this input and output ports are not available, requires extra device like 8155 to interface

devices.

It does not have inbuilt serial port, requires 8250 device .Program and data are stored in same memory. It has less multifunction pins on IC. In this Boolean operation is not possible directly. It takes many instructions to read and write data from external memory. For Example: Providing multiple interrupts using 8259 IC. Similarly we can perform many other operations by interfacing with other IC's. These types of IC's are used in computers and personal uses.

Microcontroller is an IC of family 8051 series. This is really specialized IC having all the features available within 8085 and in addition to that other features like processor core, memory, and programmable I/O peripherals. This type of IC is self sufficient, can work solely without any help from other IC's. These types of IC's are used in Automobile companies, embedded systems, remote control devices.

This type of IC is used to perform function on its own , i.e. Automatic control is handled here. This IC is most advance version of microprocessor which can control other process. This IC has its own memory, I/O controls, interrupts Etc. Microcontroller has inbuilt RAM or ROM and inbuilt timer. It has inbuilt serial port. It has separate memory to store program and data. It consists of many functional pins on the IC. In this Boolean operation is directly possible. It take few instructions to read and write data from external memory.

2.2 IC MT 8870

The MT8870D/MT8870D-1 is a complete DTMF receiver integrating both the band - split filter and digital decoder functions. The filter section uses switched capacitor techniques for high and low group filters; the decoder uses digital counting techniques to detect and decode all 16 DTMF tone-pairs into a 4-bit code. External component count is minimized by on chip provision of a differential input amplifier, clock oscillator and latched three-state bus interface.

This IC 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 made 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.

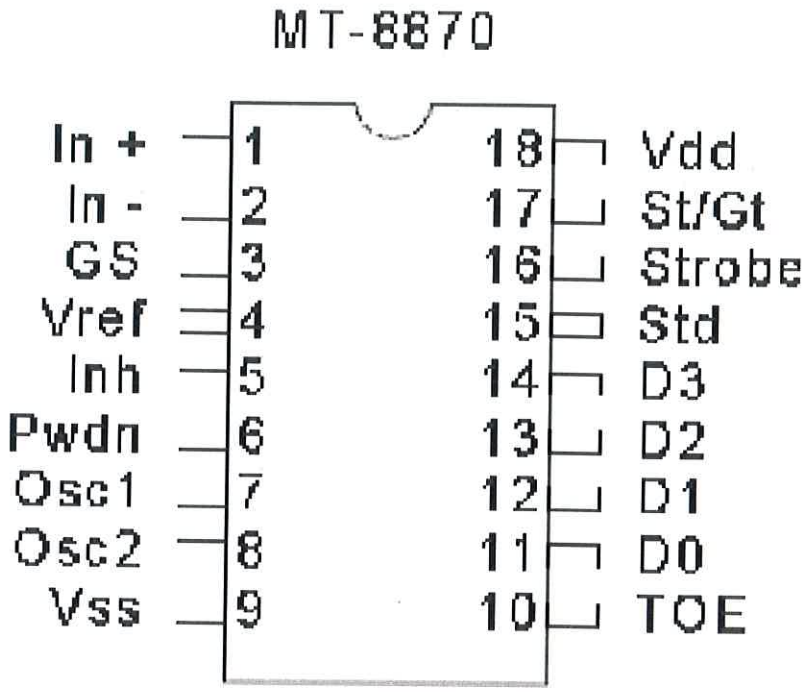
A complete communication consists of the tone generator and the tone decoder. In this article, we are use the IC MT8870DE, the main component to decode the input dial tone to 5 digital outputs. These digital bits can be interface to a computer or microcontroller for further application (eg. remote control, phone line transfer operation, etc).

The MT-8870 is a full decoder functions into a single 18-pin DIP or SOIC package. Manufactured using CMOS process technology, the M-8870 offers low power consumption (35 mW max) and precise data handling. Its filter section uses switched capacitor technology for both the high and low group filters and for dial tone rejection. Its

decoder uses digital counting techniques to detect and decode all 16 DTMF tone pairs into a 4-bit code. External component count is minimized by provision of an on-chip differential input amplifier, clock generator, and latched tri-state interface bus. Minimal external components required include a low-cost 3.579545 MHz color burst crystal, a timing resistor, and a timing capacitor.

The M-8870-02 provides a "power-down" option which, when enabled, drops consumption to less than 0.5 mW. The M-8870-02 can also inhibit the decoding of fourth column digits

2.2.1 PIN DIAGRÀM



2.2.2 TABLE FOR DIFFERENT INPUTS AT DIFFERENT KEYS

F_{LOW}	F_{HIGH}	Key (ref.)	OE	Q4	Q3	Q2	Q1
697	1209	1	H	0	0	0	1
697	1336	2	H	0	0	1	0
697	1477	3	H	0	0	1	1
770	1209	4	H	0	1	0	0
770	1336	5	H	0	1	0	1
770	1477	6	H	0	1	1	0
852	1209	7	H	0	1	1	1
852	1336	8	H	1	0	0	0
852	1477	9	H	1	0	0	1
941	1336	0	H	1	0	1	0
941	1209	*	H	1	0	1	1
941	1477	#	H	1	1	0	0
697	1633	A	H	1	1	0	1
770	1633	B	H	1	1	1	0
852	1633	C	H	1	1	1	1
941	1633	D	H	0	0	0	0
ANY	ANY	ANY	L	Z	Z	Z	Z
L = logic low, H = logic high, Z = high impedance							

2.2.3 PIN DESCRIPTION

1. IN+ Non-Inverting Op-Amp (Input).

2. IN- Inverting Op-Amp (Input).

3. GS Gain Select. Gives access to output of front end differential amplifier for connection of feedback resistor.

4. V-Ref Reference Voltage (Output). Nominally VDD/2 is used to bias inputs at mid-rail .

5. INH Inhibit (Input). Logic high inhibits the detection of tones representing characters A, B, C and D. This pin input is internally pulled down.

6. PWDN Power Down (Input). Active high. Powers down the device and inhibits the oscillator. This pin input is internally pulled down.

7. OSC1 Clock (Input).

8. OSC2 Clock (Output). A 3.579545 MHz crystal connected between pins OSC1 and OSC2 completes the internal oscillator circuit.

9. VSS Ground (Input). 0 V typical.

10. TOE Three State Output Enable (Input). Logic high enables the outputs D0-D3. This pin is pulled up internally.

11-14. D0-D3 Three State Data (Output). When enabled by TOE, provide the code corresponding to the last valid tone-pair received. When TOE is logic low, the data outputs are high impedance.

15. StD Delayed Steering (Output). Presents a logic high when a received tone-pair has been registered and the output latch updated; returns to logic low when the voltage on St/GT falls below VTSt.

16. ESt Early Steering (Output). Presents a logic high once the digital algorithm has detected a valid tone pair (signal condition). Any momentary loss of signal condition will cause ESt to return to a logic low.

17. St/GT Steering Input/Guard time (Output) Bidirectional. A voltage greater than VTSt detected at St causes the device to register the detected tone pair and update the output latch. A voltage less than VTSt frees the device to accept a new tone pair. The GT output acts to reset the external steering time-constant; its state is a function of ESt and the voltage on St.

18. VDD Positive power supply (Input). +5 V typical.

2.2.4 FUNCTIONAL DESCRIPTION

The MT88700 DTMF receiver offers small size, low power consumption and high performance. Its architecture consists of a bandsplit filter section, which separates the high group tones, followed by a digital counting section which verifies the frequency and duration of the received tones before passing the corresponding code to the output bus.

2.2.5 FILTER SECTION

Separation of the low-group and high group tones is achieved by applying the DTMF signal to the inputs of two sixth-order switched capacitor band pass
Filters, the bandwidths of which correspond to the low and high group frequencies. The filter section also incorporates notches at 350 and 440 Hz for
Exceptional dial tone rejection. Each filter output is followed by a single order switched capacitor filter section which smoothes the signals prior to limiting. Limiting is performed by high-gain comparators which are provided with hysteresis to prevent detection of unwanted low-level signals. The outputs of the comparators provide full rail logic swings at the frequencies of the incoming DTMF signals.

2.2.6 DECODER SECTION

Following the filter section is a decoder employing digital counting techniques to determine the frequencies of the incoming tones and to verify that they correspond to standard DTMF frequencies. A complex averaging algorithm protects against tone simulation by extraneous signals such as voice while

Basic Steering Circuit provides tolerance to small frequency deviations and variations. This averaging algorithm has been developed to ensure an optimum combination of immunity to talk-off and tolerance to the presence of interfering frequencies (third tones) and noise. When the detector recognizes the presence of two valid tones (this is referred to as the "signal condition" in some industry specifications) the "Early Steering" (ESt) output will go to an active state. Any

subsequent loss of signal condition will cause ESt to assume an inactive state.

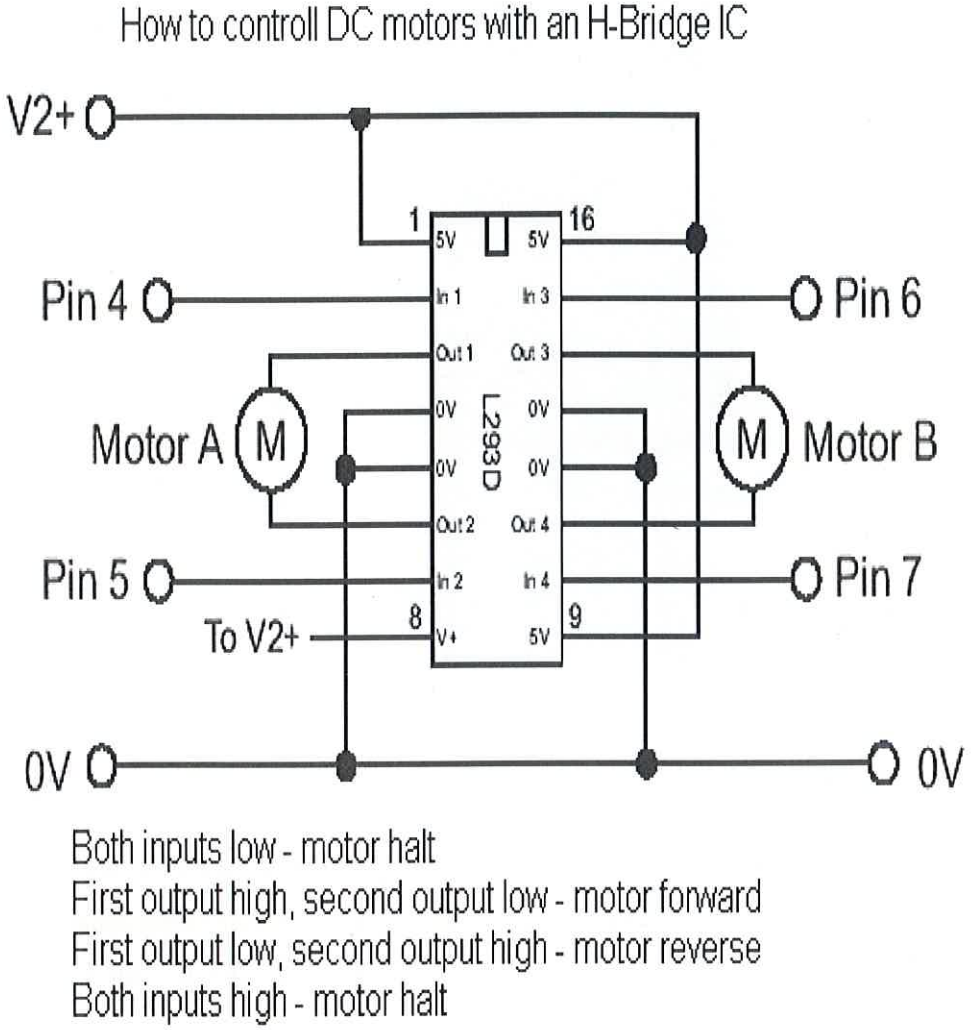
2.2.7 APPLICATION

- Paging systems
- Repeater systems/mobile radio
- Credit card systems
- Remote control
- Personal computers
- Telephone answering machine

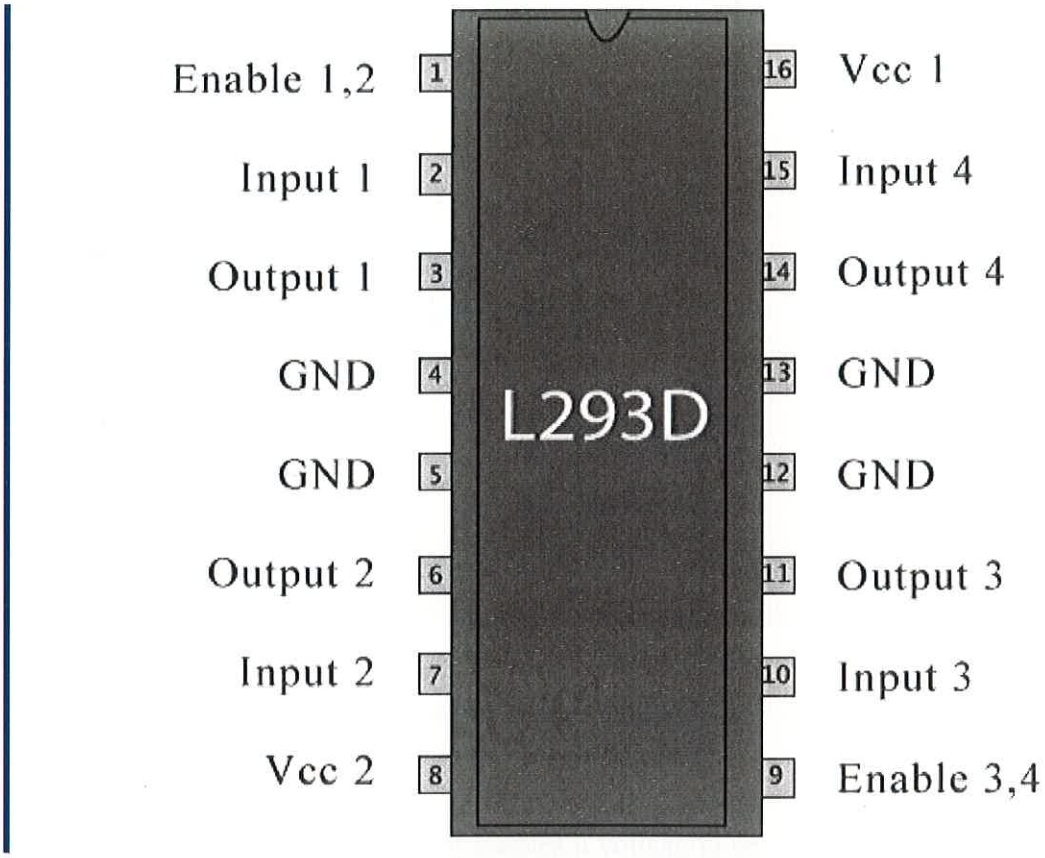
2.3 L293d MOTOR CONTROLLER DRIVER IC

L293D is a dual H-Bridge motor driver, so with one IC we can interface two DC motors which can be controlled in both clockwise and counter clockwise direction and if you have motor with fix direction of motion then you can make use of all the four I/Os to connect up to four DC motors. L293D has output current of 600mA and peak output current of 1.2A per channel. Moreover for protection of circuit from back EMF output diodes are included within the IC. The output supply (VCC2) has a wide range from 4.5V to 36V, which has made L293D a best choice for DC motor driver. Motor

drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. A simple schematic for interfacing a DC motor using L293D is shown below.



2.3.1 PIN DIAGRAM

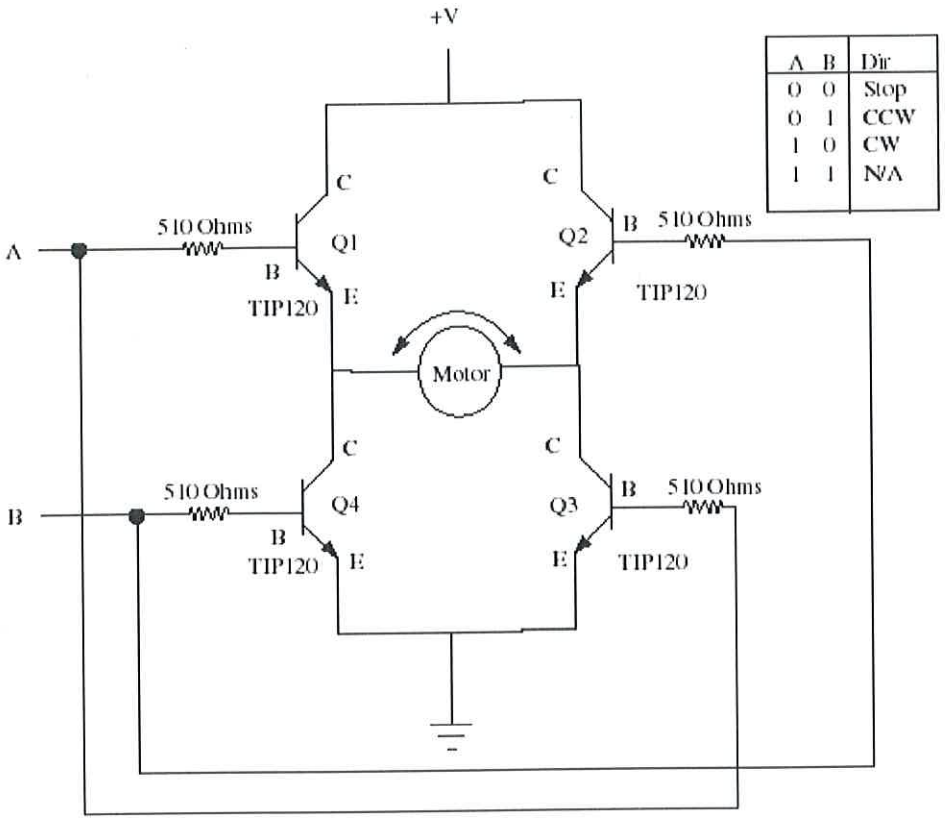


2.3.2 PIN FUNCTIONS

The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

2.3.3 H-BRIDGE



An H bridge is an electronic circuit that enables a voltage to be applied across a load in either direction. These circuits are often used in robotics and other applications to allow DC motors to run forwards and backwards. H bridges are available as integrated circuits, or can be built from discrete components

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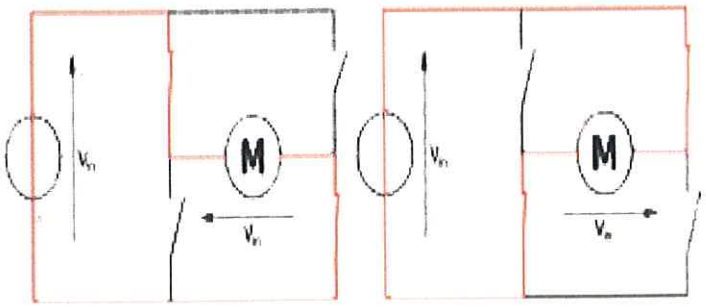
Operation



The two basic states of an H bridge

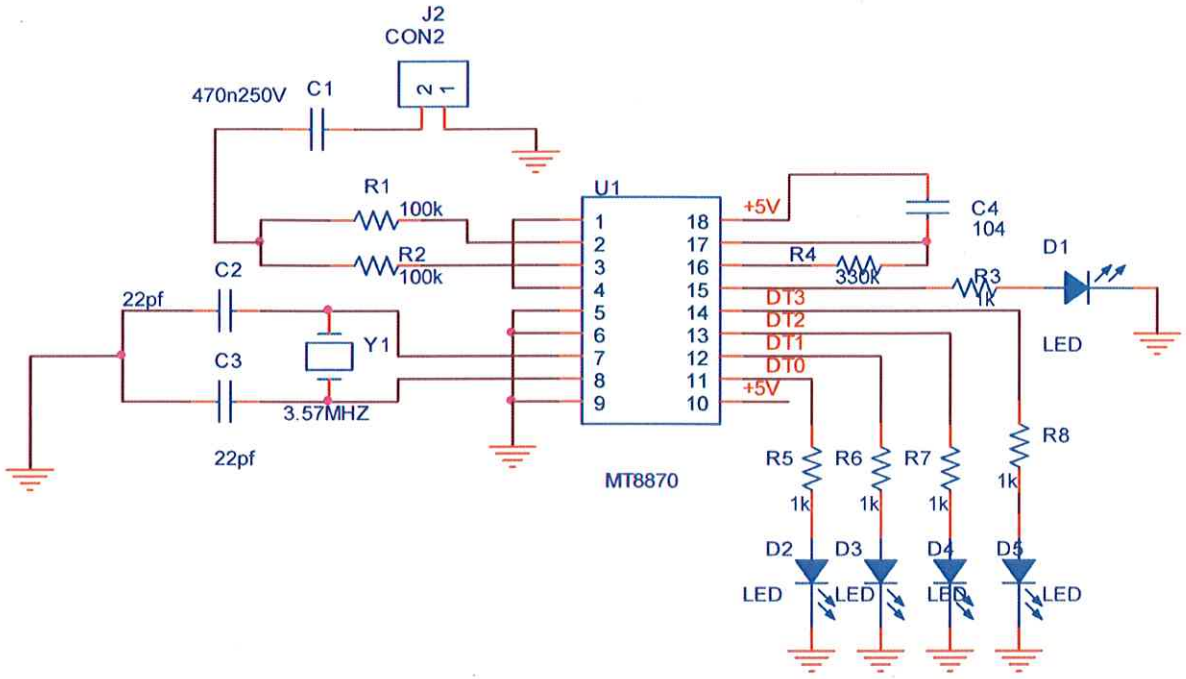
The H-bridge arrangement is generally used to reverse the polarity of the motor, but can also be used to 'brake' the motor, where the motor comes to a sudden stop, as the motor's terminals are shorted, or to let the motor 'free run' to a stop, as the motor is effectively disconnected from the circuit. The following table summarizes operation, with S1-S4 corresponding to the diagram above.

Table for movement of motors due to H-bridge.

S1	S2	S3	S4	Result
1	0	0	1	Motor moves right
0	1	1	0	Motor moves left
0	0	0	0	Motor free runs
0	1	0	1	Motor brakes
1	0	1	0	Motor brakes
1	1	0	0	Shoot-through
0	0	1	1	Shoot-through
1	1	1	1	Shoot-through

CHAPTER 3: CIRCUITS USED

3.1 DTMF CIRCUIT



In the early days, our phone system used to be operated by human operator in a telephone exchange room. The caller would pick up the phone, giving instruction to the operator to connect their line to the destination over the other end of the telephone. As more and more people found phone technology a useful communication tools, the use of human operator has become a tedious task.

As technology matured, pulse/dial tone method was inverted for telephony communication. It uses electronics and computer to assist in the phone line connection. Basically on the caller side, it is a dial tone generator. When a key is being pressed on the matrix keypad, it generates a unique tone consisting of two audible tone frequencies. For example, if the key '1' is being press on the phone, the tone you hear actually consists of a 697hz & 1209hz sine signal. The frequency use in the dial tone system is of audible range suitable for transmission over the telephone cable.

On the telephone exchange side, it has a decoder circuit to decode the tone to digital code. For example, the tone of 941hz + 1336hz will be decoded as binary '1010' as the output. This digital output will be read in by a computer, which will then act as an

operator to connect the caller's telephone line to the designated phone line. The telephone exchange center will generate a high voltage signal to the receiving telephone, so as to ring the telephone bell, to notify the receiving user that there is an incoming call.

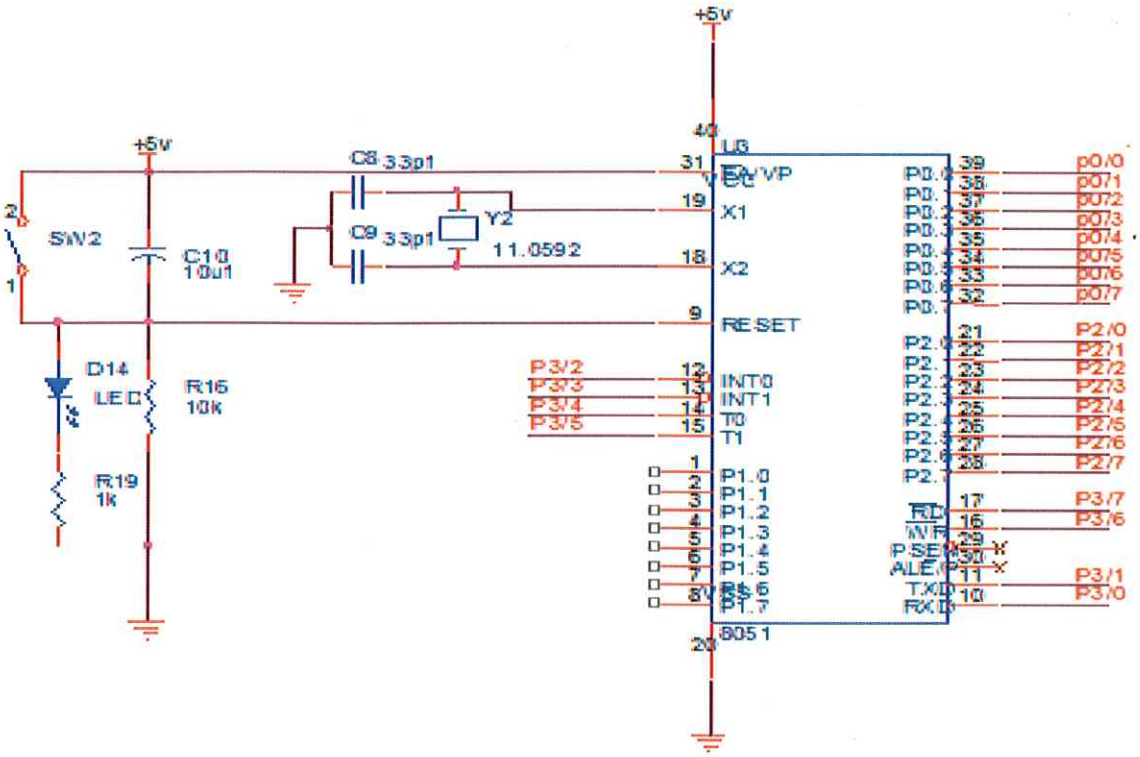
This project article focuses on a simple DTMF (dual tone multi-frequency) decoder circuit. This circuit can be interface to a computer, allowing caller to computer interaction. Many communication application can be built for example, a computerize call receiving/diverting phone network system, remote control to Home/Office electrical appliances using a telephone network.

Keypad Dial Tone Frequency Table

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

On the left side of the 8870DE the 2 resistors are chosen to set up the gain of the op-amp. The capacitor for the op-amp is for filtering noise. On the right hand side the resistor and capacitor are chosen to set up the time (ms) to detect phone rings. So the larger the values of the capacitor and resistor the longer the phone ring it will detect.

3.2 CONTROLLER CIRCUIT

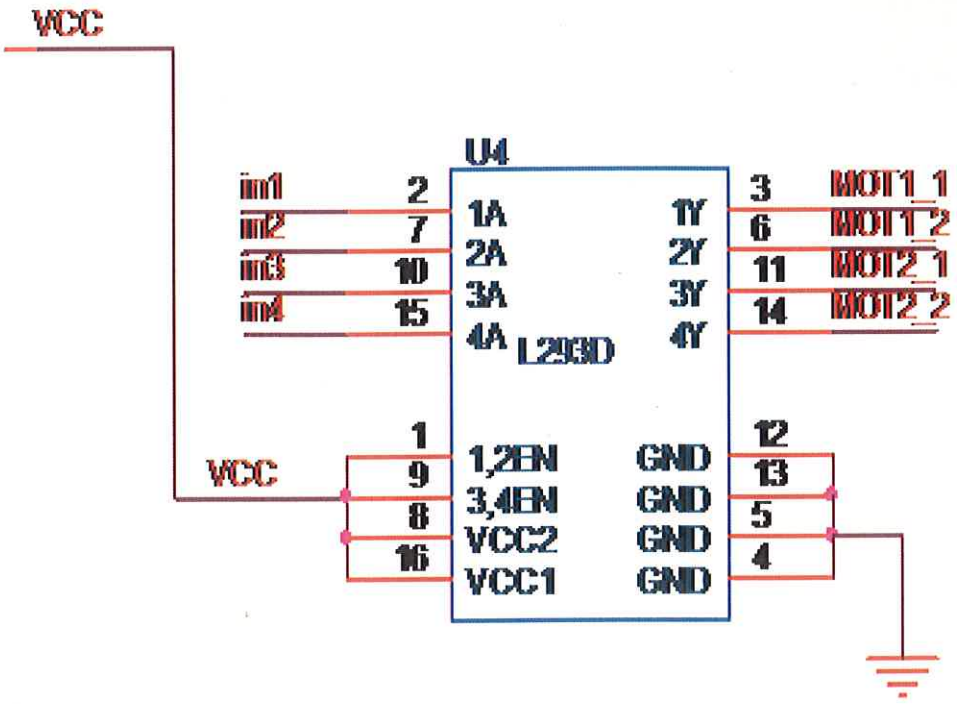


Crystal oscillator

A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency. This frequency is commonly used to keep track of time (as in quartz wristwatches) , to provide a stable clock signal for digital integrated circuits , and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, but other piezoelectric materials including polycrystalline ceramics are used in similar circuits.

Here we have used a crystal of frequency 11.0592 Mhz which is used to complete the internal circuitry of microcontroller.

3.3 MOTOR CONTROLLER DRIVER IC CIRCUIT



VCC= +5V

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

CHAPTER 4: ALGORITHM USED

4.1 INPUTS

The microcontroller 8051 is connected with DTMF decoder as follow:-The port 1 is the input port where the DTMF data bits D0 to D3 are connected with P1.0 to P1.3.

CONTROLLER PORTS	PORT PINS	DTMF DATA
PORT 1	P1.0	D0
PORT 1	P1.1	D1
PORT 1	P1.2	D2
PORT 1	P1.3	D3

4.2 OUTPUTS

The microcontroller 8051 is connected with motor driver as follow:-The port 2 is the output port and the pin connection is shown in below fig. For moving the motors in forward direction we have to give 10 to the motor or (M1A=0 & M1B1) this condition makes the motor M1 in forward direction.

CONTROLLER PORTS	PORT PINS	MOTOR DRIVER INPUTS
PORT 2	P2.0	M1A
PORT 2	P2.1	M2A
PORT 2	P2.2	M1B
PORT 2	P2.3	M2B

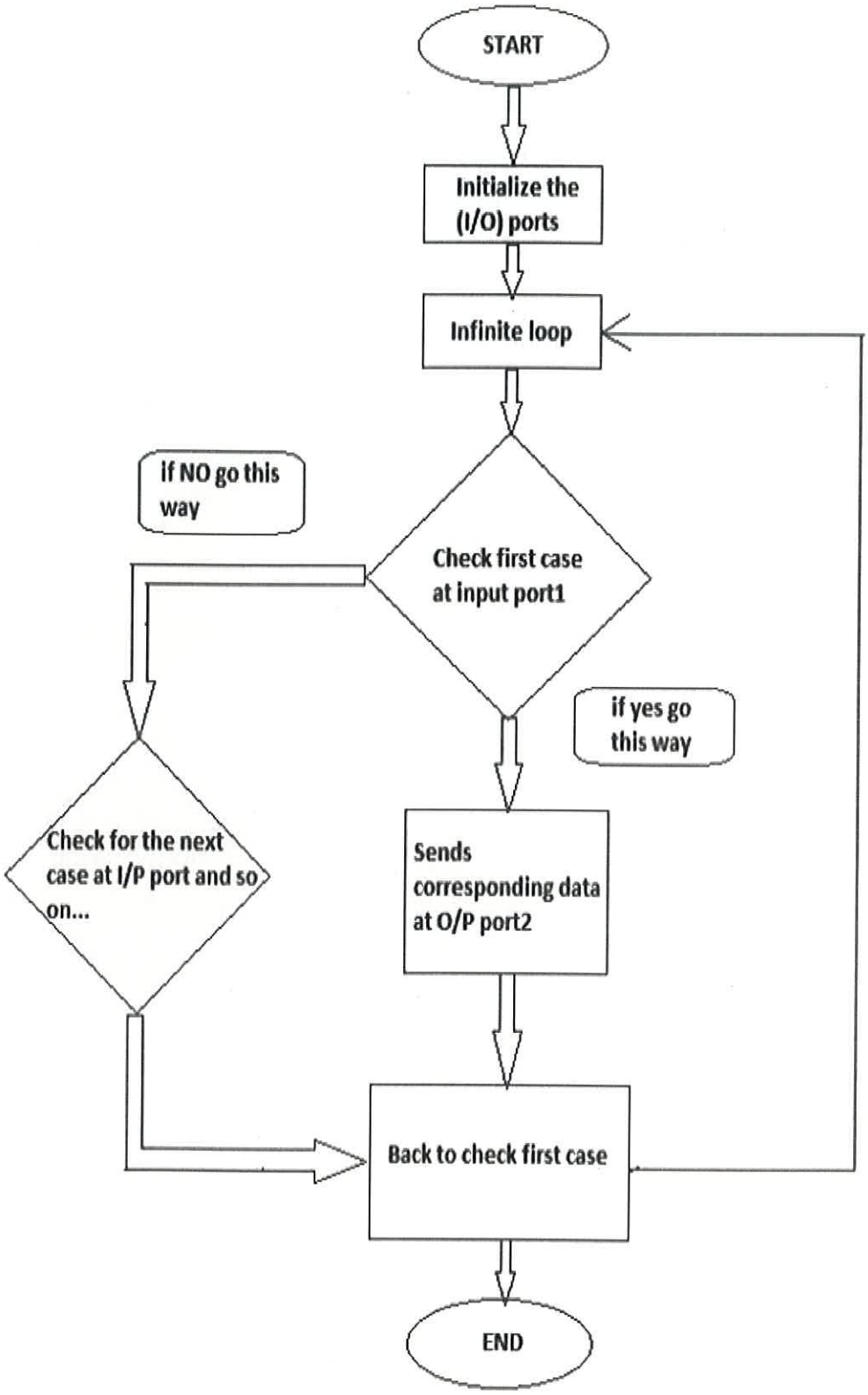
4.3 CREATING LOGIC

Now the main part of programming is to create a decision on the basis of some condition like key 2 is pressed then send some data to the output port of microcontroller. In this we
have used keys 2,4,6,8 &5 for controlling the robot.

KEY PRESSED	D3D2D1D0 (BINARY)	OUTPUT DATA AT M1A,M1B M2A,M2B	OPERATION
2	0010	1010	MOVE FORWARD
4	0100	1000	MOVE RIGHT
6	0110	0010	MOVE LEFT
8	1000	0101	MOVE BACKWARD

4.4 FLOWCHART

Programming is an art which includes some step's the flow chart is also a step of programming we can make the program without a flow chart but for making an efficient and error free program then we should use this step flow chart of the program is shown
below.


START
Initialize the (I/O) ports
Infinite loop
if NO go this way
Check first case at input port1
if yes go this way
Check for the next case at I/P port and so on...
Sends corresponding data at O/P port2
Back to check first case
END

CHAPTER 5: RESULT

We have successfully implemented DTMF based border security system.

The circuitry involving IC MT 8870 successfully decoded the key tone pressed from the remote location mobile phone. The decoded key tone served as an input for the microcontroller IC 8051 in which a program had already been burnt to perform specific functions for a particular key tone pressed. IC L293D was used to drive the motors. Hence all the parts of the project are working efficiently and serving the desired objective.

APPENDIX

1 PROGRAM

The program burnt into the microcontroller has given below:

```
#include<reg51.h>
sbit left_forward=P1^3;
sbit left_backward=P1^2;
sbit right_forward=P1^0;
sbit right_backward=P1^1;
sbit dtmf_0=P2^0;
sbit dtmf_1=P2^1;
sbit dtmf_2=P2^2;
sbit dtmf_3=P2^3;
void main()
{
left_forward=0;
left_backward=0;
right_forward=0;
right_backward=0;
while(1)
{
if(dtmf_3==0 && dtmf_2==0 && dtmf_1==1 && dtmf_0==0)
{
left_forward=1;
left_backward=0;
right_forward=1;
right_backward=0;
}

if(dtmf_3==1 && dtmf_2==0 && dtmf_1==0 && dtmf_0==0)
{
left_forward=0;
left_backward=1;
```

```
right_forward=0;
right_backward=1;
}
if(dtmf_3==0 && dtmf_2==1 && dtmf_1==1 && dtmf_0==0)
{
left_forward=1;
left_backward=0;
right_forward=0;
right_backward=0;
}
if(dtmf_3==0 && dtmf_2==1 && dtmf_1==0 && dtmf_0==0)
{
left_forward=0;
left_backward=0;
right_forward=1;
right_backward=0;
}
if(dtmf_3==0 && dtmf_2==1 && dtmf_1==0 && dtmf_0==1)
{
left_forward=0;
left_backward=0;
right_forward=0;
right_backward=0;
}
}
```

2 COMPONENTS USED FOR DESIRED RESULT

- Microcontroller AT89C51
- Battery
- Resistors
- Diode
- DC Motors (Geared)
- DTMF decoder IC 8870
- Motor driver IC L293D
- Crystal 11.0592 MHz
- Crystal 3.57 MHz

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