Mobile Operated Landrover Using Dtmf Decoder

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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 'dual-tone multiple-frequency' (DTMF) tone. The robot perceives this DTMF tone with the help of the phone stacked in the robot.*

Key words: *DTMF*

I.   Introduction

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 'dual-tone multiple-frequency' (DTMF) tone. The robot perceives this DTMF tone with the help of the phone stacked in the robot
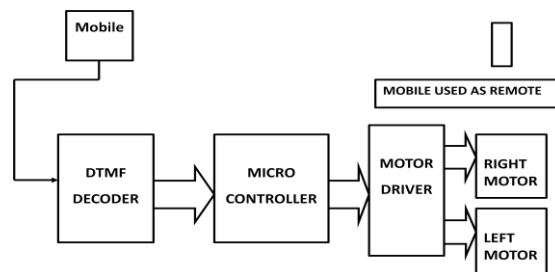

Fig 1: Block Diagram of Cell phone –Operated Land Rover

The received tone is processed by the ATmega32 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 pre programmed to take a decision for any given input and outputs its decision to motor drivers in order to drive the motors for forward or backward motion or a turn.

The mobile that makes a call to the mobile phone stacked in the robot acts as a remote. So this simple robotic project does not require the construction of receiver and transmitter units.

DTMF signaling is used for telephone signaling over the line in the voice- frequency band to the call switching centre. The version of DTMF used for telephone tone dialing is known as 'Touch-Tone'. DTMF assigns a specific frequency (consisting of two separate tones) to each key so that it can easily be identified by the electronic circuit. The signal generated by the DTMF encoder is a direct algebraic summation, in real time, of the amplitudes of two sine (cosine) waves of different frequencies, i.e., pressing '5' will send a tone made by adding 1336 Hz and 770 Hz to the other end of the line.

The tones and assignments in a DTMF system are shown in Table I.

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

Table 1: Tones and Assignment in DTMF system

The important components of this mobile operated land rover are

1.   DTMF Decoder
2.   ATMEGA32 Microcontroller
3.   Motor Driver
4.   Voltage regulator
5.   Regulated power supply

Let us briefly explain about the components

II. Dtmf Decoder

DTMF is a generic communication term for touch tone (a Registered Trademark of AT&T). The tones produced when dialing on the keypad on the phone could be used to represent the digits, and a separate tone is used for each digit. However, there is always a chance that a random sound will be on the same frequency which will trip up the system. It was suggested that if two tones were used to represent a digit, the likelihood of a false signal occurring is ruled out.

This is the basis of using dual tone in DTMF communication. sDTMF dialing uses a keypad with 12/16 buttons. Each key pressed on the phone generates two tones of specific frequencies, so a voice or a random signal cannot imitate the tones. One tone is generated from a high frequency group of tones and the other from low frequency group. The frequencies generated on pressing different phone.

i. FEATURES:
• Complete DTMF Receiver
• Low power consumption
• Internal gain setting amplifier
• Adjustable guard time
• Central office quality

ii. APPLICATIONS:
• Receiver system for British Telecom (BT) or CEPT Spec (MT8870D-1)
• Paging systems
• Repeater systems/mobile radio
• Credit card systems
• Remote control
• Personal computers
• Telephone answering machine

iii. DESCRIPTION:
An MT8870 series DTMF decoder is used here. 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. All types of the MT8870 series use digital counting techniques to detect and decode all the 16 DTMF tone pairs into a 4-bit code output.

				Table ii			
				DTMF data output			
Low group(hz)	High group(hz)	digit	OE	D3	D2	D1	D0
697	1209	1	H	L	L	L	H
697	1366	2	H	L	L	H	L
697	1477	3	H	L	L	H	H
770	1209	4	H	L	H	L	L
770	1336	5	H	L	H	L	H
770	1477	6	H	L	H	H	L
852	1209	7	H	L	H	H	H
852	1336	8	H	H	L	L	L
852	1477	9	H	H	L	L	H
941	1336	0	H	H	L	H	L
941	1209	*	H	H	L	H	H
941	1477	#	H	H	H	L	L
697	1633	A	H	H	H	L	H
770	1633	B	H	H	H	H	L
852	1633	C	H	H	H	H	H
941	1633	D	H	L	L	L	L
-	-	ANY	L	Z	Z	Z	Z

III. Atmega32 Microcontroller

The Atmel AVR ATmega32 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega32 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

i. FEATURES:
• High-performance, Low-power Atmel AVR 8-bit Microcontroller
• Advanced RISC Architecture
• High Endurance Non-volatile Memory segments
• JTAG (IEEE std. 1149.1 Compliant) Interface
• Peripheral Features
• Special Microcontroller Features
• I/O and Packages

• Operating Voltages
• Speed Grades
 • Power Consumption at 1MHz, 3V, 25°C

     The Atmel AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

     The ATmega32 provides the following features: 32Kbytes of In-System Programmable Flash Program memory with Read-While-Write capabilities, 1024bytes EEPROM, 2Kbyte SRAM, 32 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for Boundary scan, On-chip Debugging support and programming, three flexible Timer/Counters with compare modes, Internal and External Interrupts, a serial programmable USART, a byte oriented Two-wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input

IV. L293 Motor Driver

     The L293 is an integrated circuit motor driver that can be used for simultaneous, bi-directional control of two small motors. The L293 is limited to 600 mA, but in reality can only handle much small currents unless you have done some serious heat sinking to keep the case temperature down. Unsure about whether the L293 will work with your motor? Hook up the circuit and run your motor while keeping your finger on the chip. If it gets too hot to touch, you can't use it with your motor.

     The L293 comes in a standard 16-pin, dual-in line integrated circuit package. There is an L293 and an L293D part number. Pick the "D" version because it has built in fly back diodes to minimize inductive voltage spikes. The L293D can be purchased for somewhere between $2 and $3 (quantity one) from http://www.mouser.com/ (PN 511-L293D) or http://www.digikey.com/ (PN 296-9518-5-ND). For complete information, consult the Unit rode L293 data sheet (PDF file, 626Kb).

V. Lm7805 (Voltage Regulator)

I. FEATURE:
- 3-Terminal Regulators
- Output Current up to 1.5 A
- Internal Thermal-Overload Protection
- High Power-Dissipation Capability
- Internal Short-Circuit Current Limiting
- Output Transistor Safe-Area Compensation

VI. Serial Communication

     Connection between the microcontroller and peripheral devices established through I/O ports is an ideal solution for shorter distances- up to several meters. But, when it is needed to enable communication between two devices on longer distances or when for any other reason it is not possible to use "parallel" connection (for example remote control of the aircraft) it is obvious that something so simple cannot be taken into account. In such and similar situations, communication through pulses, called serial communication is the most appropriate to use.

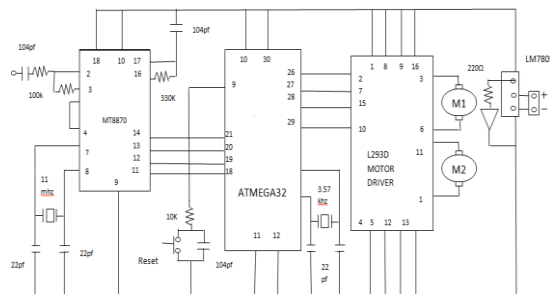The circuit diagram of mobile operated land rover is as follows

Fig2: circuit diagram of mobile operated land rover

VII. Power Supply

     A variable regulated power supply, also called a variable bench power supply, is one where you can continuously adjust the output voltage to your requirements. Varying the output of the power supply is the recommended way to test a project after having double checked parts placement against circuit drawings and the parts placement guide.

VIII. Construction

When constructing any robot, one major mechanical constraint is the number of motors being used. Either a two-wheel drive or a four-wheel drive can be used. Though four-wheel drive is more complex than two-wheel drive, it provides more torque and good control. Two-wheel drive, on the other hand, is very easy to construct. The chassis used in this model is a 10×18cm2 sheet made up of par ax. Motors are fixed to the bottom of this sheet and the circuit is affixed firmly on top of the sheet. A cell phone is also mounted on the sheet as shown in the picture. In the four-wheel drive system, the two motors on a side are controlled in parallel. So a single L293D driver IC can drive the rover. For this robot, beads affixed with glue act as support wheels.

IX. Working

In order to control the robot, make a call to the cell phone attached to the robot (through head phone) from any phone, which sends DTMF tunes on pressing the numeric buttons. The cell phone in the robot is kept in 'auto answer' mode. (If the mobile does not have the auto answering facility, receive the call by 'OK' key on the rover-connected mobile and then made it in hands-free mode.) So after a ring, the cell phone accepts the call. press any button on your mobile to perform actions as listed in Table III. The DTMF tones thus produced are received by the cell phone in the robot. These tones are fed to the circuit by the headset of the cell phone. The MT8870 decodes the received tone and sends the equivalent binary number to the microcontroller. According to the program in the microcontroller, the robot starts moving.

When you press key '2' (binary equivalent 00000010) on your mobile phone, the microcontroller outputs '10001001' binary equivalent. Port pins PD0, PD3 and PD7 are high. The high output at PD7 of the microcontroller drives the motor driver (L293D). Port pins PD0 and PD3 drive motors M1 and M2 in forward direction (as per Table III). Similarly, motors M1 and M2 move for left turn, right turn, backward motion and stop condition

TABLE III DTMF DATA OUTPUT				
Number pressed by user	Output of DTMF	Input to the micro controller	Output from micro	Actions performed
2	0X20	0X20	0XAA	Forward motion
4	0X40	0X40	0X22	Left turn
6	0X60	0X60	OX88	Right
8	0X80	0X80	OX55	Backward motion
5	0X50	0X50	0X00	stop

X. Software Description

The software is written in 'C' language and compiled using Code Vision AVR 'C' compiler. The source program is converted into hex code by the compiler. Burn this hex code into Atmega32 AVR microcontroller.

i.AVR STUDIO:

AVR Studio, with its Integrated Development Environment (IDE), is the ideal software for all AVR development. It has an editor, an assembler and a debugger and is front-end for all AVR emulators. And needs the GCC compiler i.e. WIN-AVR tool.
Two Software's are needs to install
1. AVR Studio
2. AVR GCC Compiler

ii. AVR COMPILER (WINAVR):

WinAVR is a suite of executable, open source software development tools for the Atmel AVR series of RISC microprocessors and AVR32 series of microprocessors hosted on the Windows platform. It includes the GNU GCC compiler for C and C++.

WinAVR is a collection of executable software development tools for the Atmel AVR processor hosted on Windows.
These software development tools include:
- Compilers
- Assembler
- Linker
- Librarian
- File converter
- C Library

- Programmer software
- Debugger
- In-Circuit Emulator software
- Editor / IDE

XI. Applications

- Cell phone controlled robot can be used in the borders for displaying hidden Land mines
- The robot can used for reconnaissance or surveillance
- The robot can be used anywhere there is the service provider tower of the connection provided that is mounted on robot.
- Robot is small in size so can be used for spying

XII. Conclusion

The primary purpose of the mobile phone operated land rover with DTMF decoder is to know the information in the places where we cannot move. The robot perceives the DTMF tone with the help of the phone stacked in the robot. It provides the advantage of robust control, working range as large as coverage area of service provider.

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