Cell Phone Operated Land Rover

Sumona Biswas, Bipin Kumar, Aditya kushwaha, Debasish Sardar

Department of Electronics and Communication Engineering,
Birbhum Institute of Engineering& Technology, Suri(west Bengal)

Abstract:-The robot described here is controlled by cell phone from very large distance and is a good example of long range wireless remote control device. The dual-tone multiple-frequency (DTMF) tone follow by decoder, atmega16 microcontroller and motor drive play key factor during the device operation.

Components:-

Semiconductors:-
IC1 - MT8870 DTMF decoder
IC2 - ATmega16 AVR Microcontroller
IC3 - L293D motor driver
IC4 - 74LS04 NOT gate
D1 - 1N4007 rectifier diode
Resistors (all ¼-watt, ±5% carbon):-
R1, R2 - 100-kilo-ohm
R3 - 330-kilo-ohm
R4-R8 - 10-kilo-ohm

Capacitors:-
C1 - 0.47µF ceramic disk
C2, C3, C5, C6 - 22pF ceramic disk
C4 - 0.1µF ceramic disk
Miscellaneous:-
XTAL1 - 3.57MHz crystal
XTAL2 - 12MHz crystal
S1 - Push-to-on switch
M1, M2 - 6V, 50-rpm gearedDC motor.

Key words: DTMF

*****

Introduction

Mostlywireless-controlled robots use RF circuits, which have the drawbacks of limited frequency, limited control&limited frequency range. Since here cell phone is used for control the operation of robot, can overcome these limitations. The cell phone signal have a wide range over the surface that's why robot can be operated from far away without disturbance and interference with other signals.
The control action of robot is includes three parts Perception, processing and action. Generally, the preceptors are sensors mounted on the robot, processing is done by the on-board microcontroller or processor, and the action is performed using motors. The tones and assignments in a DTMF system are shown in Table 1.

Table 1: DTMF Tones and Assignment

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

Block Diagram:-

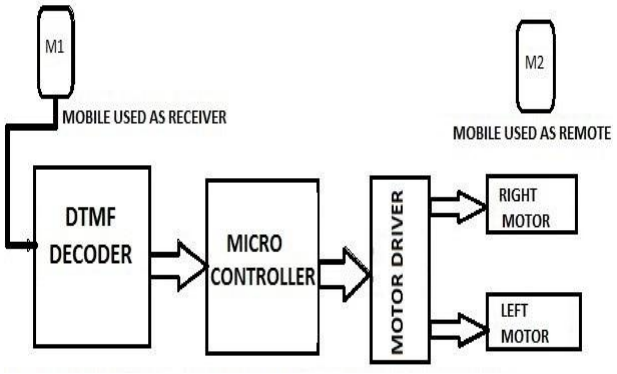

Figure 1.Block diagram of cell phone operated land rover

DTMF Decoder (MT8870)

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

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

 ISSN: 2321-8169
617 – 621

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.

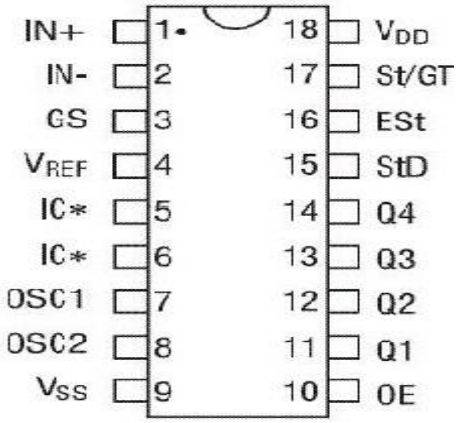

Fig.2.Pin configuration of MT8870 decoder.

Description: An MT8870 series DTMF decoder is used here. The MT8870 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	0E	D3	D2	D1	D0
697	1209	1	H	L	L	L	H
697	1336	2	H	L	L	H	L
697	1577	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

Atmega16 Microcontroller (ATMEGA16)

ATmega16is an 8-bit high performance microcontroller of Atmel's Mega AVRfamily with low power consumption. Atmega16 is based on enhanced RISC(Reduced Instruction Set Computing, Know more about RISC and CISC Architecture) architecture with 131 powerful instructions. Most of the instructions execute in one machine cycle. Atmega16 can work on amaximum frequency of 16MHz.ATmega16 has 16 KB programmable flash memory, static RAM of 1 KB and EEPROM of 512 Bytes. The endurance cycle of flash memory and EEPROM is 10,000 and 100,000; respectively.There are 32 I/O (input/output) lines which are divided into four 8-bit ports designated as PORTA, PORTB, PORTC and PORTD.
ATmega16 has various in-built peripherals like USART, ADC, AnalogComparator, SPI, JTAG etc. Each I/O pin has an alternative task related to inbuiltperipherals.

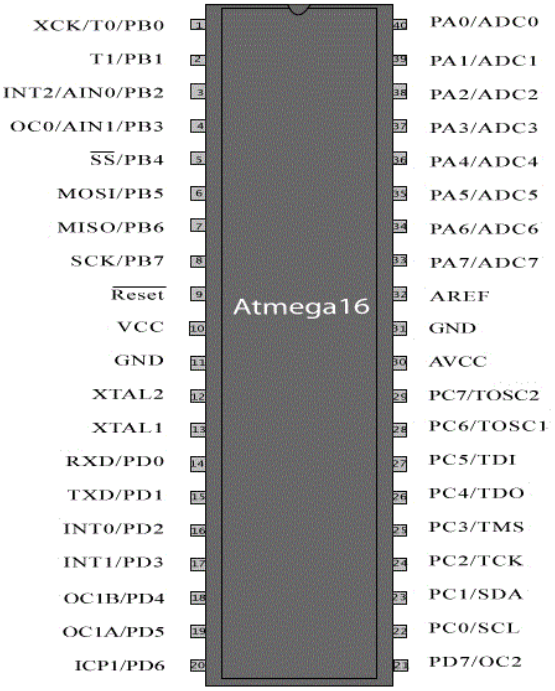

Fig.3.Pin configuration of ATMEGA16

Features-

High-performance, Low-power Atmel® AVR® 8-bit Microcontroller
• Advanced RISC Architecture – 131 Powerful Instructions
– Most Single-clock Cycle Execution
– 32 × 8 General Purpose Working Registers
– Fully Static Operation
– Up to 16 MIPS Throughput at 16 MHz
• High Endurance Non-volatile Memory segments
– 16 Kbytes of In-System Self-programmable Flash program memory
– 512 Bytes EEPROM
– 1 Kbyte Internal SRAM
– Write/Erase Cycles: 10,000 Flash/100,000 EEPROM

 ISSN: 2321-8169
617 – 621

• JTAG (IEEE std. 1149.1 Compliant) Interface
– Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
• Peripheral Features– Two 8-bit Timer/Counters with Separate
• I/O and Packages – 32 Programmable I/O Lines
• Operating Voltages – 4.5V - 5.5V
• Speed Grades– 0 - 16 MHz

Motor Driver (L293D):-

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.

L293D is quadruple high-currentHalf-H drivers. The L293 is designed to provide Bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V.

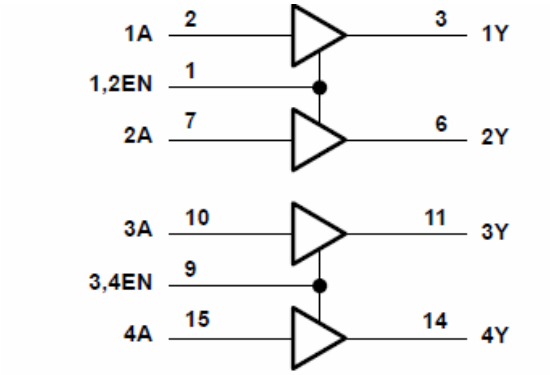

Fig.4.Logic diagramof L293D

Table-III.Bidirectional DC control logic

EN	1A	2A	FUNCTION
H	L	H	Turn right
H	H	L	Turn left
H	L	L	Fast motor stop
H	H	H	Fast motor stop
L	X	X	Fast motor stop

L = low, H = high, X = don't care

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.

74LS04 (Hex Inverting Gate)

The 74LS04 is a invert the output of MT8870 Q1, Q2, Q3, Q4 which giver through N1 to N4 as shown in fig.6

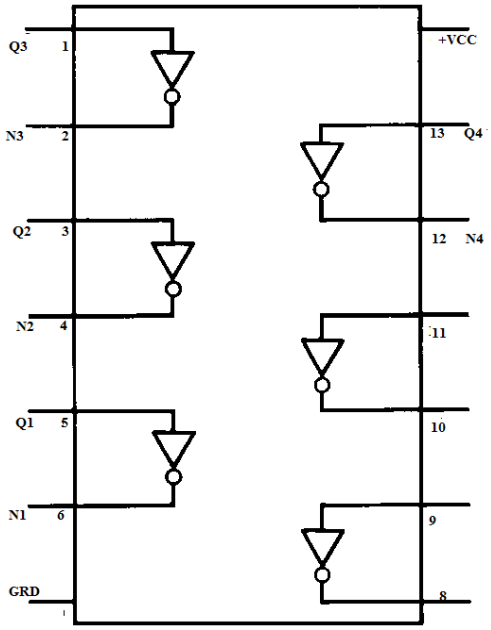

Fig.6.Pin configuration of 74LS04

IN4007 (Rectifier diode)

Feature:

- 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.

Circuit description:-

The circuit diagram of cell phone operated land rover is shown in Fig.7. An MT8870 series DTMF decoder is used here.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. The built-in dial tone rejection circuit eliminates the need for pre-filtering. When the input signal given at pin 2 (IN-) in single-ended input configuration is recognized to be effective, the correct 4-bit decode signal of the DTMF tone is transferred to Q1 (pin 11) through Q4 (pin 14) outputs. Table II shows the DTMF data. Table II shows the DTMF dataoutput table of MT8870. Q1 through Q4 outputsof the DTMF decoder (IC1) are connected to port pins PA0 through PA3 of ATmega16 microcontroller (IC2) after inversion by N1 through N4, respectively. The ATmega16 is a low-power, 8-bit, CMOS microcontroller based on the AVR enhanced RISC architecture.

 ISSN: 2321-8169
617 – 621

Circuit diagram:-

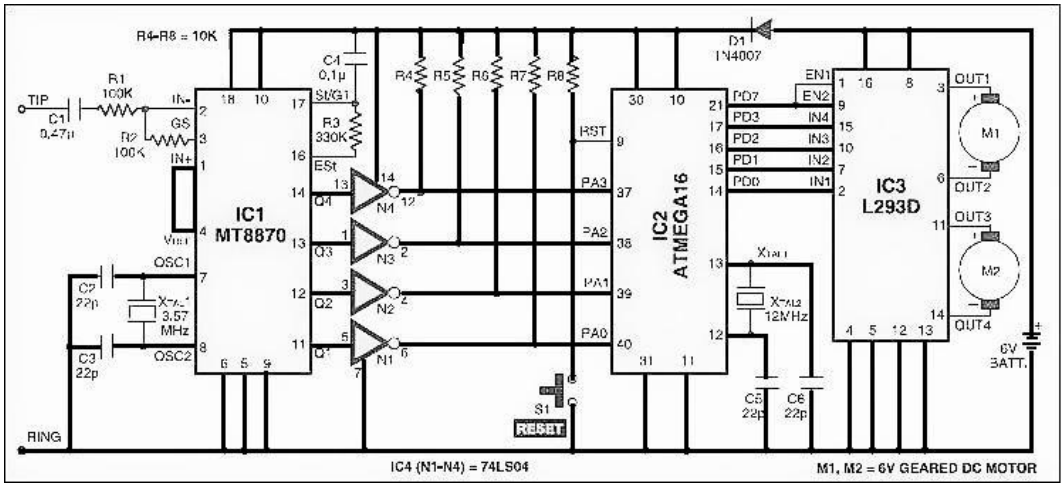

Fig.7.Circuit diagram of cell phone operated land rover

Software Description

Two Software's are needs to install

1. 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

2. AVR GCC Compiler: -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.

Procedure:-

The program can be 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 Atmega16 AVR microcontroller.

These software development tools include:-

- Compilers
- Assembler
- Linker
- Librarian
- File converter
- C Library

Programmer software:-

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

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. Press any button on your mobile to perform actions as listed in Table IV.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 IV). Similarly, motors M1 and M2 move for left turn, right turn, backward motion and stop condition.

Table IV

DTMF data output Command

Number pressed by user	Output of DTMF	Input to the microcontroller	Output from microcontroller	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

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.
- Easy to operate.

Conclusion:-

Today it seen that wireless controlled robot have some limitation of short working range, limited frequency range and limited control. As the operation of robot is control by cellular frequency which having very large range compare to any other wireless remote control. It provides the advantages of robust control, working range as large as the coverage area of the service provider, no interference with other controllers and up to twelve controls. Although the appearance and capabilities of robots vary vastly, all robots share the features of a mechanical, movable structure under some form of control. The control of robot involves three distinct phases: reception, processing and action. Generally, the preceptors are sensors mounted on the robot, processing is done by the on-board microcontroller or processor, and the task (action) is performed using motors or with some other actuators. So the motive is that to increase the range of remote controlled products. For this mobile phone operated control is best because we can globalize our project & no limitation of range

References:-

[1] "The 8051 Microcontroller and Embedded Systems" By Muhammad Ali Mazidi and Janice GillispieMazidi. Pearson Education.
[2] S. Chemishkian, "Building smart services for smart home", Proceedings of IEEE 4thInternational Workshop on Networked Appliances, 2011 pp: 2 15 -224.s
[3] R. Sharma, K. Kumar, and S. Viq, "DTMF Based Remote Control System," IEEE International Conference ICIT 2006, pp. 2380-2383, December 200
[4] Robotics and automation proceedings,1997 IEEE international conference on robotics & control systems.
[5] Intelligent control 1989 proceedings IEEE international symposium on robotics & control systems.
[6] Emerging trends in robotics and communication technologies, 2010 International conference on Robotics & control systems.
[7] http://www.alldatasheet.com
[8] http://www.atmel.com/literature