

Cellphone Controlled Car Designed using Microcontroller

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Abstract — In this paper a robot car is controlled by cell phone using DTMF. 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 on the robot. The received tone is processed by the microcontroller with the help of DTMF decoder. The microcontroller then transmits the signal to the motor driver ICs to operate the motors & our robot starts moving

Keywords:- Motor, Microcontroller, DTMF, Mobile.

I. INTRODUCTION

ATmega16 is an 8-bit high performance microcontroller of Atmel's Mega AVR family 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 a maximum frequency of 16MHz. ATmega16 has 16 KB programmable flash memory, static RAM of 1 KB and EEPROM of 512 Bytes[1]. The endurance cycle of flash memory and EEPROM is 10,000 and 100,000, respectively. ATmega16 is a 40 pin microcontroller. 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, Analogy Comparator, SPI, JTAG etc. Each I/O pin has an alternative task related to in-built peripherals.

Some microcontrollers may use four-bit words and operate at clock rate frequencies as low as 4 kHz, for low power consumption (single-digit milliwatts or microwatts). They will generally have the ability to retain functionality while waiting for an event such as a button press or other interrupt; power consumption while sleeping (CPU clock and most peripherals off) may be just Nano watts, making many of them well suited for long lasting battery applications[2]. Other microcontrollers may serve performance-critical roles, where they may need to

act more like a digital signal processor (DSP), with higher clock speeds and power consumption.

II. MY PROJECT

A Usually remote control Car use RF circuits, which have the drawbacks of limited working range, limited frequency range and the limited control. Use of a mobile phone for Car control can overcome these limitations. It provides the advantage of robust control, working range as large as the coverage area of the service provider, no interference with other controllers and up to twelve controlled. The Control of Car involves three distinct phases: perception, processing and action. Generally, the preceptors are sensors mounted on the Car, processing is done by the on-board microcontroller or processor, and the action is performed using motors[3][4]. DTMF Mobile ROBOT is a machine that can be controlled with a mobile. 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 on the robot. The received tone is processed by the microcontroller with the help of DTMF decoder. The microcontroller then transmits the signal to the motor driver ICs to operate the motors & our robot starts moving.

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.'

III. BLOCK DIAGRAM

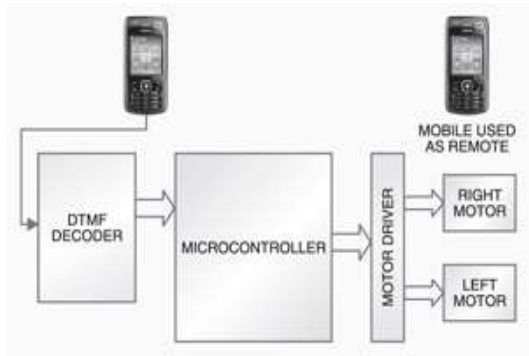


Fig.1 shows the block diagram.

The major building blocks are microcontroller, Cell phone, DTMF Decoder and DC-Motor-driver circuit. The cellphone is the most important part of the entire system because the entire system works and is activated by the cellphone. DTMF (dual tone multi frequency) receives the input signal from cell phone and decode it, and then generates 4-bit-digital output of the 8051 microcontroller. When the DTMF decoder gives a digital output, it also generates an interrupt every time

MICROCONTROLLER

Microcontroller, as the name suggests, are small controllers. They are like single chip computers that are often embedded into other systems to function as processing/controlling unit. For example, the remote control you are using probably has microcontrollers inside that do decoding and other controlling functions. They are also used in automobiles, washing machines, microwave ovens, toys ... etc, where automation is needed.

DTMF (Dual Tone Multi Frequency):- DTMF tone

The DTMF technique outputs distinct representation of 16 common alphanumeric characters (0-9, A-D, *, #) on the telephone. The lowest frequency used is 697Hz and the highest frequency used is 1633Hz. The DTMF keypad is arranged such that each row will have its own unique tone frequency and also each column will have its own unique tone frequency. Above is a representation of the typical DTWFMF keypad and the associated row/column frequencies. By pressing a key, for example 5, will generate a dual tone consisting of 770 Hz for the low group and 1336 Hz for the high group.

DTMF decoder-

The MT-8870 is a DTMF Receiver that integrates both band split filter and decoder functions into a single 18-pin DIP or SOIC package. It is manufactured using CMOS process technology. The MT-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. Minimal external components required includes a low-cost 3.579545 MHz colour burst crystal, a timing resistor, and a timing capacitor. The filter section is used for separation of the low-group and high group tones and it is achieved by applying the DTMF signal to the inputs of two sixth order switched capacitor band pass filters, the bandwidths of which corresponds to the low and high group frequencies[5][6]. 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. 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 the standard DTMF frequencies.

L293D (MOTOR DRIVING IC):-

The Device is a monolithic integrated high volt- age, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoids, DC and stepping motors) and switching power transistors. To simplify use as two bridges each pair of channels is equipped with an enable input. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp di- odes are included [7]. This device is suitable for use in switching applications at frequencies up to 5 kHz. The L293D is assembled in a 16 lead plastic package which has 4 centre pins connected together and used for heat sinking The L293DD is assembled in a 20 lead surface mount which has 8 centre pins connected together and used for heat sinking.

IV. CIRCUIT AND PCB LAYOUT

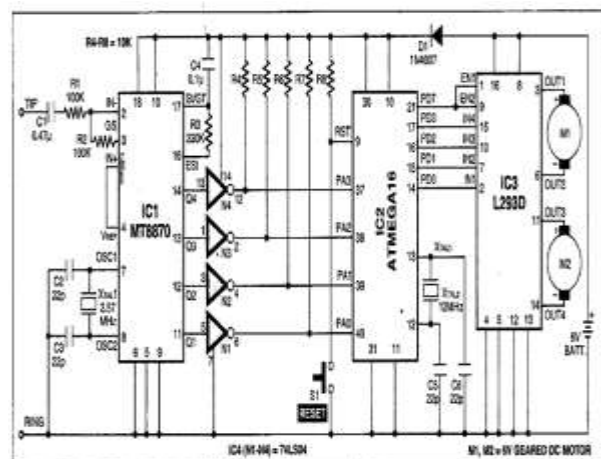


Fig 2 shows circuit diagram.

Fig. 2 shows the circuit diagram of the microcontroller based mobile phone-operated robot car. The important components of this rover are a DTMF decoder, microcontroller and motor driver.

An MT8870 series DTMF decoder is used in this project which uses digital counting techniques to detect the 16 DTMF tone pairs into a 4-bit code output. The built-in dial tone circuit eliminates prefiltering. If an input signal is given at the pin2, then the input configuration is recognized to be effective [8]. The 4-bit-decode signal of the DTMF tone is transferred to the pin11 through the pin 14's output. These pins are connected to the microcontroller pins Pao, Pa1, Pa2 and Pa3. The output of the microcontroller from port pins PD0 through PD3 and PD7 are fed to the inputs IN1, IN4 and enable the pins EN1, EN2 of the motor-driver L293D IC to drive the two DC motors. In this circuit, S1 switch is used for manual reset. The output of the microcontroller is not enough to drive the DC motors, so current drivers are necessary for motor rotation[9][10]. The L293D motor driver is designed to provide bidirectional drive currents of up to 600 mA at voltages from 4.5V to 36V, which makes it easier to drive the DC motors. The L293D motor driver consists of four drivers. The pins IN1 through IN4 & OUT1 and OUT4 are the input and output pins of the driver 1 through driver 4. The drivers 1,2,3 and 4 are enabled by the enable pin1(EN1) and the pin 9 (EN2). When enable input EN1 (pin1) is high, the drivers 1 and 2 are enabled. Similarly, the enable input EN2 (pin9) enables the drivers 3 and 4.

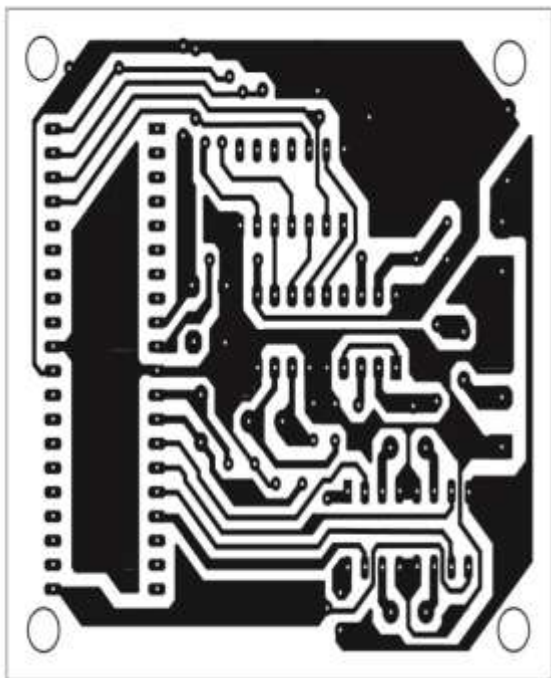


Fig. 3: An actual-size PCB layout of Cellphone Controlled Car Designed using Microcontroller.

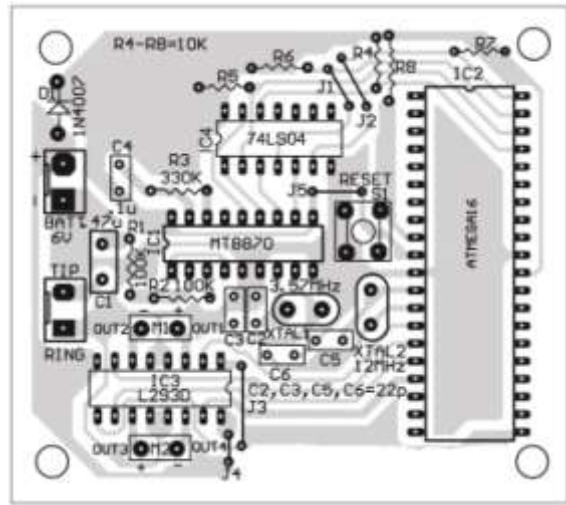


Fig. 4: component layout of Cellphone Controlled Car Designed using Microcontroller.

Working

In order to control the robot, you need to 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 cellphone accepts the call. Now you may press any button on your mobile to perform actions as listed in Table III. The DTMF tones thus produced are received by the cellphone in the robot. These tones are fed to the circuit by the headset of the cellphone. 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 0000010) 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.

Construction

When constructing any robot, one major mechanical constraint is the number of motors being used. You can have either a two-wheel drive or a four-wheel drive. 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.

V. RESULT

A remote control Car use RF circuits, which have the drawbacks of limited working range, limited frequency range and the limited control. Use of a mobile phone for Car control can overcome these limitations. It provides the advantage of robust control, working range as large as the coverage area of the service provider, no interference with other controllers and up to twelve controlled. The Control of Car involves three distinct phases: perception, processing and action. Generally, the preceptors are sensors mounted on the Car, processing is done by the on-board microcontroller or processor, and the action is performed using motors.

VI. CONCLUSION

The primary purpose of the mobile phone operated robot car 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. By developing this robotic vehicle with its multi-tasking feature, I have overcome the drawbacks of RF communication which have a limited range whereas this car can be controlled from anywhere just using this DTMF technology. The main advantage of this robot is that it is password protected so that any other person cannot communicate with the robot.

Further applications

This robot car can be further improved to serve specific purposes. It requires four controls to roam around. The remaining eight controls can be configured to serve other purposes, with some modifications in the source program of the microcontroller

VII. REFERENCE

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