



Materials and its Characterization

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Voice Controlled Robotic Vehicle

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Abstract. This project Voice Controlled Robotic Vehicle helps to control robot through voice commands received via android application. The integration of control unit with Bluetooth device is done to capture and read the voice commands. The robotic vehicle then operates as per the command received via android application. For this 8051 microcontroller is integrated in the system which makes it possible to operate the vehicle via android application. The controlling device may be any android based Smartphone/tab etc. having an android OS. The android controlling system provides a good interactive GUI that makes it easy for the user to control the vehicle. The transmitter uses an android application required for transmitting the data. The receiver end reads these commands and interprets them into controlling the robotic vehicle. The android device sends commands to move the vehicle in forward, backward, right and left directions. After receiving the commands, the microcontroller then operates the motors in order to move the vehicle in four directions. The communication between android device and receiver is sent as serial communication data. The microcontroller program is designed to move the motor through a motor driver IC as per the commands send by android device.

Keyword: Embedded chip, Microcontroller, Transformer, Motor, Diode, Bluetooth Device

1. INTRODUCTION

An Embedded System is combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a specific function. An embedded system is not a computer system that is used primarily for processing, not a software system on PC or UNIX, not a traditional business or scientific application. High-end embedded system - Generally 32, 64 Bit Controllers used with OS. Examples Personal Digital Assistant and Mobile phones etc. Lower end embedded systems -Generally 8, 6 Bit Controllers used with a minimal operating systems and hardware layout designed for the specific purpose.

2. EXPLANATION

The paper is designed to control a robotic vehicle by voice commands for remote operation. An ARM series microcontroller is used together with an Android Application for the desired operation. The Android Application is connected to the Bluetooth module (HC-05) present on the Robot via Bluetooth. The commands are sent to the robot using push buttons or voice commands present on the android application. At the receiving end two dc servo motors are interfaced to the microcontroller where they are used for the movement of the vehicle.

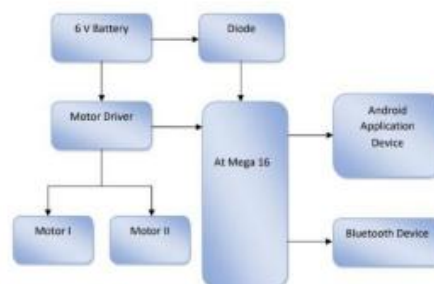


FIGURE 1. Block diagram

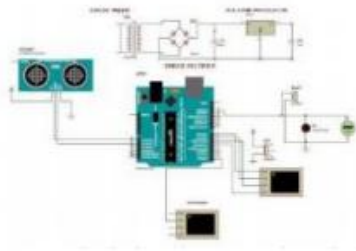


FIGURE 2.circuit diagram

3. HARDWARE DISCRIBTION

3.1AT Mega16: The AVR ATmega16 is a low-power CMOS 8- bit microcontroller based on the AVR enhanced RISC architecture. The throughput of AVR ATmega16 is about 1 MIPS per MHz using single clock per instruction allowing the system designed to optimize power consumption versus processing speed. The AVR has 32 general purpose working registers and rich instruction set. They are directly connected to the ALU, and allow two independent registers to be accessed in one single instruction executed in one clock cycle. Getting started with avr microcontroller tutorial helps you to understand real time examples. Atmel studio 6 is used for writing c code and generating hexa file.

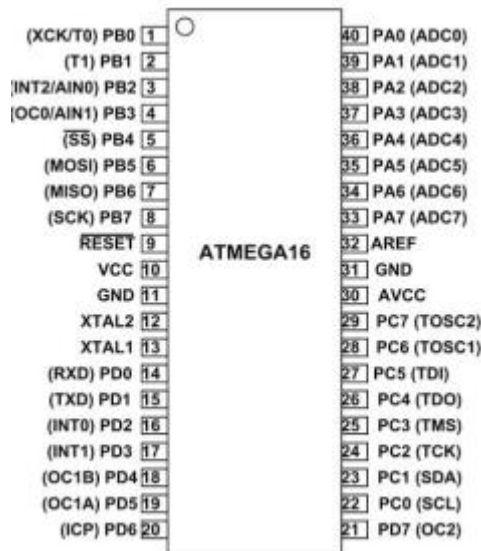


FIGURE3. AT Mega16 Microcontroller Pin Description

3.2ATmega16 Microcontroller CLOCK SOURCES: ATmega16 has the following clock source options, selectable by Flash Fuse bits as shown below. The clock from the selected source is input to the AVR clock generator, and routed to the appropriate modules. In device clocking option for External Crystal or Ceramic Resonator combination for bits is 1111 or 1010. For External Low frequency Crystal it is 1001 and for External RC Oscillator 1000 or 0101. Calibrated Internal RC Oscillator 0100 or 0001 and for External Clock it is 0000. Bit “1” means un-programmed while “0” means programmed

3.3ATmega16 Microcontroller USART: Main feature used from microcontroller is USART used for serial communication between controller and GSM modem. The Universal Synchronous and Asynchronous serial Receiver and Transmitter (USART) is a highly supple serial communication device. General Baud rates supported are 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 38400,57600, 115200. In our project we are using 9600.

3.4Transformer: The purpose of a transformer is to change electrical voltage to a different value. For example, a farmer has a large, 480-V, 3- phase motor powering a well. The motor is in a building, and the farmer wants one 120- V circuit for a few lights and a receptacle outlet. A transformer is used to lower the voltage from 480 V to 120 V for the lighting circuit. The controls for furnaces and air conditioning units are often operated at 24 V. A small transformer inside the equipment lowers the line voltage to 24 V for the control circuit. Transformers are frequently used inside electronic equipment.

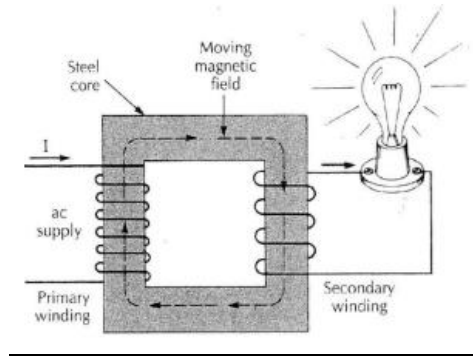


FIGURE4. Transformer

3.5 Voltage and turns ratio: The input winding to a transformer is called the primary winding. The output winding is called the secondary winding. If there are more turns of wire on the primary than on the secondary, the output voltage will be lower than the input voltage. This is illustrated in Figure 14-8 for a step-down and a step-up transformer. Notice that the winding with the greater number of turns has the higher voltage. One winding has twice as many turns as the other. In one case the voltage is stepped down to half, while in the other the voltage is stepped up to double. It is important to know the ratio of the number of turns of wire on the primary winding as compared to the secondary winding. This is called the turns ratio of the transformer. The actual number of turns is not important, just the turns ratio

$$\text{Turns Ratio} = \frac{\text{Number of turns on the primary}}{\text{Number of turns on the secondary}}$$

3.6 Transformer: EMF equation If the flux in the core is purely sinusoidal, the relationship for either winding between its rms voltage Arms of the winding, and the supply frequency f, number of turns N, core cross-sectional area a in m² and peak

$$E_{\text{rms}} = \frac{2\pi f N a B_{\text{peak}}}{\sqrt{2}} \approx 4.44 f N a B_{\text{peak}}$$

magnetic flux Wb/m² or T (tesla) is given by the universal EMF equation.

3.7 Motor Driver: The L6219 is a bipolar monolithic integrated circuits intended to control and drive both winding of a bipolar stepper motor or bidirectional control two DC motors. The L6219 with a few external components form a complete control and drive circuit for LS-TTL or microprocessor controlled stepper motor system. The power stage is a dual full bridge capable of sustaining 46V and including four diodes for current recirculation. A cross conduction protection is provided to avoid simultaneous cross conduction during switching current direction. An internal pulse-width modulation (PWM) controls the output current to 750 mA with peak startup current up to 1 A. Wide range of current control from 750 mA (each bridge) is permitted by means of two logic inputs and an external voltage reference. A phase input to each bridge determines the load current direction. A thermal protection circuitry disables the outputs if the chip temperature exceeds safe operating limits.

3.8 L293D IC Pin Out: The L293D is a 16 pin IC, with eight pins, on each side, to controlling of two DC motor simultaneously. There are 4 INPUT pins, 4 OUTPUT pins and 2 ENABLE pin for each motor

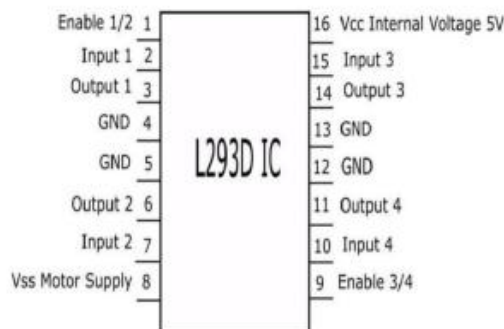


FIGURE5. L293D IC Pin Out

3.9MOTOR: A stepper motor is an electromechanical device which converts electrical pulses into discrete mechanical movements. The shaft or spindle of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in the proper sequence. The motor's rotation has several direct relationships to these applied input pulses. The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly related to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied.

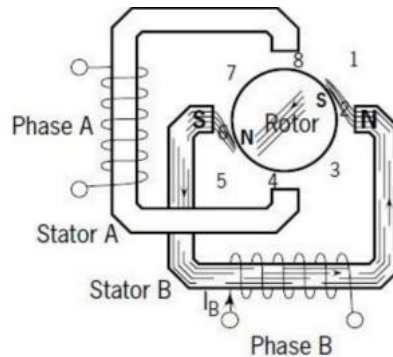


FIGURE6. Motor

3.10Diode: A semiconductor device, which conducts the current in one direction only. Two terminals: Anode and Cathode. When the positive polarity is at the anode –the diode is forward biased and is conducting. When the positive polarity is at the cathode –the diode is reverse biased and is not conducting. If the reverse-biasing voltage is sufficiently large the diode is in reverse breakdown region and large current flows through it. Voltage drop across the diode when forward biased: 0.6-0.7V. The current through the diode when reverse biased: ~ 1nA (10⁻⁹A)

3.11Bluetooth Device: Bluetooth is a standard used in links of radio of short scope, destined to replace wired connections between electronic devices like cellular telephones, Personal Digital Assistants (PDA), computers, and many other devices. Bluetooth technology can be used at home, in the office, in the car, etc. This technology allows to the users instantaneous connections of voice and information between several devices in real time. The way of transmission used assures protection against interferences and safety in the sending of information. Between the principal characteristics, must be named the hardness, low complexity, low consume and low cost. The Bluetooth is a small microchip that operates in a band of available frequency throughout the world. Communications can realize point to point and point multipoint.

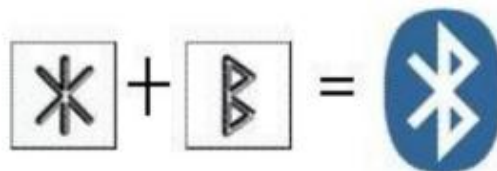


FIGURE7.Bluetooth

3.12BLUETOOTH MODULE: The Bluetooth module HC-05 is a MASTER/SLAVE module. By default the factory setting is SLAVE. The Role of the module (Master or Slave) can be configured only by AT COMMANDS. The slave modules cannot initiate a connection to another Bluetooth device, but can accept connections. Master module can initiate a connection to other devices. The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC to embedded project, etc.

3.13BUTTON SWITCH: This is used to switch the module into AT command mode. To enable AT command mode, press the button switch for a second. With the help of AT commands the user can change the parameters of this module but only when the module is not paired with any other BT device. If the module is connected to any other Bluetooth device, it starts to communicate with that device and fails to work in AT command mode.

CONCLUSION

This project completely reforms the robotic vehicle and gives it a new dimension. It can easily recognize the voice commands and runs smoothly. Further enhancement in project can be used for Home security and military purposes where the commands can be given to robot without risk by increasing the range and by installing cameras. This research work has been narrowed down to short range Bluetooth module. Using long range modules and other connectivity devices will result in connectivity with the robot for long distances. Power Optimization such sleep and wakeup schedules can be incorporated. Image processing can be implemented in the robot to detect the color and the objects. A thermal camera can be installed to sense the heat emitted by bodies useful in military purposes to detect enemies on the lines. Automatic Targeting System can be implemented in the robot for tracking the target

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