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VOICE CONTROLLED AND OBSTACLE AVOIDANCE ROBOTIC CAR USING MOBILE

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ABSTRACT

The major principle of the robotic vehicle is to accept the user voice command and perform the given user task and without the human presence specifically area can control the robot via user voice input. The robot can be operated through user voice input it requires android app to communicate via Bluetooth HC-05 module. Subsequently, the robotic vehicle can sense the things with the assistance of Ultrasonic sensor module. For the hardware, customized Arduino will give the control over the motors that use to run the robotic vehicle. Ultrasonic sensors interact with the Arduino help in automatic braking of a vehicle on sudden obstacle detection. The obstacle avoidance robots are currently employed in dangerous areas where the human cannot enter. It can easily recognize the voice.

Keywords: Android, NodeMCU, GPS Module, OLED, Latitude, Longitude Etc.

I. INTRODUCTION

The roots of foundation of robotics belong back in 1950s; more than six decades has passed since then, and robotic evolution has been running unparalleled. Today we can feel the presence of robots everywhere and in every field whether it is medical, military, education or governance and so on. Robotics has become a helping hand for humans, and they are making our life easier, better and faster. Robotics is a boon for human kind, because robotic machines are giving alternatives, which is providing a great support to physically impaired people. This proposal focuses in the problems faced by specially abled people who wish to drive their vehicle on their own but they cannot because of the natural cause. In this proposed project, the emphasis is on voice control of robot with automatic braking, speed slow down and avoidance of obstacles automatically or manually (through voice command).In this model, we will use an android app to pass on the voice commands to the Arduino through Bluetooth communication using Bluetooth module. Ultrasonic sensor will act as the obstacle detector, which will act as a mediator for Arduino microcontroller (or the CPU) and the proximal environment, and it would eventually lead to slowing down the vehicle or to fully break its motion.

II. LITERATURE REVIEW

In 2003, Worldwide speculation in modern robots up 19%. In 2004, orders for robots were up another 18% to the highest level ever recorded. Overall development in the period 2004-2007 conjecture at a normal yearly pace of about 7%. More than 600,000 family unit robots being usedseveral millions in the next few years. Various researches have been made by different researchers in developing this project. Be that as it may, they serve an alternate application and have various innovations actualized. Some of those papers are mentioned below stating their technology and application.

Robot Control Design Using Android Smartphone.

The motivation behind this paper is to furnish amazing computational android stages with less difficult robot equipment design. This paper depicts how to control a robot utilizing portable through Bluetooth communication, a few highlights about Bluetooth innovation, segments of the versatile and robot. It present an audit of robots constrained by smart phone by means of moving the robot upward, reverse, left and right side by the android application, for example, Arduino, Bluetooth Smart Phone Controlled Robot Using ATMEGA328 Microcontroller.

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III. METHODOLOGY

Install any Bluetooth Application for Arduino. Pair HC-05 Bluetooth module with the mobile Default password is "1234" or "0000".Click on the "MIC" icon and speak/instruct the robot .On speaking our speech gets recognized and converted into text. That text is transferred using Bluetooth .The Bluetooth Module receives the string, decodes it and compares it with the Instructions that are described in the program and moves the robot in direction given by the user using mobile application.

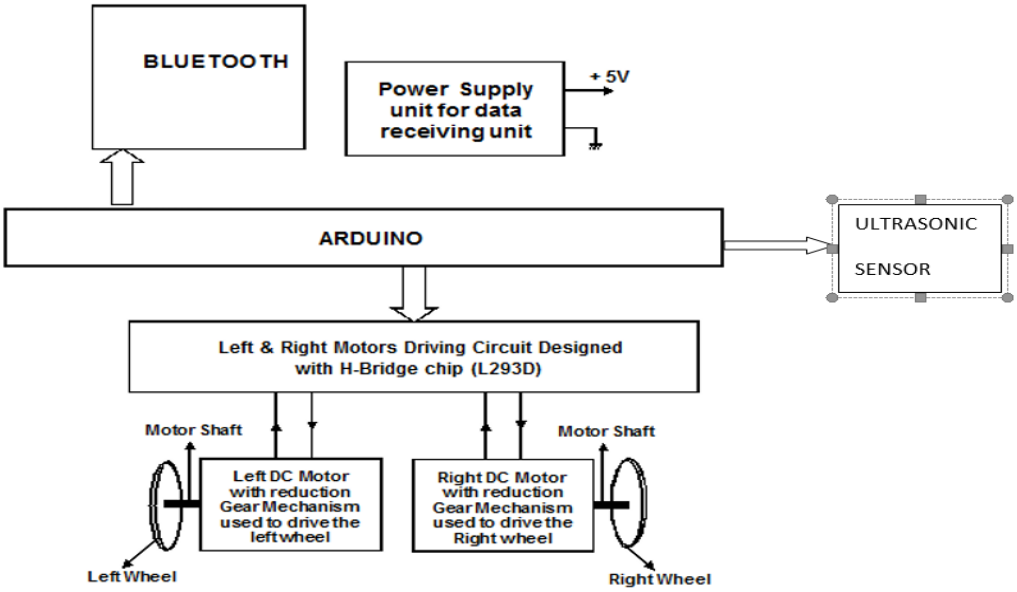

Figure 1: Block Diagram Voice Controlled And Obstacle Avoidance Robotic Car

IV. THE HARDWARE

ARDUINO UNO

The Arduino Uno is an open-source microcontroller board dependent on the Microchip ATmega328P microcontroller and created by Arduino.cc. It is programmable with the Arduino IDE through a kind B USB cable. It can be controlled by the USB link or by an outside 9-volt battery, however it acknowledges voltages between 7 and 20 volts. Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available. The word "uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.

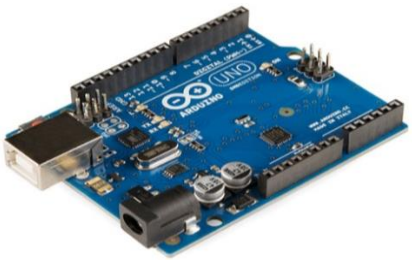

Figure 2: Arduino Uno

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BLUETOOTH MODULE

This project work consists of two main modules: the android mobile phone and the Arduino BT board (Bluetooth module). The android mobile phone consists of several Bluetooth apps which enables the user to access the control commands for the robot. In this project we are targeting Android platform since it has huge market and open source. Android is a software stack for mobile devices that includes an operating system, middleware and key applications. The Android OS is based on Linux. Android Applications are made in a Java-like language running on a virtual machine called 'Dalvik' created by Google. The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language. Accessory mode is a feature of Android OS since version 2.3.4 Gingerbread and 3.1 Honeycomb and above. A project can also be named as smart phone Android operated robot. Here is a simple control technique for your robot/robo car using Bluetooth module and microcontroller with your android Smartphone device. The controlling devices of the whole system are a Bluetooth module, DC motors that are interfaced to the microcontroller. The data received by the Bluetooth module from android smart phone is fed as input to the controller. The controller acts accordingly on the DC motor of the robot. The robot in the project can be made to move in all the four directions using the android phone. In achieving the task the controller is loaded with program written using Embedded 'C' or assembly Language.

The Bluetooth module picks up the packets sent from the cell phone. Subsequently, these packets containing the appliance status commands are pipelined through the microcontroller and the designed analogue circuitry according to the definition of each output. The DC motors are connected to the digital output ports of the controller via H - Bridge to provide sufficiently high currents and voltage compatibility. For demo purpose two DC motors are used fo the robot movement in all the directions.

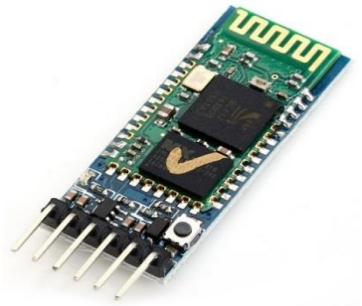

Figure 3: Bluetooth Module

DC GEAR MOTOR

In this project work two DC motors are used to operate the robot. By giving the command signals from the mobile through the bluetooth app i.e., forward, backward, right and left directions, the robot will be moved.

DC motors are widely used, inexpensive, small and poweful for their size. They are most easy to control. One DC motor requires only two singals for its operation. They are non-polarized, means you can reverse the voltage without any damage to motor. DC motors have +ve and –ve leads. Connecting them to a DC voltage source moves motor in one direction (clockwise) and by reversing the polarity, the DC motor will move in opposite direction (counter clockwise). The maximum speed of DC motor is specified in rpm (rotation per minute). It has two rpms: no load and loaded. The rpm is reduces when moving a load or decreases when load increases. Other specifications of DC motors are voltage and current ratings. Below table shows the specifications of the motor used in the project.

Figure 4: DC Gear Motor

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L293D MOTOR DRIVER

L293d IC is known as a motor driver. It is a low voltage operating device like other ICs. The Other ICs could have the same functions like L293d but they cannot provide the high voltage to the motor. L293d provides the continuous bidirectional Direct Current to the Motor. The Polarity of current can change at any time without affecting the whole IC or any other device in the circuit. L293d has an internal H-bridge installed for two motors.

H-Bridge is an electrical circuit that enables the load in a bidirectional way. L293d bridge is controlled by external low voltage signals. It may be small in size, but its power output capacity is higher than our expectation. It could control any DC motor speed and direction with a voltage range of 4.5 – 36 Volts. Its diodes also save the controlling device and IC from back EMF. To control the max 600mA amount of current an internal "Darlington transistor sink" installed in it, which could be used to control a large amount of current by providing a small amount of current. It has also internal "pseudo-Darlington source" which amplifies the input signal to control the high voltage DC motor without any interception.

Figure 5: L293d MOTOR DRIVER

12V BATTERY

The main power source to drive the entire Vehicle including DC motors is designed to operate at 12V DC, a heavy duty rechargeable battery of 12V and 3 AH (Ampere Hour) is used as a back-up source, which drives entire. The DC motors used in this project work consumes 150 milli amps each, and other circuitry including electronic circuit & microcontroller will consume around 200 milli amps, always two motors remains in energized condition, there by total consumption of the system is 500 milliamps approximately. Since huge rating rachargable battery is used where as the machine consumes less power, the battery can take care of the machine for long time. The battery back-up time = battery rating / consumed energy = 3 / 0.5 = 6. Means the battery can with stand up to 6 hours (approximately) continuously. During the idle condition, the battery is charged with 0.5A current. At this rate, the battery charging time = battery rating / charging current = 3 AH / 0.5 A = 6 hours. To define how long the vehicle has to run, it is purely depends up on the capacity of the battery. The DC motors selected to drive the mechanical transmission section operates at 12V DC, hence output of the battery can be used to drive these motors directly. The control circuit designed with microcontroller required a stable supply of + 5V DC, here using a positive voltage regulator of LM7805, constant supply of +5 V is generated, though the battery voltage varies +/_ 30 %, the output of the regulator remains constant..

Figure 6: 12V BATTERY

ULTRASONIC SENSOR

Ultrasonic Sensors also known as transceivers when they both send and receive work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves

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respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring: wind speed and direction (anemometer), fullness of a tank and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure the amount of liquid in a tank, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultrasonography, burglar alarms and non-destructive testing. Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed. The technology is limited by the shapes of surfaces and the density or consistency of the material. For example foam on the surface of a fluid in a tank could distort a reading.

Figure 7: Ultrasonic Sensor

V. SOFTWARE

ARDUINO IDE SOFTWARE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called **sketches**. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

Installation

The steps to get started with Arduino UNO are listed below:

- Install the drivers of the board.

As soon we connect the board to the computer, Windows from XP to 10 will automatically install the board drivers. But, if you have expanded or downloaded the zip package, follow the below steps:

1. Click on Start -> Control Panel -> System and Security.
2. Click on System -> Device Manager -> Ports (COM &LPT) -> Arduino UNO (COMxx). If the COM &LPT is absent, look Other Devices -> Unknown Device.
3. Right-click to Arduino UNO (COmxx) -> Update Driver Software -> Browse my computer for driver software.
4. Select the file "inf" to navigate else, select "ArduinoUNO.inf" Installation Finished.

VI. RESULTS AND DISCUSSION

DEVICE:

The pictures below are to represent the result of this work.

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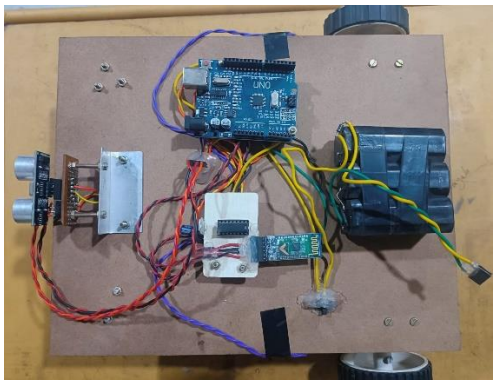
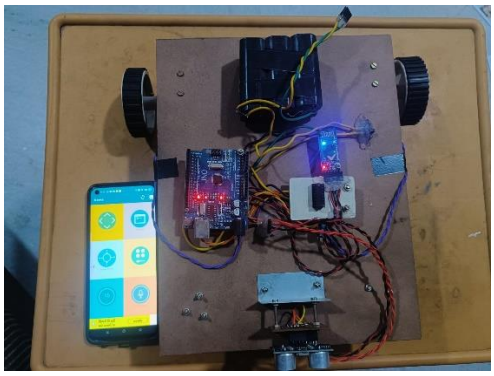


Circuit off state



Circuit on state

Fig 8

APPPLICATION:

Figure 9: APPLICATION

The pictures above are the screenshots of android application which is developed using ANDROID STUDIO. The application is connected to the Arduino uno through the Bluetooth module and the voice commands are taken by the app and send them to Arduino uno through the Bluetooth module.

VII. CONCLUSION

The project work "Bluetooth controlled Robot" is designed and developed successfully, for the demonstration purpose prototype module is constructed and results are found to be satisfactory. Since it is a prototype module, a simple robot is constructed, which can be used for many applications. While designing and developing this proto type module, we have consulted few experts those who are having knowledge in robotics, embedded systems, etc and these professionals working at different organizations belongs to Hyderabad helped us while fabricating this project work. Since it is a prototype module, much amount is not invested. The whole machine is constructed with locally available components. Some of the modifications must be carried out in design to make it as real working system. In this concept the robot is controlled through the bluetooth technology whose range is nearly 100m approximately. If a camera is placed over the robot, direction can be controlled and will broadcast the video signals to the monitoring station, where the person is monitoring and control operation can be performed much better. The full functionality of the robot control system was tested

and the wireless communication between the cell phone and Bluetooth module was found to be limited to <50m in a concreted building and maximum of 100m range was reported to be applicable in an open range. This project developed an obstacle avoiding robot to detect and avoid obstacles in its path. The robot is built on the Arduino platform for data processing and its software counterpart helped to communicate with the robot to send parameters for guiding movement.

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