IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering

Vol. 8, Issue 6, June 2020

Wheelchair Control using Android phone

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Abstract: This Work is based on Arduino, motor driver and Bluetooth module. Arduino is an open source prototyping platform Based on easy-to-use hardware and software. Arduino uses an ATmega328 microcontroller. Since robotics has become a major part in our daily life and also in the engineering field and it plays a vital role in the development of new technology. This is a very simple and easy type form of remote-control wheelchair, where the ordinary micro-controller has been replaced by Arduino and IR sensors has been replaced by a Bluetooth module. The remote can be any android or IOS cell phones. This project can be made in a bigger scale for real time vehicles. We are now living in the 21st century. Now, smart phone has become the most essential thing in our daily life. Android application based smart phones are becoming each time more powerful and equipped with several accessories that are useful for Robots. This project describes how to control a wheelchair using mobile through Bluetooth communication, some features about Bluetooth technology, components of the mobile and robot. We present a review of wheelchair controlled by mobile phone via moving the wheelchair upward, backward, left and right side by the android application such as Arduino, Bluetooth. Bluetooth has changed how people use digital device at home or office, and has transferred traditional wired digital devices into wireless devices. Here we are using Bluetooth communication, interface microcontroller and android application. We are using Arduino software to interface the Bluetooth module with microcontroller. According to commands received from android the robot motion can be controlled. We derived simple solutions to provide a framework for building wheelchair with very low cost but with high computation and sensing capabilities provided by the smart phone that is used as a control device.

Keywords: Arduino, Bluetooth module, Wheelchair, Android phone.

I. INTRODUCTION

This paper represents android application-based Bluetooth controlled robotic car. Here main motto of our project is to control the car with android application. Here we use mainly Arduino UNO (ATMEGA 328P), Bluetooth module (HC-05). We interface the Bluetooth module with the system so that we can easily control the system by smart phone application. This project is more necessary to the modern society in context of spying and surveillance. The project aims in designing a Robot that can be operated using Android mobile phone. The controlling of the Robot is done wirelessly through Android smart phone using the Bluetooth feature present in it. Here in the project the Android smart phone is used as a remote control for operating the Robot. The controlling device of the whole system is a Microcontroller. Bluetooth module, DC motors 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 motors of the Robot. In achieving the task the controller is loaded with a program written using Embedded 'C' language. Related reference articles implementing wireless control of robots have been studied as mentioned. Still there exists a requirement of a cost-effective automation system, which will be easy to implement. An example of such a cost effective project has been proposed here. A robot is an electromechanical machine that is controlled by computer program to perform various operations. Industrial robots have designed to reduce human effort and time to improve productivity and to reduce manufacturing cost. Today human-machine interaction is moving away from mouse and pen and becoming much more pervasive and much more compatible with the physical world. Android app can control the robot motion from a long distance using Bluetooth communication to interface controller and android. Microcontroller ATMEGA328P-PU can be interfaced to the Bluetooth module though UART protocol and code is written in embedded C language. As per the commands received from android app the robot motion can be controlled. The output motion of a robotic vehicle is accurate and repeatable. Pick and Place robots can be reprogrammable and tool can be interchanged to provide for multiple applications. The purpose of this work is to design and implement an Android Controlled Bluetooth Robot which is used for Surveillance, home automation, wheelchairs, military and hostages Rescue applications.

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ISSN (Print) 2321-5526

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Electrical, Electronics, Instrumentation and Control Engineering

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Fig: Block diagram of wheelchair

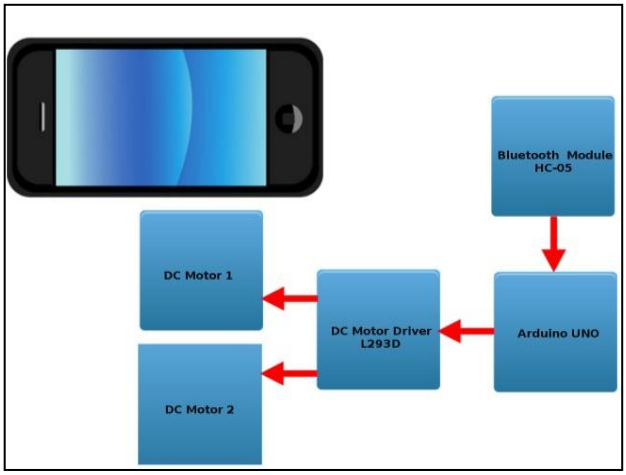
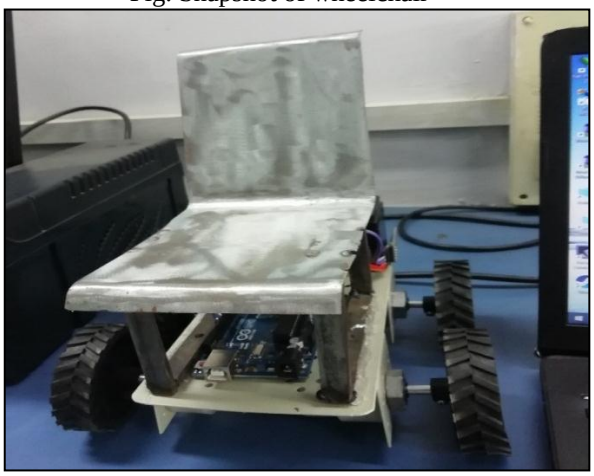


Fig: Snapshot of wheelchair



II. COMPONENTS

Arduino UNO: The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs). Programs can be loaded on to it from the easy-to-use Arduino computer program. The Arduino has an extensive support community, which makes it a very easy way to get started working with embedded electronics. The R3 is the third, and latest, revision of the Arduino Uno.

Bluetooth Module (L293d): The Bluetooth module will act as an interface between Smartphone and microcontroller. We will be using HC-05 Bluetooth module for the system, which can be used as either receiver or transmitter. Generally our transmitter will be smart-phone and receiver will be Bluetooth module . Bluetooth module will give the commands given by smart-phone to the microcontroller.

DC Motor: A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

Chassis: Chassis is the main support structure of the vehicle which is also known as 'Frame'. It bears all the stresses on the vehicle in both static and dynamic conditions. In a vehicle, it is analogous to the skeleton in living organisms. The origin of the word Chassis lies in the French language. Every vehicle whether it is a two-wheeler or a car or a truck has a chassis-frame. However, its form obviously varies with the vehicle type.

Battery (12V): A 12V battery means that the voltage that is supplied under nominal load is 12V, that's it. Different batteries can have different maximal current and thus different maximum power. A battery also has ever a capacity given by mAh which is how much current for how much time it can provides.

Chair: The chair was custom build by our team as it is assembled on the vehicle.

III. IMPLEMENTATION

The working principle is kept as simple as possible. The working principle of the circuit has been elaborated with the help of a block diagram, of the system interconnection as shown. A DC power supply is required to run the system. The DC power supple feeds the Microcontroller and the Bluetooth module. The Bluetooth module receives the signal sent from an android smart-phone, where the application software coded in C language is installed. The microcontroller, thereby, sends instructions, which when executed, helps in functioning of the motor driver. The movement and functioning of the motor can be controlled by using the android based application software. Hardware of this project consists of Arduino UNO, Bluetooth module and a motor driver IC. The Bluetooth module is connected with the Arduino UNO board for the connection with the user. Through the Bluetooth module for monitoring and controlling the particular

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motor reaches the board and process accordingly and the output of the Arduino goes to the motor driver IC and it controls the particular motor. Our proposed project consists of the following three sections:

a) Input section
b) Microcontroller section
c) Output section

In our android application base Bluetooth controlled robotic car, the user interacts with the system with a smart phone. In this method user must be present within in range (< 15 meters) to control the system. In future we would try to extend the range using Internet of Things (IoT). When user sends any data to the Arduino board then the corresponding pin of Arduino goes to high state and switches the motor driver ic in the on mode. The corresponding motor moves as per the input data. Here in this project the user (android application) is the input section. This device is connected with the Arduino board (microcontroller section) by the means wirelessly i.e. Bluetooth module. The system can now be connected with the motors (output section) to be controlled via wireless connectivity.
Here are the simple steps to upload code into the Arduino UNO:

1. Type the code in Arduino IDE
2. Compile the code.
3. Make it error free.
4. Select the port.
5. Upload the code in the Arduino UNO.

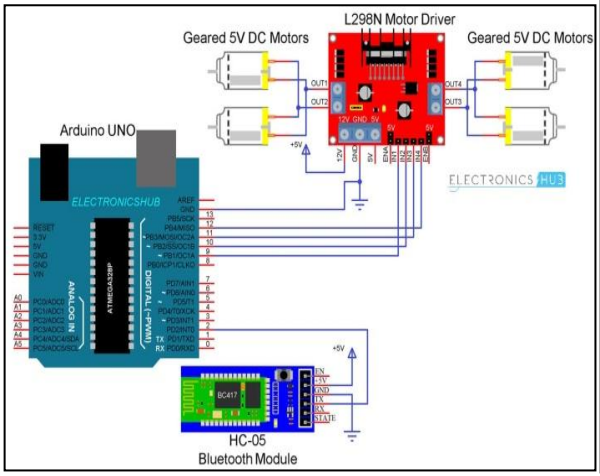

Fig: Circuit diagram of wheelchair

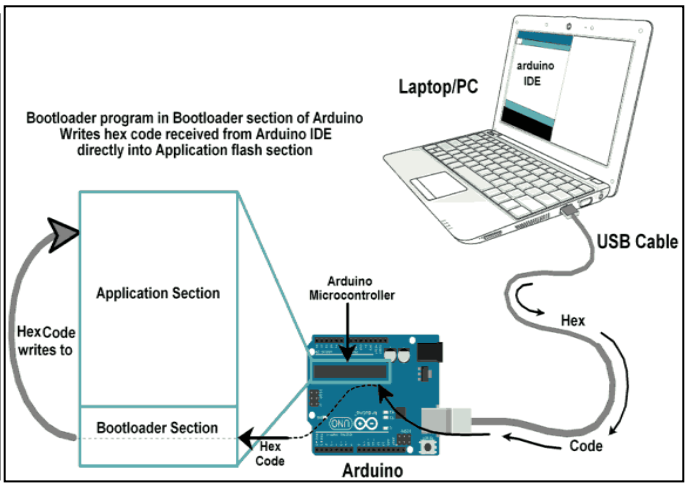

Fig: Working of wheelchair

1. Connect your Arduino using the USB cable.The square end of the USB cable connects to your Arduino and the flat end connects to a USB port on your computer.
2. Choose Tools→Board→Arduino Uno to find your board in the Arduino menu.You can also find all boards through this menu, such as the Arduino MEGA 2560 and Arduino Leonardo.
3. Choose the correct serial port for your board.You find a list of all the available serial ports by choosing Tools→Serial Port→ comX or /dev/tty.usbmodemXXXXX. X marks a sequentially or randomly assigned number. In Windows, if you have just connected your Arduino, the COM port will normally be the highest number, such as com 3 or com 15.

Many devices can be listed on the COM port list, and if you plug in multiple Arduinos, each one will be assigned a new number. On Mac OS X, the /dev/tty.usbmodem number will be randomly assigned and can vary in length, such as /dev/tty.usbmodem1421 or /dev/tty.usbmodem262471. Unless you have another Arduino connected, it should be the only one visible.

Click the Upload button. This is the button that points to the right in the Arduino environment. You can also use the keyboard shortcut Ctrl+U for Windows or Cmd+U for Mac OS X.
Here at first we construct the circuit as shown. Then through the data cable we insert the commands in the microcontroller ATMEGA 328P. These commands help the microcontroller to interface with the Bluetooth module HC05 and also with the motor driver IC L293D. Here the Bluetooth module act as a receiver which receives the instruction from the smart phone (remote or transmitter). Then the microcontroller decides the operation for the instruction which is coming from the smart phone. The functions of the given instructions are operated by the microcontroller. The instructions are sent by

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the smart phone. We can easily control the movements of the dc motor. The Bluetooth module can operate below the 10 m range, which we would try to extend in future. Here we are using four 12 V, 200 R.P.M DC motors and a 12 V DC battery as main power supply of this system. Until we send any instruction to the microcontroller the motors remain stop. When any input is given then the motors moves as per the preloaded functions in the microcontroller. Figure 8 shows the snapshot of the whole Bluetooth Based Smart Phone Control Robot Project.

System Implementation:

1. First make sure your HC-06 Bluetooth module is paired with your mobile. The default password for pairing is "1234" or "0000". Check the manual of Bluetooth module. Click on "SELECT DEVICE" icon to select paired Bluetooth module.
2. When press "up arrow" it sends the data "A" to Bluetooth module connected with the circuit. When microcontroller detects "A" the robot/robot car moves FORWORD.
3. When press "DOWN ARROW" it sends the data "B" to Bluetooth module connected with the circuit. When microcontroller detects "B" the robot/robot car moves REVERSE.
4. When press "LEFT ARROW" it sends the data "C" to Bluetooth module connected with the circuit. When microcontroller defects "C" the robot/robot car turns LEFT.
5. When press "RIGHT ARROW" it sends the data "D" to Bluetooth module connected with the circuit. When microcontroller defects "D" the robot/robot car turns RIGHT.
6. When press "STOP" button which is in the center of remote it sends the data "E" to the Bluetooth module connected with the circuit. When microcontroller defects "E" the robot/robot car gets stopped.
7. Click on "DISCONNECT" icon to disconnect paired Bluetooth module.

The Android application controlled robot communicates via Bluetooth to the Bluetooth module present on the robot. While pressing each button on the application, corresponding commands are sent via Bluetooth to the robot. The commands that are sent are in the form of ASCII. The Arduino on the robot then checks the command received with its previously defined commands and controls the servo motors depending on the command received to cause it to move forward, backward, left, right or to stop. Thus allowing us to create an Android controlled robot. Setup the hardware connections with the Arduino and the servo motors. The continuous rotation servo motors are those kinds of servo motors that cannot be controlled or set at a particular angle, unlike normal servos. Servos have three wires coming from them: Red- Power, Black -Ground, White/Yellow- PWM /PPM Signal. The left servo motor (white/yellow wire) is hooked up to Arduino digital pin 9 and the right servo motor (white/yellow wire) Arduino digital pin 10. The black wires of both the motors are connected to Arduino GND and the Red wires to the positive terminal of the battery holder. Connect the RX pin of the Bluetooth module to TX pin (digital pin 1) on the Arduino and the TX pin on the module to the RX pin on the Arduino (pin 0). Connect Vcc and Gnd of the module to the Arduino. Connect the negative terminal of the battery holder to Arduino GND.

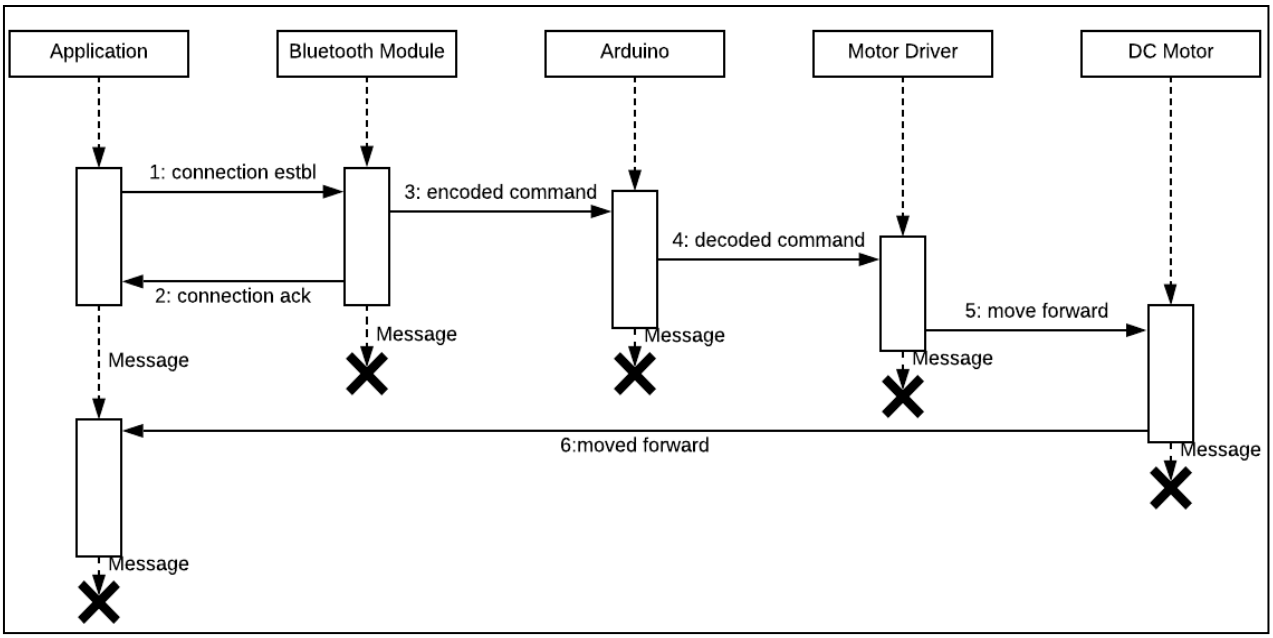

Fig: System Implementation

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IV. CONCLUSION

This is indeed a cost-effective and efficient project. The novelty lies in the fact that it is a cost-effective project with a simple and easy to use interface compared to existing ones. Also the Bluetooth RC Controller application is more user friendly. The robot is small in size so it can be used in spying purpose. With few additions and modifications, this robot can be used in army for detecting and disposing hidden land mines. The robot can be used for surveillance. In future we can interface sensors to this robot so that it can monitor some parameters and we can improve the efficiency using Internet of Things (IOT) technology. We can also add wireless camera, in order to incorporate other security features. A health monitoring system should be introduced in the wheelchair such that it can measure basic information about health, such as temperature, blood pressure and pulse etc. Upper and lower ranges should be defined and immediate emergency indication should be provided to the care taker on crossing these ranges.

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