

JOE PROJECT REPORT
ON
BLUETOOTH CONTROLLED ROBOT CAR

Submitted to
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Title: ROBOT CAR.

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Gurugram 27 November 2019

Table of Contents

Acknowledgement

Abstract

- 1 Executive Summary
- 2 Business Case Analysis of Project:
- 3 Benchmarking the existing solutions with respect to Project
- 4 Project Product specifications:
 - 4.1.1 Specific Functional Requirements
 - 4.1.2 Performance Requirements
 - 4.1.3 Physical Requirements
- 5 Brainstorming & Concept Generation for Project Product
- 6 Implementation plans for Project product
- 7 FUTURE SCOPE
- 8 APPLICATIONS
- 9 Conclusions
- 10 References

ACKNOWLEDGEMENT

Keep away from people who try to belittle your ambitions. Small people always do that, but the great make you feel that you too, can become great. We take this opportunity to express my sincere thanks and deep gratitude to all those people who extended their wholehearted co-operation and have helped me in completing this project successfully. First, we would like to thank Mr. Surya Prakash for creating opportunities for us to enhance our skill through the project. He inspires suggestions and timely guidance enabled me to perceive the various aspects of the project in a new light.

Special thanks to Mr. Yogesh for all the help and guidance extended to me by him in every stage during my project. We are highly indebted and graceful to Mr. Kunal for their strict supervision, constant encouragement, inspiration and guidance. Working under him was an enrich experience.

We would also like to thank my project mates for guiding and encouraging me throughout the duration of the project.

ABSTRACT

A remote-control vehicle is defined as any mobile device that is controlled by a means that does not restrict its motion with an origin external to the device. This is often a radio control device, cable between control and vehicle or an infrared or Bluetooth controller. A remote-control vehicle (Also known as RCV) is always controlled by a human and takes no positive action autonomously. It is vital that a vehicle should be capable of proceeding accurately to a target area; manoeuvring within that area to fulfil its mission and returning equally accurately and safely to base. In this project we are using Bluetooth wireless technology to control our robot car which is a very simple communication system. The remote in this project is an android device which has Bluetooth feature built in. The user must install an application on his/her mobile and turn on the Bluetooth in the mobile phone. User can perform various actions like moving Forward, Backward, move Left and move right using commands that are sent from the android mobile. The Bluetooth is a serial communication medium through which we can connect two devices wirelessly. Here we have used a Bluetooth module in our robot car which gets connected to the phone's Bluetooth, that allows us to communicate and allows to take command over it. The task of controlling the car is done by the Arduino UNO which houses the microcontroller ATMEGA32. Arduino has played a major role in the robotic section and has made it easier to convert digital and analogy signal to physical movements. The project is Bluetooth based because it gives us wider range of control and more efficiency. It also gives us the advantage of changing the remote anytime, meaning that we can use any android devices including phones, tablets, computers. Physical barriers like walls, doors, etc. do not affect in controlling the car.

1.EXECUTIVE SUMMARY

The Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

The L298 is an integrated monolithic circuit in a 15- lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage. Bluetooth is a wireless technology standard for exchanging data over short distances (using short wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices and building personal area networks (PANs). Range is approximately 10 Meters (30 feet). These modules are based on the Cambridge Silicon Radio BC417 2.4 GHz Bluetooth Radio. This is a complex chip which uses an external 8 Mbit flash memory.

2.BUSSINESS CASE ANALYSIS OF PROJECT

The working of our remote-controlled vehicle can be understood easily by observing the block diagram shown below:

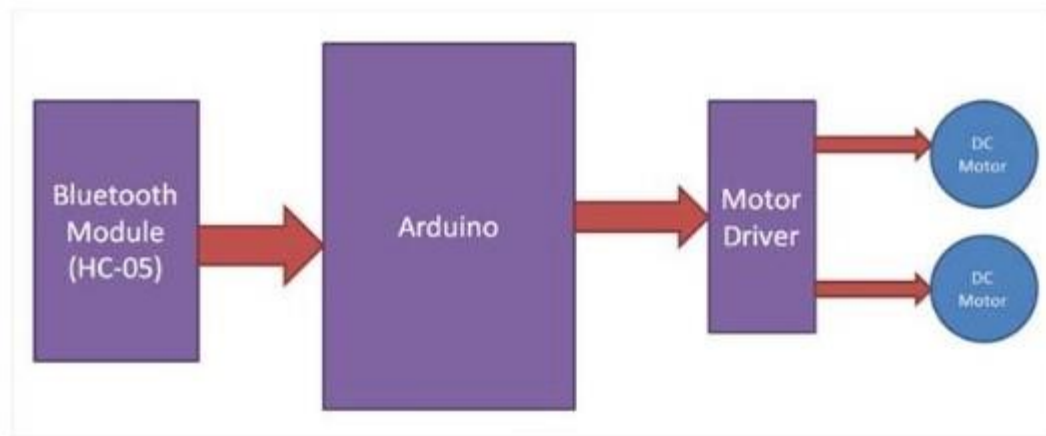


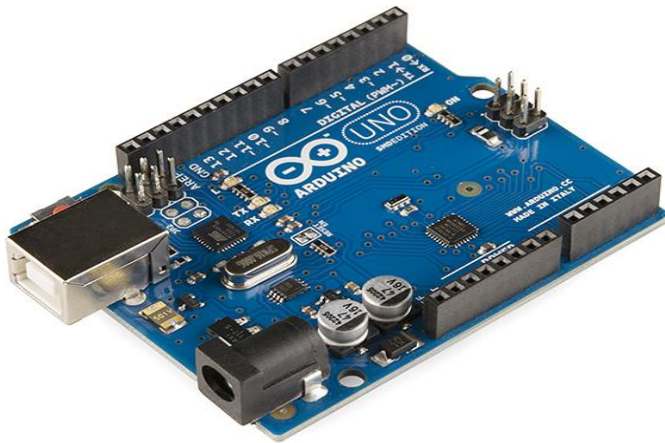
Fig.2. Block diagram of Bluetooth controlled robot car.

Here, the whole system is divided into four principal blocks viz Bluetooth block, microcontroller block, and the motor driver block. The Bluetooth block comprises of the Bluetooth module present in the mobile phone used along with the Bluetooth module used in our robot car. The mobile phone consists of an application that provides us an interface to send ASCII characters via Bluetooth which is then received by the Bluetooth module on the robot car. The microcontroller then receives the data from the Bluetooth module and then manipulates the data received into series of digital outputs which run the motor driver section. The data rate of communication is set to 9600 bauds per second. Two BO motors which run at 60 RPM are used.

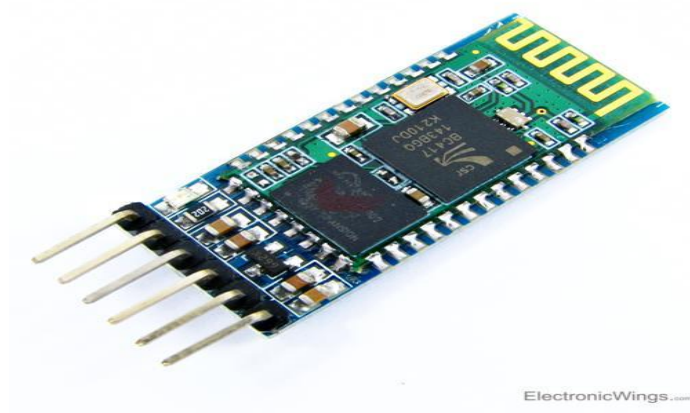
3.BENCHMARKING THE EXISTING SOLUTIONS WITH RESPECT TO PROJECT

Hardware: The hardware portion consists of the following principle parts:

1)Arduino UNO: Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino consists of both a physical programmable circuit board and a piece of software, or IDE (Integrated Development Environment) that runs on user's computer, used to write and upload computer code to the physical board. The Arduino Uno microcontroller board is based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. It can be powered by simply connecting to a computer with a USB cable or with a AC-to-DC adapter or battery to get started. We have used Arduino because it is an open source device which can be programmed through any operating system like Windows, Mac, Linux, etc. The language used is understandable and easy. Changing of program is also very easy. Various shields and modules that are easily connected to Arduino are available for various purpose like, if we want to connect the Arduino to a network then a Wi-Fi shield is available. For controlling the motor, a motor shield is available, and for this project a Bluetooth module is used.



2)HC 05: HC-05 module(Fig.4) is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature).



4.PROJECT PRODUCT SPECIFICATION

Power Supply: A power supply is an electronic device that supplies electric energy to an electrical load. The primary function of a power supply is to convert one form of electrical energy to another and, as a result, power supplies are sometimes referred to as electric power converters.

Bluetooth module: It is small wireless serial communication module that can relate to a Micro-Controller to receive and send data when connected with other Bluetooth devices.

Arduino-UNO: Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino consists of both a physical programmable circuit board and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

Motor driver: It is a small circuit that hoists the motor driving IC and can control two motors at the same time. It controls the motor speed by pulse width modulation (PWM).

The HC-05 Bluetooth Module has 6 pins. They are as follows: 1)Enable: When enable is pulled low, the module is disabled which means the module will not turn on and it fails to communicate. 2) Vcc: Supply Voltage 3.3V to 5V

3) GND: Ground pin

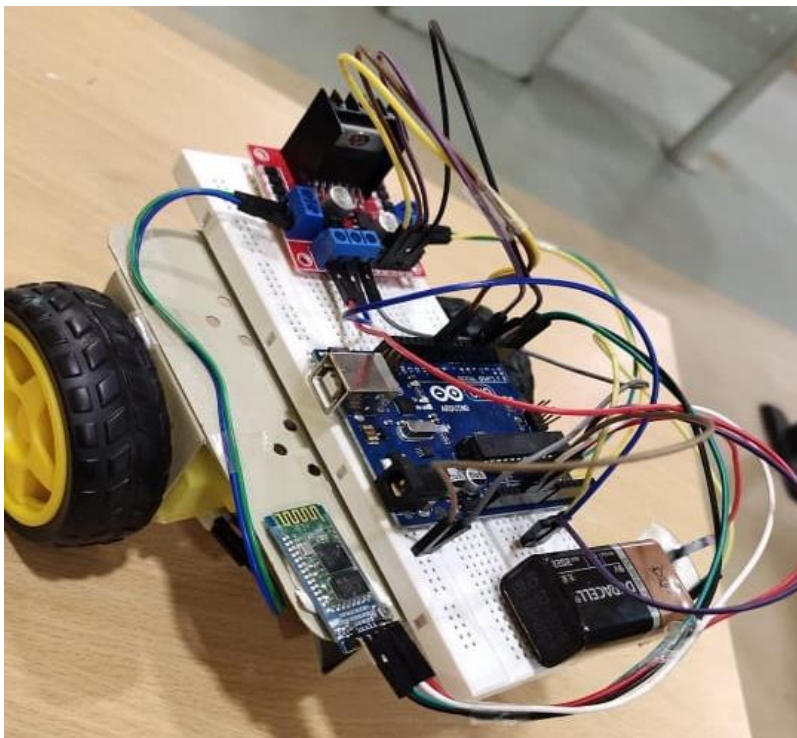
4) Txd & Rxd: These two pins acts as an UART interface for communication

5) State: It acts as a status indicator. When the module is not connected to / paired with any other Bluetooth device, signal goes Low. At this low state, the led flashes continuously which denotes that the module is not paired with another device. When this module is connected to/paired with any other Bluetooth device, the signal goes High. At this high state, the led blinks with a constant delay say for example 2s delay which indicates that the module is paired.

6) Button 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. 3)L293D motor driver: L293D is a typical Motor driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motors with a single L293D IC. In a single L293D chip there are two H-Bridge circuit inside the IC which can rotate two dc motor independently. Due its size it is very much used in robotic application for controlling DC motors. Given below is the pin diagram of a L293D motor controller.

(7) There are two Enable pins on l293d. Pin 1 and pin 9. For driving the motor with left H-bridge you need to enable pin 1 to high. And for right H-Bridge you need to make the pin 9 to high. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch. Pin no 2, 7, 9 and 11 are used as logic inputs and 4, 5, 12 and 13 are ground.



4.1.1. Specific Functional Requirements



Fig.3. Arduino Uno

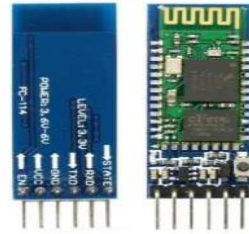


Fig.4. HC05 Bluetooth module

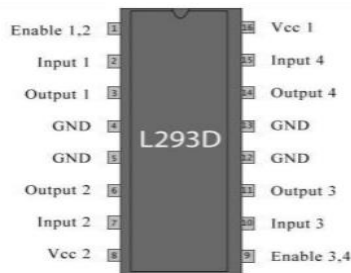


Fig.5 L293D motor driver IC



Fig.6 BO motor 60 RPM

A robot can be controlled using Bluetooth module HC-05 and ATMEGA328P-PU microcontroller with android Smartphone device. The controlling devices of the whole system are a microcontroller. Bluetooth module, DC motors are interfaced to the microcontroller.

The data receive by the Bluetooth module from android smart phone is fed input to the controller. The controller acts accordingly on the DC motor of the robot. The robot can move to move in all the four directions using the android phone.

The direction of the robot is indicators using LED indicators of the Robot system. In achieving the task, the controller is loaded with program written using Embedded 'C' Languages. Android smart phone controller Bluetooth

4.1.2.Performance Requirements

Software Tools: Arduino

For writing code in assembly and simulation of code, Arduino software plug-in to write code in C. Compilers: IAR, Image Craft. Code Vision Arduino Program type:

Application Clock frequency: 7.372800 MHz Memory model: Small

Programming Digital I/O pins of Arduino UNO board:

- Each pin is controlled by three commands associated with it which are designated as:

Motor Driver Control Using Bluetooth

```
Int a;
int led=13;
int motor1=2; //left motor up
int motor2=3; //left motor down
int motor3=4; //right motor up
int motor4=5 ; //right motor down
void setup() {
  pin Mode(motor1,OUTPUT);
  pin Mode(motor2,OUTPUT);
  pin Mode(motor3,OUTPUT);
  pin Mode(motor4,OUTPUT);
  pin Mode(led, OUTPUT);
  Serial. Begin(9600);
}

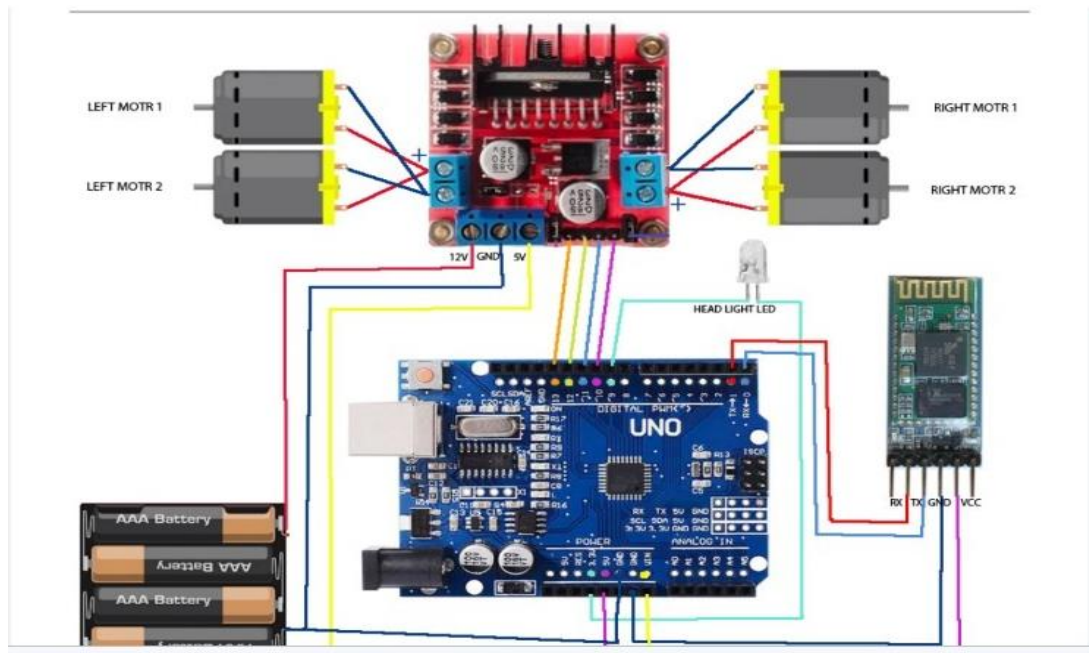
void loop() {
  a=Serial.read();
  if(a=='1')
  {
    digitalWrite(motor1,HIGH);//forward
    digitalWrite(motor2,LOW);
    digitalWrite(motor3,HIGH);
    digitalWrite(motor4,LOW);
  }
  if(a=='2')
  {
    digitalWrite(motor1,LOW);
    digitalWrite(motor2,HIGH);
    digitalWrite(motor3,LOW);//backward
    digitalWrite(motor4,HIGH);
  }
  if(a=='3')
  {
    digitalWrite(motor2,LOW);//right
    digitalWrite(motor1,HIGH);
```

```
digitalWrite(motor3,LOW);
digitalWrite(motor4,LOW);
}
}
if(a=='4')
{
digitalWrite(motor1,LOW);
digitalWrite(motor2,LOW);
digitalWrite(motor4,LOW);//left
digitalWrite(motor3,HIGH);
}
if(a=='5')
{
digitalWrite(motor1,LOW);//stop
digitalWrite(motor2,LOW);
digitalWrite(motor3,LOW);
digitalWrite(motor4,LOW);
}
}
```

LED Control Using Bluetooth

```
int a;
int led=13;
void setup() {
pinMode(led, OUTPUT);
Serial.begin(9600);
}
```

4.1.3 .Physical Requirements



CIRCUIT DESCRIPTION As shown in the diagram, two rechargeable batteries are used as supply, which is connected to the motor driver and Arduino respectively. When the circuit is energized, we will have to first pair the android phone with the Bluetooth module through the phone's Bluetooth settings; the default password of the Bluetooth module will be `_1234_`. Once the phone gets paired, open the application `_CAR BLUETOOTH RC_` which we can download from `_Google play store_`. On opening the application, there will be sets of controls displayed on the screen. If the device has not been connected, the control will be locked, meaning the control buttons cannot be pressed. When the car is at its initial position, the application automatically sends the command `_S_` meaning stop. The stop command is put in a loop that keeps on repeating throughout the execution of the program. As the user presses any control buttons, the stop command will be interrupted by the move forward, backward, right, left, depending on the user, and the car moves likewise. The program is designed in such a manner that we can also give two commands at the same time, i.e. move front and turn right or left and same with the backward motion. The Arduino also stores the program in its memory, so it does not require re-uploading of the program. The IN1, IN2, IN3, and IN4 are the inputs for the motor driver that receive commands from the Arduino for the two motors respectively. The motor driver should be grounded with the Arduino ground pin (GND). The motor driver requires a minimum of 6V and above.

to run, any voltage below 6v the motor remains off. The RXD pin of the Bluetooth module is for receiving commands from the Android devices and sends to Arduino through this pin and the TXD is for transmitting or sending dates or information's. It is supplied with a 5v dc source from the Arduino 5v pin. The main part of the above circuit diagram is Arduino UNO. The power supply section is very Important. It should provide constant voltage to the devices for successful working of the project.

Mobile app: Here we have used Arduino Bluetooth controller application(Fig.7). It provides a Nintendo joystick style interface which is highly convenient for controlling robot cars (9) and similar projects that utilize Bluetooth as their communication Technology. The buttons can be assigned ASCII Characters that can be sent with the button pressed. Fig.7. User interface of Bluetooth remote controller application In the figure shown above, the values assigned to the different buttons on the joystick interface are shown. When a button is pressed the respective ASCII character assigned to the button is sent by the mobile phone via Bluetooth.



Figure 1 4• to bluetooth connection on to move the robot

5.DISSION OF PROJECT

In the course of developing this project we have achieved the following milestones. The android guided arduino car has been created successfully and testing has been done for all the known cases regarding the usage of project. We has successfully created an android application that will provide user an interface to interact with the arduino powered car. The interface is easy to use and provide feedback from the arduino microprocessor through the Bluetooth after giving instruction to arduino for various actions through interface via Bluetooth module. An appropriate program in the arduino microprocessor to interact with the android controller has been created successfully. The program has been successfully complied through arduino IDE to the arduino microprocessor & loaded in to it after proper checking of logic to decrease any loss/damage of hardware. We have been able to successfully implement the ultrasonic sensor with servo motor in arduino car to save the car from collision. The project has completed its aim to designing an android interface, arduino bot and write program in to the arduino microprocessor. Arduino car contains arduino microcontroller with basic mobility features. Arduino programs contains instructions mediating between android controller and Arduino car. Android mobile controller uses different mobile sensors to supervise motion.

6.IMPLEMENTATION PLANS FOR PROJECT PRODU

The project is implemented on breadboard and the breadboard itself is used as the chassis for the robot car as shown in Fig.11. The Bluetooth module HC05 is connected to the Arduino board through simple single strand wires. The transmission pin of the Bluetooth module is connected to the receiver pin of Arduino and the receiver pin of the Bluetooth module is connected to the transmission pin of the Arduino. The Digital output pins 9, 10, 11 and 12 of Arduino board are connected to the pins 4, 10, 7 and 2 of the L298N motor driver IC respectively.

Two rechargeable batteries as supply is used which is connected to motor driver and Arduino respectively. When the circuit is energized, we will have to first pair the android phone with the Bluetooth module through the phones Bluetooth setting. The default password of the Bluetooth module will be 1234. Once the phone gets paired open the application "Bluetooth Remote Controller" which we can download from Google play store. After connecting the mobile to HC05, four options will appear on the application-Controller mode, Switch mode, Dimmer mode and Terminal mode. We have to select the Controller mode from it. The controller mode will provide us a joystick interface. We will send ASCII values from the application to the Bluetooth module. As the user presses any control buttons, the controller will run programs move forward, backward, right, left, depending on the data sent by the mobile and the car moves likewise. The Arduino also stores the program in its memory, so it does not require re uploading of Program. The IN1, IN2, IN3 and IN4 are the inputs for the motor driver that receives command from the Arduino for the two motors respectively. The motor driver should be grounded with the Arduino ground pin(GND). The motor driver requires minimum of 6v and above to run, any voltage below 6v the motor remains off. The RXD pin of the Bluetooth module is for receiving commands from the Android devices and sends to Arduino through this pin and the TXD is for transmitting or sending data or information's It is supplied with a 5v dc source from the arduino 5v pin. The main part of the above circuit diagram is Arduino UNO. The power supply section is very Important. It should provide constant voltage to the devices for successful working of the project.

7.FUTURE SCOPE

A wireless camera is mounted on the robot vehicle for spying and surveillance purpose even in night time by using infrared lighting. Future modifications can be made to perform different tasks with precise control such as:

~~control is a mission with a full-~~
A Robot Mounted with camera

A headset, with a full-colour display

A mission control centre.

Due to time & resource constraints these ideas were not brought to light in the project.

Application the project concept of guiding through mobile device to quadcopter, so that we can cover the aerial view of the surrounding

8.APPLICATIONS

In Domestic Use: This project can be used at homes for many purposes like picking up and placing someone to other.

In Spying Operations: This robot can help in spying operations. The object recognition and android control makes it Hi-Fi.

For Handicapped People: This project can help the handicapped people especially those who had lost their feet unfortunately.

Robo Races: The tilt control of robots can be used in robot races which will be revolutionary.

Military Application and Hostage Rescue

9.CONCLUSION

The operating system of smart phone is android which can develop effective remote-control program. At the same time , this program uses blue-tooth connection to communicate with robot. It has proven to allow for meaningful two-way communication between the Android phone and the robot which would allow a non-expert to interact with and adjust the functionality of a system which uses ATmega328 controller, a single board micro-controller intended to make the application of interactive objects or environments more accessible. The surveillance is always has been a quite sensitive task. And it includes so many risks. So it's better to use robot for this job instead of people. And if you are able to control the robots with efficiency and accuracy then you can guarantee yourself with good results and success. This system is a good step for secure surveillance using robots. Wireless control is one of the most important basic needs for all the people all over the world. But unfortunately, the technology is not fully utilized due to a huge amount of data and communication overheads. Generally, many of the wireless-controlled robots use RF modules. But our project for robotic control make use of Android mobile phone which is very cheap and easily available. The available control commands are more than RF modules. For this purpose, the android mobile user has to install a designed application on her/his mobile.

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