

**Project Report**  
**Report on**  
**ROBOD Using Arduino Uno**

This report is submitted in partial fulfilment of the requirement for the award of the degree

**BACHELOR OF TECHNOLOGY**

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## DECLARATION CERTIFICATE

This is to certify the work presented in the Project Report in “**ROBOD using Arduino Uno**”, in partial fulfilment of the requirement for the award of Degree of Bachelor of Technology in Computer Science and Engineering of Sityog Institute of Technology, Aurangabad, is an authentic work carried out by my Team under the supervision of undersigned **S.K Jha** (Director).

To the best of my knowledge, the content of this report does not form a basis for the award of any previous Degree to anyone else.

Date : 14<sup>th</sup> August 2023

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## CERTIFICATE OF APPROVAL

The foregoing Project REPORT on “**ROBOD using Arduino Uno**” is hereby approved as a creditable study Of Project report and has been presented in satisfactory manner to warrant its acceptance as prerequisite to the degree for which it has been submitted.

It is understood that by these undersigned do not necessarily endorse any conclusion drawn or opinion expressed therein, but approve the report for the purpose for which it is submitted.

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It gives us immense pleasure to present our design on the project -

### **ROBOD using Arduino Uno**

First and foremost, we are totally indebted to god, the almighty for showering us with blessings, and showing us the guiding light throughout the tenure of this project.

We express our sincere thanks to Prof. SK Jha, Director, Department of Computer Science and Engineering for guide us and providing us all necessary facilities, which helped us a lot in the successful completion of our project.

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## **ABSTRACT**

Humanoid robotics is an emerging research field that has received significant attention during the past years and will continue to play an important role in robotics research and many applications of the 21st century and beyond. In this rapid moving world, there is a need of robot such a “An Object Following Robot” that can interact and coexist with them. Because of its human following capability, these robots can work as assistants for humans in various situations and it can also acquire or monitor certain information associated with the human subject. In this paper we present a prototype that uses Arduino Uno along with basic sensors such as ultrasonic and IR sensor. All the processing is carried out by the microprocessor while the control of the motors is carried out by the controller. This robot can further be modified by using many technologies such as Bluetooth.

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# 1. Introduction

Robotic technology has increased appreciably in past couple of years. Such innovations were only a dream for some people a couple of years back. But in this rapid moving world, now there is a need of robot such as “**ROBOD using Arduino Uno**” that can interact and co-exist with them. The development of robot technology had increased significantly due to industrial, medical and military applications. In various fields with harsh environment such as underground mining, war-zones, medical, construction, space exploration etc. the work done by one is extremely dangerous. Life of individuals assisting are also put at risks. Tasks performed by humans have its own limitations in many ways. In order to perceive beyond the human limitation in vision, speed, consistency, flexibility, quality e.tc we should make use of robots. A key requirement for these robots is the ability to detect humans and to interact with the min non-technical way. The main objective of this dissertation is to make a robot that can help humans with various tasks. In this paper, we present a prototype of a human following robot that uses Arduino Uno and different sensors for detection and following an object.

The Robot must follow the following objectives:

- The robot must be capable of accurately follow a person
- It should be capable of taking various degrees of turns.
- The robot must be insensitive to environmental factors such as noise.
- The robot must be capable to avoid collision.

## **2. Purpose of Plan**

As most of the work in this area has been done regarding the Arduino & its application, what left out most of the time is the Android controller. In this project we are trying to exploit the android open accessory Bundle so that we can give

- a) More realistic experience to the user.
- b) Better Connectivity to the Arduino Chip.
- c) Increasing the efficiency in controlling of Bot.

### **2.1. Project objectives**

In this project we will be constructing the android guided Arduino Car by extracting the powers of both the open source technologies- Android and Arduino Programming.

### **2.2. Project goals**

- To develop an android application that will provide user an interface to interact with the Arduino powered car.
- To develop an appropriate program in the Arduino microchip to interact with the android controller.
- To compile all the developed modules that we constructed above.
- To produce Arduino car that is controlled by android phone remote which can be used in various fields, like defense, scientific expeditions and so on.

### **2.3. Scope Definition**

The project is limited 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.

## **3. Literature review**

This literature review explores potential information to identify current knowledge and key issues relating to development of Android Supervised Arduino Car, which are divided into two sections: Arduino interface & programming, android application development.



### 3.1.Android

Android was made up from the scratch by its founder who has been working on the Linux kernel. Their true aim was to design an operating system which is so powerful to use all its hardware & software power. They didn't expect that the openness concept of android is so much liked by the developer that android operating system has the largest app store than any other mobile operating system.

Android as we know a common term in the market of smartphone. A million of devices run on the android smartphone which is forwarded by the google in the wake for need of mobile operating system.

Google has made the Android an open source technology which is one of the reasons behind the success of Android. Google announced in its IO Conference the fusion of Android with Arduino which is also the open source technology.

As Google draw out more Arduino libraries for Android IDE which comes under the name of Android Open Accessory, it created numerous possibilities for developers to use Arduino side by side with Android & create application which can be used in various field.

#### Application anatomy

Running applications could be a major goal of in operation systems and android an operating system provides many suggests that on completely different layers to compose, execute and manage applications.

For this purpose, android an operating system clearly differentiates the terms application, process, task and thread. This chapter explains every term by itself yet because the correlation between the terms.

### 3.2.. Android Open Accessory

Android Open Accessory give us the power to interact with android powered device to external USB hardware in special mode. Android phone when in accessory mode the connected accessory work as USB accessory role. When android USB accessory is connected to an android powered phone then it will search the accessory mode in the android phone with the help of android open accessory protocol. For charging power, accessory should provide the 500ma at 5V.The before android device are unavailable to make connection to the USB connected device. This problem has been overcoming with the release of Android open accessory. An API level 12 & higher can use the android open accessory protocol.

### 3.3. Android Bluetooth Libraries

Package containing android libraries is in – android. Bluetooth package

Get Adapter -> Get Paired Devices -> Search Bluetooth Android connects Arduino via the android Bluetooth package      `interface = BluetoothAdapter.getDefaultAdapter();` Obtain a list of paired devices with a reference to the adapter.

```
pairedDevices = btInterface.getBondedDevices();
```

Search our firefly Bluetooth from a list of devices

```
Iterator<BluetoothDevice> btlist = pairedDevices.iterator();
```

```
While(it.hasNext()){
```

```
BluetoothDevice bd = it.next();
```

```
If(bd.getName().equalsIgnoreCase(BluetoothName))
```

Initiate Connection -> Create Socket -> Connect Socket      After bluetooth is found, initiate connection      with      the      function

```
connectToBluetooth(bd);
```

 When connecting to

the Bluetooth

```
createRfComSocketToServiceRecord()method
```

is used socket =

```
bd.createRfcommSocketToServiceRecord (UUID.fromString("00001101-0000-1000-8000-00805F9B34FB"));
```

Connect to the socket by using the connect() method.

```
Socket.connect();
```

Monitoring the bluetooth connection

To do this, register two bluetooth events:

`ACTION_ACL_CONNECTED`      and

ACTION\_ACL\_DISCONNECTED

When the device are connected, the handleConnected() method is invoked.

```
“android.bluetooth.device.action.ACL_Connected”))
```

```
{ handleConnected();
```

When the remove device disconnects, the handleDisconnected() method is invoked.

```
“android.bluetooth.device.action.ACL_DISCONNECTED”))
```

```
{ handleDisconnected();
```

Once handleConnected() is invoked, the connection is established.

Set up the input and output streams for communication between android and android.

```
Is = socket.getInputStream();
```

```
Os = socket.getOutputStream(); Error Event
```

Call close method to disconnect

```
Socket.close();
```

Bluetooth permission

Defined Permission in AndroidManifest.xml file:

```
<uses-permission android:name=
```

```
“android.permission.BLUETOOTH”>
```

```
</usepermission>
```

#### **4. Software and Hardware Specification**

Software used:-

- S/W Tool: Android Studio
- Operating System: Windows 7 (x86 & x64)
- S/W Tool: Arduino IDE

Hardware requirements:-

- Android Operating System (2.3.3 – 4.4.4)
- 1.0GHz or faster processor
- 256 MB RAM minimum
- Minimum 500MB of available hard disk space
- Arduino Uno
- Arduino Uno shield
- L298 Motor shield
- Ultrasonic sensor
- Infrared sensor
- Motor driver
- Servo motor
- Bluetooth module- class II
- Ultrasonic sensor
- 5-8V External Power Source/Battery

## 5. Project Design and Implementation

For this project we are following the agile model. We created modules individually and performed manual testing, since most of the modules were of different platforms.

### 5.1.Approach to Design

Enlisted our design approaches for the application. These were chosen after thorough discussion.

#### Scrum Model

A scrummage project involves a cooperative effort to form a replacement product, service or alternative result as outlined within the project vision statement. Project are compact by constraints of your time, cost, scope, quality, resources, structure capabilities and alternative limitations that build them troublesome to arrange execute manage and ultimately succeed. However, successful implementation of the results of a finished project provides important business edges to a company. It's so necessary for organizations to pick Associate in Scrum apply an acceptable project management methodology.

Scrum is one among the foremost in style methodologies. It's Associate in Scrum is adaptable, fast, versatile and effective methodology designed to deliver important price quickly and throughout a project. Scrummage ensures transparency in communication

Associate in Scrum creates a setting of collective respondents and continuous progress.

The scrummage framework as outlined within the SBOK guide is structured in such the way that it supports product and repair development all told the kinds if industries and in any style of project, no matter its quality

A key strength of scrum lies in its use of cross-functional, self-organized and empowered groups, their addition to short, focused work cycles known as Sprints figure below offer an outline of a scrum project's flow

The scrum cycle begins with a stakeholder meeting, throughout that the project vision is formed. The product owner then develops a prioritized product backlog that contains a prioritized list of business and project necessities written within the kind of user stories.

Each Sprint begins with a Sprint planning conference throughout that high priority user stories are thought-about for inclusion. A sprint typically lasts between one and 6 weeks and involves the scrum team operating to form probably shippable deliverables or product increments. Throughout the sprint, short extremely targeted daily standup conferences are conducted wherever team members discuss daily progress.

Towards the top of the sprint, a sprint review meeting is conducted throughout that the product owner and relevant stakeholders are provided an illustration of the deliverables. The product owner accepts the deliverables providing they meet the predefined acceptance criteria. The sprint cycle ends with a retrospect sprint meeting wherever the team discusses ways in which to boost processes and performance as they move forward into the next sprint.

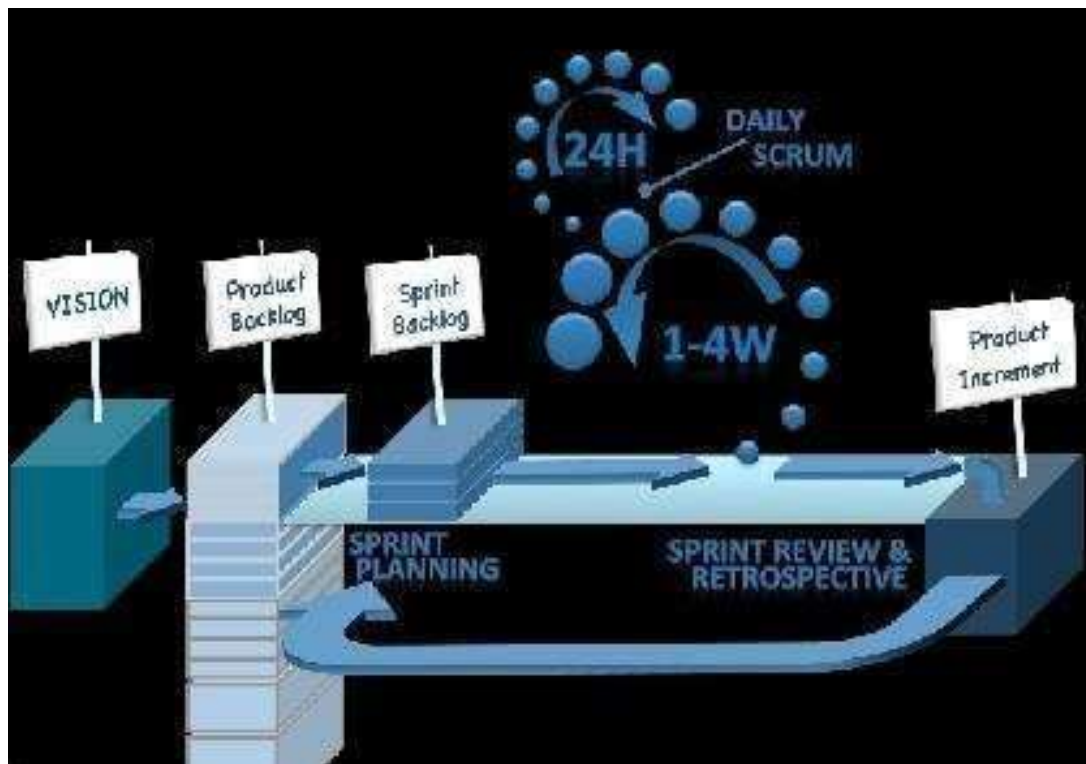


Fig. Scrum model phases (made by own)

Scrum phases

Initiate

Plan and estimate

Implement

Review and retrospect

## 6. Experimentation

### 6.1. Android Studio

Android Studio is that the official IDE for android application development, supported IntelliJ idea. On prime of the capabilities you expect from IntelliJ, android Studio offers:

Flexible Gradle-based build system

Build variants and multiple apk file generation

Code templates to assist you build common app options

Rich layout editor with support for drag and drop theme piece of writing lint tools to catch performance, usability, version compatibility, and alternative issues.

ProGuard and app-signing capabilities

Built-in support for Google Cloud Platform, creating it straightforward to integrate Google Cloud electronic communication and

App Engine □ And much more.

### 6.2. Arduino IDE

The Arduino integrated development environment (IDE) could be a cross-platform application written in Java, and derives from the IDE for the process programming language and also the Wiring projects. It's designed to introduce programming to artists and different newcomers unfamiliar with code development. It includes a code editor with options like syntax highlighting, brace matching, and automatic indentation, and is additionally capable of compilation and uploading programs to the board with one click. A program or code written for Arduino is named a "sketch".

Arduino programs are written in C or C++. The Arduino IDE comes with a code library referred to as "Wiring" from the first Wiring project that makes several common input/output operations a lot of easier. The users would like solely to outline 2 functions to create a possible cyclic government program:

setup (): a function run once at the beginning of a program that may initialize settings loop (): a function referred to as repeatedly till the board powers off+ programming languages.

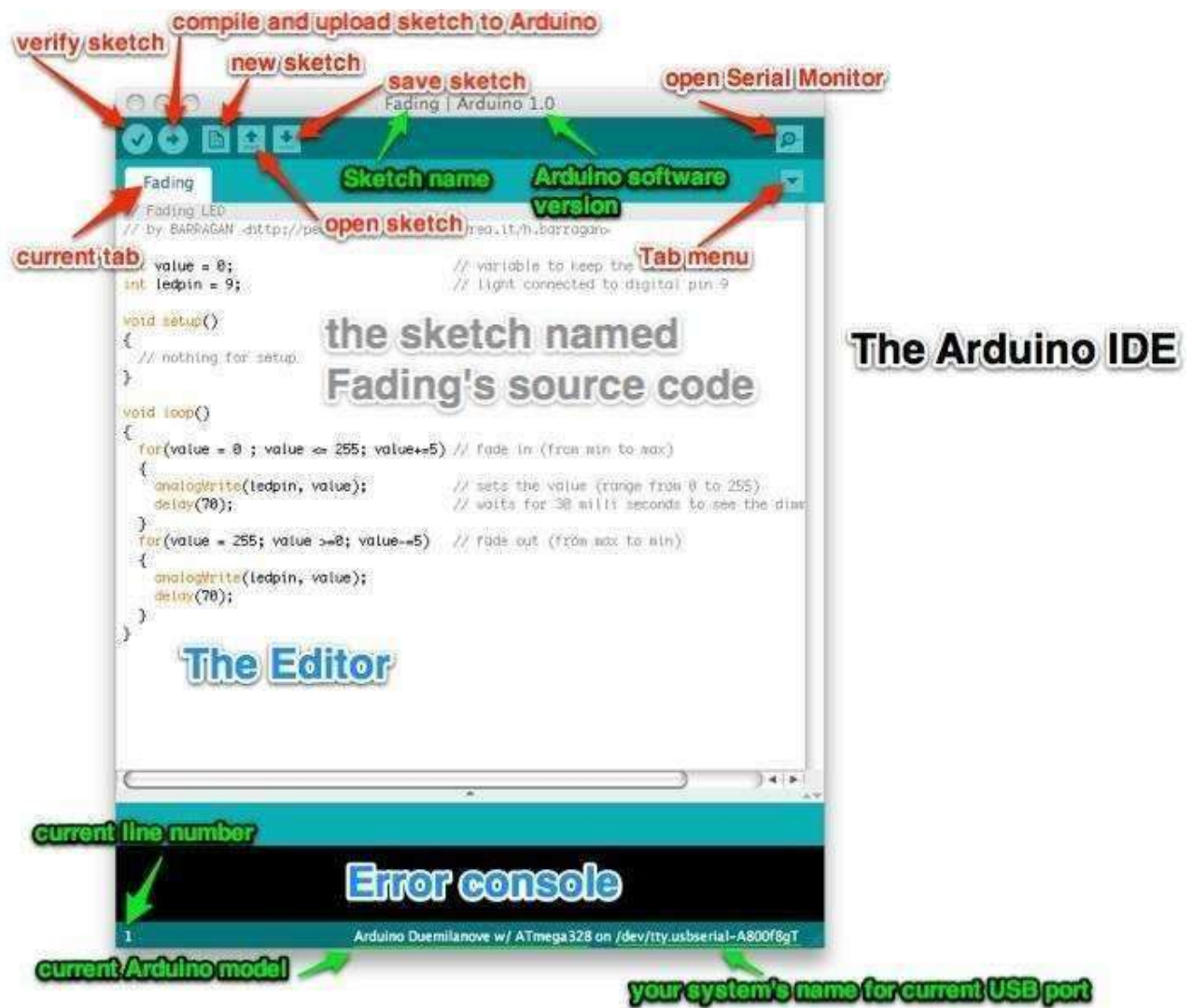


Fig.5.1- Arduino IDE

Arduino Uno R3 microprocessor

Uno means one in Italian, as uno is the first microcontroller of arduino family.

Arduino uno r3 microcontroller board work on ATmega-328

ATmega 328 microcontroller

5V operating voltage

7-12V input voltage

6-20V input voltage (limits)  
 14(6 PWN outputs) Digital Pins  
 6 Analog input pins  
 40mA DC current per I/O pin  
 50mA DC current for 3.3V pin  
 32KB (0.5 used for bootloader) flash memory  
 2KB SRAM  
 1KB EEPROM  
 16 MHz clock Speed

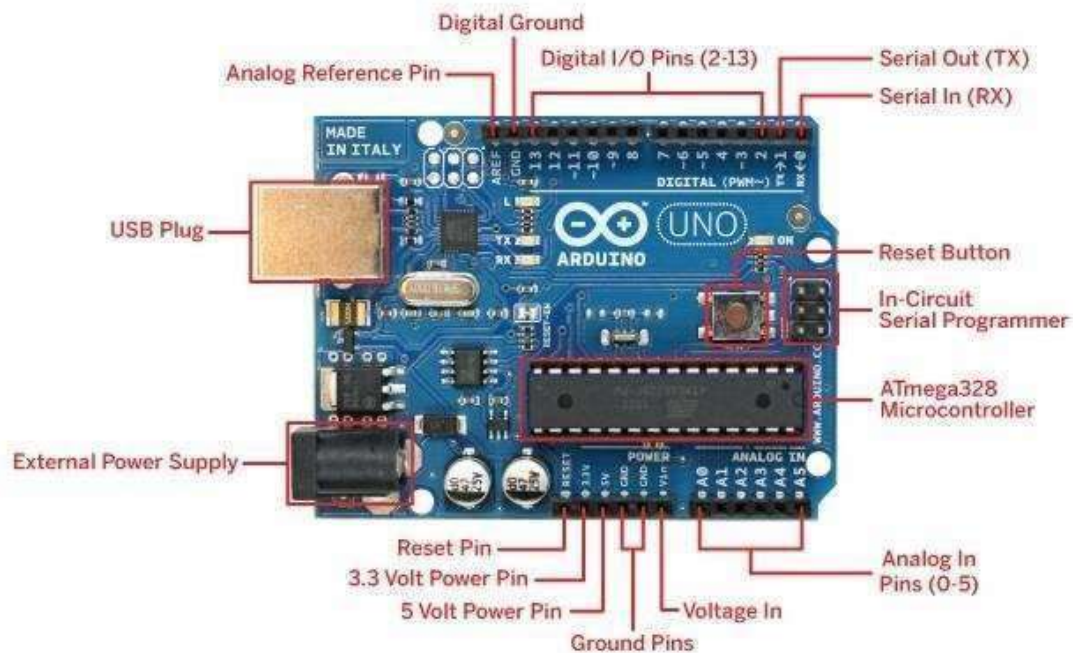


Fig 5.2- Arduino Microprocessor

### L298 Motor Shield

L298 motor shield is a dual full bridge driver designed to drive inductive load i.e. stepper motor, relays & solenoids. It gives you the control to drive two DC motor with arduino microcontroller and provide you the royalty to control the direction and speed of the motor.

5V (from arduino) Logic control voltage

4-8V ~ 35V (from external power source) motor driven voltage

36mA  $\geq$  Logic supply current  $I_{ss}$



$2A \geq \text{motor driver current } I_o$

25W Maximum power consumption ( $T=75^\circ\text{C}$ )

PWN, PLL Speed control mode

High  $2.3V \leq V_{in} \leq 5V$

Low  $-0.3V \leq V_{in} \leq 1.5V$

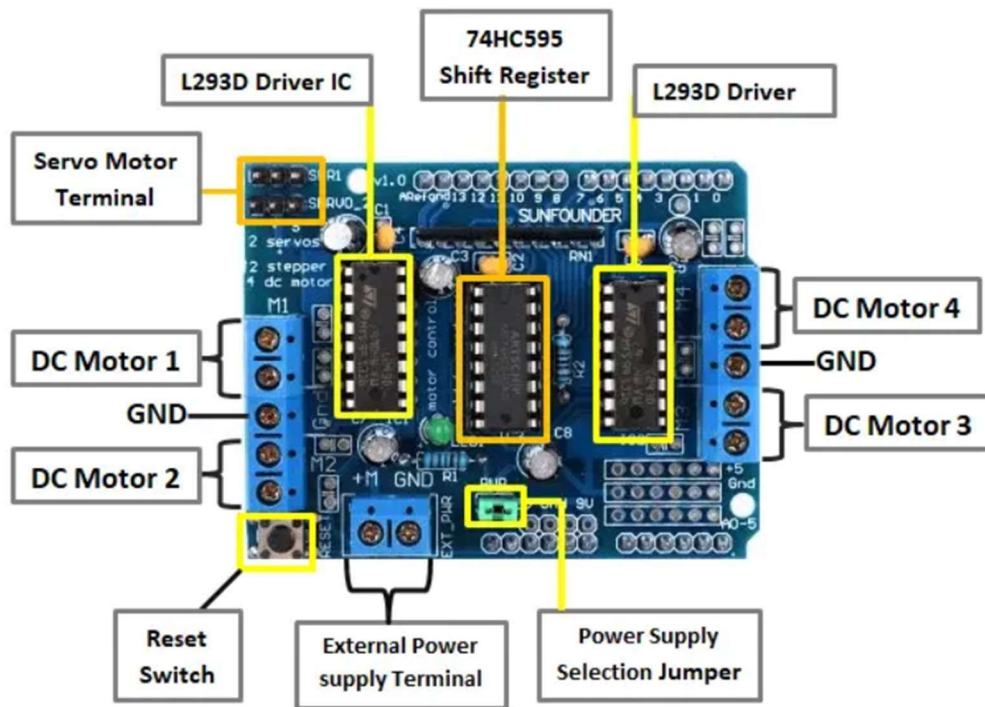


Fig 5.3- Motor shield

### Stepper Motor

Stepper motor works as an electrometrical device that with the help of electric pulses. Workout its mechanical operations the stepper motor rotates only when proper/clear. Sequence signal logic applied through the motor shield.

The sequence of electric pulses is directly connected to the direction of the stepper motor. The speed of the stepper depends upon the frequency of input pulses and length of rotation directly depends upon the applied no. of input pulses.

Stepper motor is of good choice when we want to control the rotation angle, speed, position and synchronism.

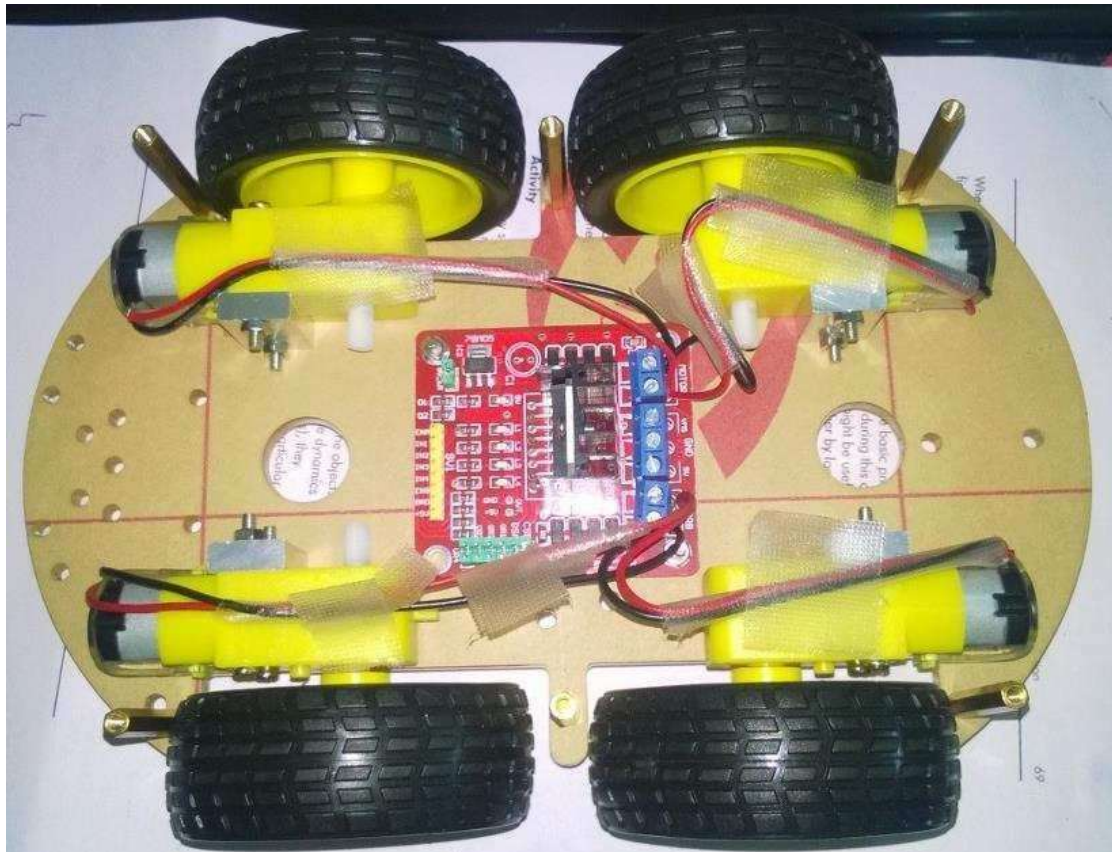


Fig 5.4- Stepper motor connected with motor shield

### Servo motor

Servo motor (3 wire dc motor) is used for a low power (~100W) control application balanced servomotor is ideally suited as it can be driven by means of a relatively rugged (drift free) ac amplifier. The motor torque can be easily controlled by varying the magnitude of the ac voltage applied to the control phase of the motor.

A three wire dc servo motor has

DC motor

A geartrain

Limit stops (after which shaft can't turn)

A potentiometer (position feedback)

Three wires of servo motor are described as one for power, one for ground, one for control input which determines the position motor should servo.



Fig 5.5 Servo motor with ultrasonic sensor

Screenshots of Application

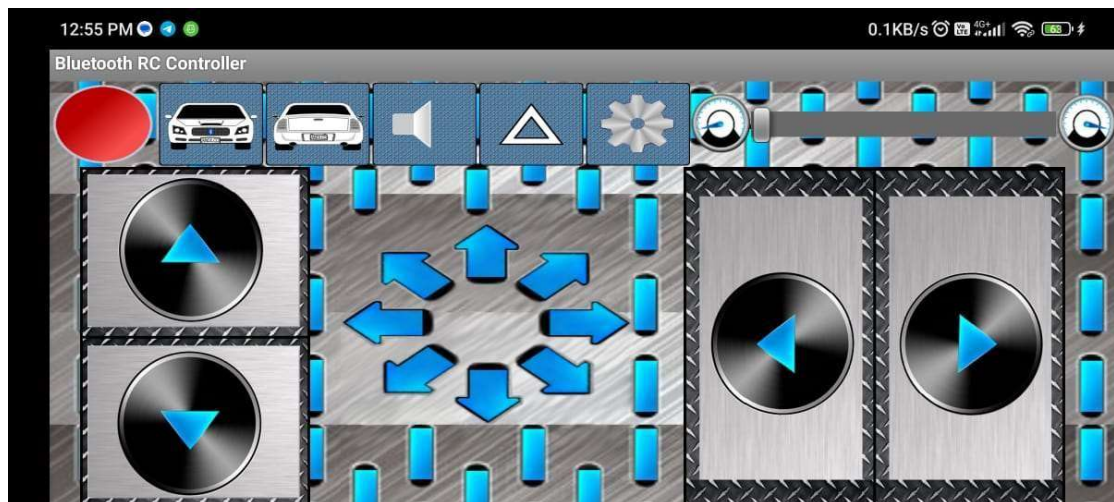


Fig 5.6. Android controller Splash Screen



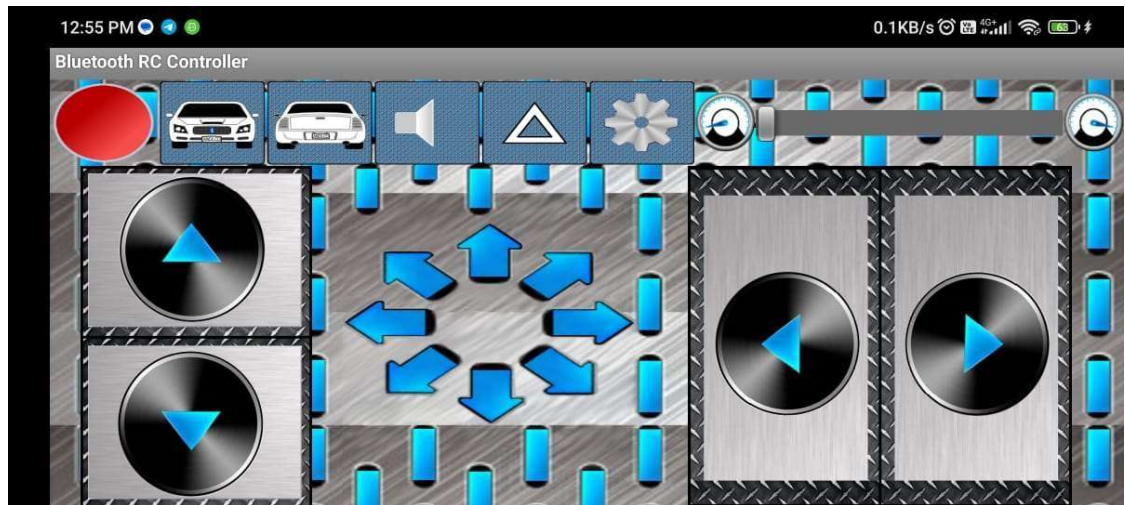


Fig 5.7. Android controller main interface. When it is disconnected.

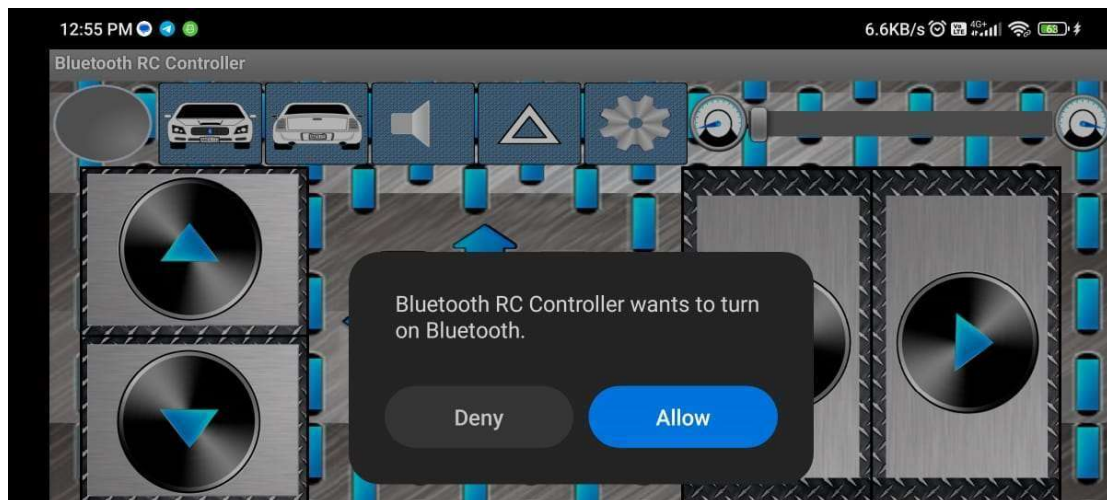


Fig 5.8. Android controller initiating the bluetooth connection

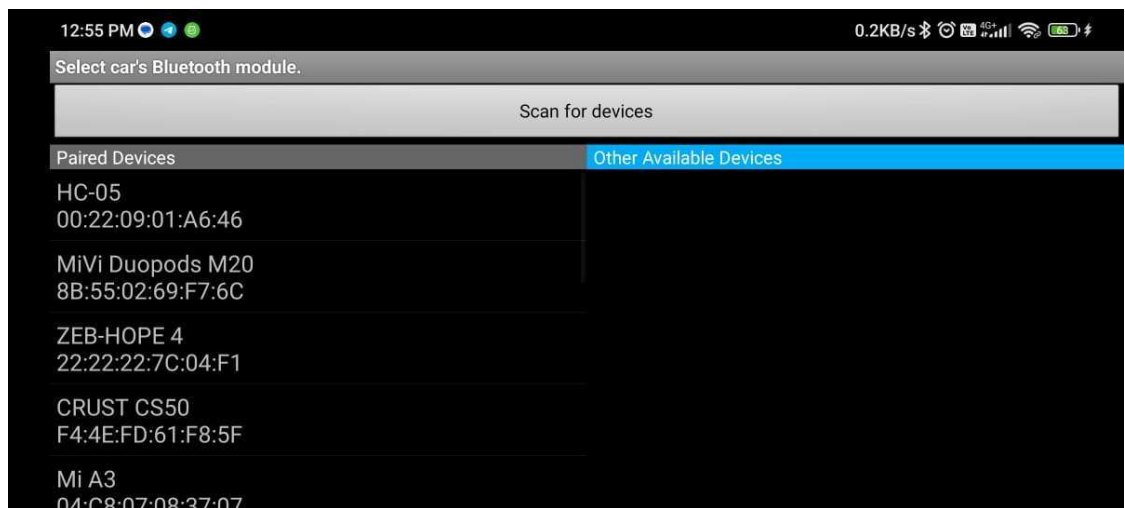


Fig 5.9. Scanning for the arduino car's bluetooth

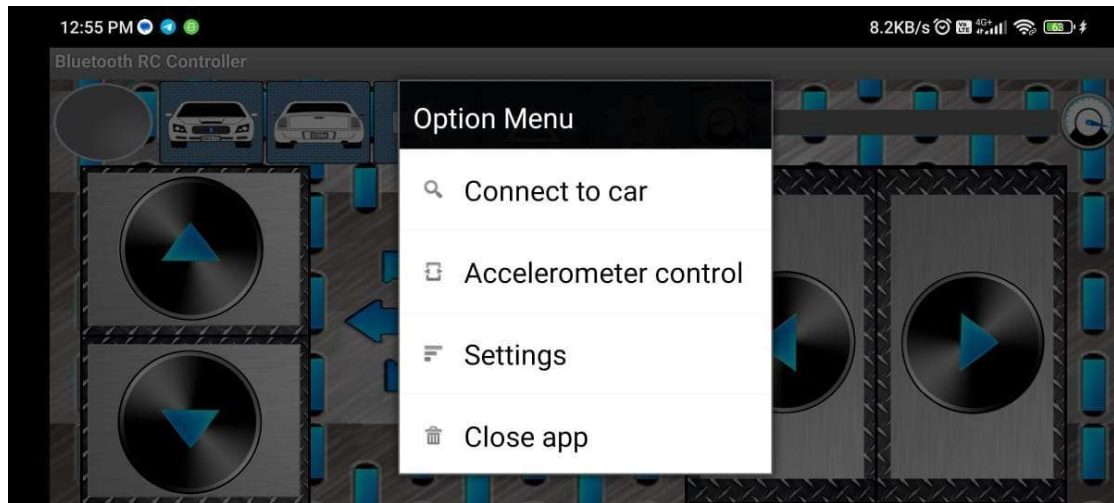


Fig 5.10. Android controller trying to connect with arduino car

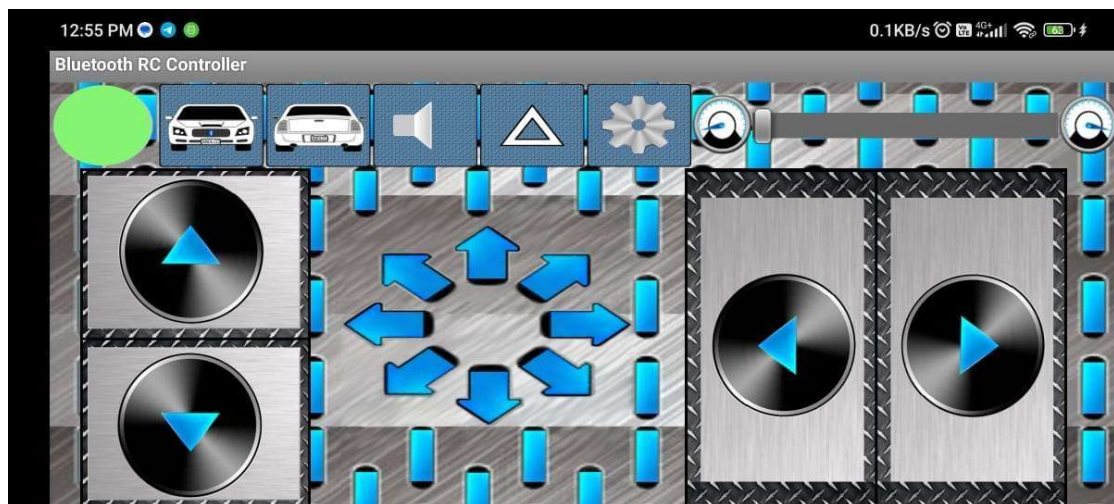


Fig 5.11. Android controller connected with arduino car

### Test cases

Manual testing was chosen as the method for testing. The randomness of the test cases is one of the characteristic of manual testing.

Ref No.	Test Data	Expected Outcome	Final Result
1.	Install the Android Application on the Android Operating System (2.3.3-5.1)	Application is installed on the Android Device Successfully	Pass
2.	Switch ON the external power supply/battery key of the Arduino car	Power supply has been reached to every microprocessor of Arduino car	Pass
3.	Connect the bluetooth module to the arduino shield	Light of red colour starts to blink from the bluetooth module	Pass

4.	Start the android application by clicking the icon	Application is started on the android OS	Pass
5.	Splash Screen Of the Application	Splash Screen is coming after the starting of Application	Pass
6.	Click on the search new bluetooth device	Bluetooth device list has been generated	Pass
7.	Click the connection button on the application interface	A message of Connected will show onto the application interface/Blinking	Pass

		stops of bluetooth module	
8.	Click on to the forward button of the android application interface	Arduino car starts to move forward & going forward message will generate in to the message box	Pass

9.	Click on to the Stop button of the android application interface	Arduino car stop moving & stopping  message will generate in to the message box	Pass
10.	Click on to the back button of the android application interface	Arduino car starts to move forward & going backwards  message will generate in to the message box	Pass
11.	Click on to the Stop button of the android application interface	Arduino car stop moving & stopping  message will generate in to the message box	Pass
12.	Click on to the Right button of the android application interface	Arduino car starts to move in right direction & turning right message will generate in to the message box	Pass
13.	Click on to the Stop button of the android application interface	Arduino car stop moving & stopping	Pass



		message will generate in to the message box	
14.	Click on to the left button of the	Arduino car starts to move in left direction & turning left message	Pass
	android application interface	will generate in to the message box	
15.	Click on to the Stop button of the android application interface	Arduino car stop moving & stopping message will generate in to the message box	Pass
16.	Take the android phone beyond 10 feet & give above used command of direction/Button	Unable to connect to the arduino device	Pass

17.	Click on to the Disconnect Button	Bluetooth module start to blink/closing connection & then disconnected message will generate in to the message box of android box	Pass
18.	Close the application on to the android device	Bluetooth module still blinking	Pass
19.	Switch OFF the Arduino car	All the blinking light of microprocessor immediately faded	Pass

### Discussion of Results

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.

## **Conclusion**

The project titled Android guided arduino car is an application based on popular open source technologies- android & arduino. The aim of the project was to create an arduino integrated car that has to be controlled through an application that runs on the android operating system. Since most of the application in the android market were unable to provide such simplicity that we have covered in this project.

The project has been completed with success with the utmost satisfaction. The constraints square measure met and overcome with success. The system styled /is meant/ is intended as find it irresistible was set within the design section. The project offers smart plan on developing a full-fledged application satisfying the user needs.

The system is extremely versatile and versatile. This code encompasses an easy screen that permits the user to use with none inconvenience. Validation checks iatrogenic have greatly reduced errors. Provisions are created to upgrade the code. The applying has been tested with live information and has provided a prosperous result. Thence the code has proven to figure expeditiously.

The system created met its objectives, by being straightforward to use, implement and secure. This code is developed with measurability in mind. Further modules may be simply other once necessary. The code is developed with standard approach. All modules within the system are tested with valid information and invalid information and everything work with success.

However there\'s still lots of scope for future improvement and add ons in practicality. A number of the foremost ones being mobile application development for different mobile software package

## **Future Prospects**

The Future Prospects are as follows:

Mobile application of this project can be brought on other mobile operating system like iOS & windows phone. Using of Wi-Fi direct/cellular network instead of bluetooth module, so that the range of the arduino car be increased to larger scale. Application the project concept of guiding through mobile device to quadcopter, so that we can cover the aerial view of the surrounding. With the help of DIP we can install a camera on the car which will provide us the view of camera on the mobile device. Due to time & resource constraints these ideas where not brought to light in the project.

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