# ANDROID CONTROLLED ROBOT

**Submitted in partial fulfillment of the requirement for the award of Degree of Bachelor of Technology in Information Technology Discipline**

**Submitted To**


**SVKM's NMIMS,**
**Mukesh Patel School of Technology Management & Engineering,**
**Shirpur Campus, Shirpur (M.H.)**

**Submitted By :**

**Pooja Patel** **Enrollment No – 71201120031**
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**Under The Supervision Of:**

**Mr. Piyush Kumar Soni (I.T. Dept Assistant professor)**
**Mrs. Chayyadevi Bhamre (E.X.T.C. Dept Assistant professor)**

**DEPARTMENT OF INFORMATION TECHNOLOGY**
**Mukesh Patel School of Technology Management & Engineering**
**SESSION: 2015-16**

# CERTIFICATE

This is to certify that the work embodies in this Project entitled **"Android Controlled Robot , *A prototype of wheelchair* "** being submitted by

**"Pooja Patel" (Roll No.: B430)**

**"Aaradhana Khairnar" (Roll No.: B417)**

**"Divya Dindorkar" (Roll No.: B113)**

for partial fulfillment of the requirement for the award of "**Bachelor of Technology** in **Information Technology"** discipline to "NMIMS, Mumbai (M.H.)" during the academic year 2015-16 is a record of bonafied piece of work, carried out by them under my supervision and guidance in the **"Department of Information Technology", MPSTME, Shirpur (M.H.).**

**APPROVED & SUPERVISED BY:**

**Guide Name**
**Mr. Piyush Kumar Soni (I.T. Dept Assistant professor)**
**Mrs. Chayyadevi Bhamre (E.X.T.C. Dept Assistant professor)**

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**(Dr. N.S. Choubey)**
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**(Dr. Aaquil Bunglowala)**
Associate Dean,
MPSTME, Shirpur

**DEPARTMENT OF INFORMATION TECHNOLOGY**
**Mukesh Patel School of Technology Management & Engineering**

# CERTIFICATE OF APPROVAL

The Project entitled **"Android Controlled Robot, *A prototype of wheelchair"*** being submitted by

"**Pooja Patel"** **(Roll No.:B430)**

"**Aaradhana Khairnar"** **(Roll No.:B417)**

"**Divya Dindorkar"** **(Roll No.:B113)**

has been examined by us and is hereby approved for the award of degree **"Bachelor of Technology in Information Technology Discipline"**, for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein, but approve the project only for the purpose for which it has been submitted.

**(Internal Examiner)** **(External Examiner)**

**Date:** **Date:**

**DEPARTMENT OF INFORMATION TECHNOLOGY**
**Mukesh Patel School of Technology Management & Engineering**

# DECLARATION

We,

**Pooja Patel**
**Aaradhana Khairnar**
**Divya Dindorkar[E.X.T.C.]**

The students of **Bachelor of Technology** in **Information Technology** discipline, **session: 2015-16, MPSTME, Shirpur Campus,** hereby declare that the work presented in this Project entitled **"Android Controlled Robot, *A prototype of wheelchair*"** is the outcome of our work, is bonafied and correct to the best of our knowledge and this work has been carried out taking care of Engineering Ethics. The work presented does not infringe any patented work and has not been submitted to any other university or anywhere else for the award of any degree or any professional diploma.

**Pooja Patel – 71201120031**
**Aaradhana Khairnar – 71201120017**
**Divya Dindorkar – 71205120013**

**Date:**

**DEPARTMENT OF INFORMATION TECHNOLOGY**
**Mukesh Patel School of Technology Management & Engineering**

# ACKNOWLEDGEMENT

*After the completion of this Major Project work, words are not enough to express our feelings about all those who helped us to reach our goal; feeling above this is our indebtedness to The Almighty for providing us this moment in life.*

*It's a great pleasure and moment of immense satisfaction for us to express our profound gratitude to Mr. Piyush Kumar Soni, Asst. Professor, Information Technology Department, MPSTME, Shirpur, whose constant encouragement enabled us to work enthusiastically. His perpetual motivation, patience and excellent expertise in discussion during progress of the project work have benefited us to an extent, which is beyond expression. Their depth and breadth of knowledge of Information Technology field made us realize that theoretical knowledge always helps to develop efficient operational software, which is a blend of all core subjects of the field. We are highly indebted to them for their invaluable guidance and ever-ready support in the successful completion of this project in time. Working under their guidance has been a fruitful and unforgettable experience.*

*We express our sincere thanks and gratitude to Dr. N.S. Choubey, Head, Computer Engineering/Information Technology Department, MPSTME, Shirpur, for providing necessary infrastructure and help to complete the project work successfully.*

*We also extend our deepest gratitude to Dr. RS Gaud , Director, MPSTME, Shirpur Campus and Dr. Aaquil Bunglowala, Associate Dean, MPSTME, Shirpur Campus for providing all the necessary facilities and true encouraging environment to bring out the best of our endeavors.*

*We sincerely wish to express our grateful thanks to all members of the staff of Information Technology department and all those who have embedded us with technical knowledge of computer technology during various stages of B.Tech. Information Technology.*

*We would like to acknowledge all our friends, who have contributed directly or indirectly in this Major Project work.*

*The successful completion of a Major Project is generally not an individual effort. It is an outcome of the cumulative effort of a number of persons, each having their own importance to the objective. This section is a vote of thanks and gratitude towards all those people who have directly or indirectly contributed in their own special way towards the completion of this project.*

***"Pooja Patel" (Roll No.:B430)"***

***"Aaradhana Khairnar" (Roll No.:B417)"***

***"Divya Dindorkar" (Roll No.:B113)"***

# ABSTRACT

Handicapped people find it difficult to move their wheelchair and among them paralysed people are always dependent on a third person to move their wheelchair. Sometimes due to an obstacle or hurdle they may get injured. Also, for paralysed people it becomes difficult to pick the things which are placed even nearby them .Wheelchairs available in market with more functionality are not economically feasible.

So a need is there of a wheelchair which will help such people to operate their wheelchair easily, also will provide ease to the third person to control it. Advance functionality like obstacle detection and pick and place will provide additional benefit, and above all having this integrated functionality into one wheelchair should be cost effective.

Our Project Android controlled robot (a prototype of wheelchair),will help handicapped people to operate their wheelchair easily and for paralysed people, it will provide ease to the third person who has to operate their wheelchair by taking it everywhere ,so he or she will able to operate it easily via android app. In addition to this wheelchair will be capable enough to detect obstacle and stop automatically .It will also have a functionality of pick and place to help paralysed people to get something kept nearby them by the instructions given by third person .Addition to this, the project will be cost effective.

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CHAPTER : 01

# INTRODUCTION

## 1.1 PUROPOSE

Due to the disability to move , many handicapped people are facing many problems to operate their wheelchair and if they are paralysed they are dependent on a third person every time . In our country wheelchair with better facilities are not available and even if they are available then too they are too costly to be afforded by middle class .In order to help this kind of people we are developing this prototype.

## 1.2 SCOPE

Future scope of our project is that Artificial intelligence can be used so that the dependency on the another person is totally diminished that is the wheelchair traces it's on path by different algorithms. Different algorithms which will give minimum distance from source to destination can be used.More advance sensors can be used for avoiding the obstacles including the stairs, pits or edges of the surface.

## 1.3 OVERVIEW

Our Project Android controlled robot a prototype of wheelchair ,will help handicapped people to operate their wheelchair easily and for paralyzed people, it will provide ease to the third person who has to operate their wheelchair by taking it everywhere ,so he or can operate it easily via android app. In addition to this wheelchair is capable enough to detect obstacle and stop automatically .It is also have a functionality of pick and place to help paralyzed people to get something kept nearby them by the instructions given by the person operating the wheelchair using the robotic arm which is interfaced with the wheelchair .Addition to this, the project is cost effective so that more number of people can use it.

The android app is user friendly so that users don't face any problem in using it. Connectivity of android app and the wheelchair is made via Bluetooth using Bluetooth module.

CHAPTER : 02

# LITERATURE SURVEY

## 2.1 RESERACH PAPERS:-

We have referred to following Research paper which are as follows:-

1. Arpit Sharma1 , Reetesh Verma2 , Saurabh Gupta3 and Sukhdeep Kaur Bhatia4 "***Android Phone Controlled Robot Using Bluetooth***" 1 Student, Dept. of Instrumentation & Control Engg, J.S.S. Academy of Technical Education Noida, India 2 Student, Dept. of Instrumentation & Control Engg, J.S.S. Academy of Technical Education, Noida, India 3 Student, Dept. of Instrumentation & Control Engg, J.S.S. Academy of Technical Education, Noida, India 4Dept. of Instrumentation & Control Engg, J.S.S. Academy of Technical Education, Noida, India

Today human-machine interaction is moving away from mouse and pen and is becoming pervasive and much more compatible with the physical world. With each passing day the gap between machines and humans is being reduced with the introduction of new technologies to ease the standard of living. Gestures have played a vital role in diminishing this abyss. In this paper, a rigorous analysis of different techniques of "Human-Machine Interaction" using gestures has been presented. Gestures can be captured with the help of an accelerometer, however, with the evolution of smartphone its independent usage has been rendered useless. This paper analyses the motion technology to capture gestures through an android smartphone with an inbuilt accelerometer and Bluetooth module to control the kinetics of a robot. The signals of the Bluetooth Module are controlled by the Microcontrollers.

2.Pahuja, Ritika, and Narender Kumar. "***Android Mobile Phone Controlled Bluetooth Robot Using 8051 Microcontroller***." Electronics & Communication Engineering, Department, BRCM College of Engineering & Technology, Bahal, India, International Journal of Scientific Engineering and Research (IJSER) www. ijser. in ISSN (Online) (2014): 2347-3878.

A robot is usually an electro-mechanical machine that is guided by computer and electronic programming. Many robots have been built for manufacturing purpose and can be found in factories around the world. Designing of the latest inverted ROBOT

which can be controlling using an app for android mobile. We are developing the remote buttons in the android app by which we can control the robot motion with them. And in which we use Bluetooth communication to interface controller and android. Controller can be interfaced to the Bluetooth module though UART protocol. According to commands received from android the robot motion can be controlled. The consistent output of a robotic system along with quality and repeatability are unmatched. Pick and Place robots can be reprogrammable and tooling can be interchanged to provide for multiple applications.

**2.2 WEBSITE:-**

We have referred to following website which is as follow:-
https://www.arduino.cc/en/Guide/HomePage

The above mentioned website was being referred by us to understand the basics of arduino.

The website contains the basic information about arduino.

The website provides us information about the introduction of arduino.

It contains information about arduino software IDE and how to use that software, contains information about arduino libraries and instructions of how to install arduino.

This websites provide a column for troubleshooting which offers solutions to various problems encountered during working with arduino.

There are various tutorials that give basic idea about arduino.

CHAPTER : 03

# PROBLEM DEFINITION & PROPOSED SOLUTION

**PROBLEM DEFINITION :-**

Handicapped people find it difficult to move their wheelchair and among them paralyzed people are always dependent on a third person to move their wheelchair. Sometimes due to an obstacle or hurdle they may get injured. Also, for paralyzed people it becomes difficult to pick the things which are placed even nearby them .Wheelchairs available in market with more functionality are not economically feasible.

The problem statement of this project revolves around that how to provide ease to paralyzed people by providing integrated functionality, keeping in mind the main problems faced by them.

Furthermore, we have focused on cost effectiveness of the solution provided by us, having all the functionalities into one.

**PROPOSED SOLUTION :-**

So we proposed a solution of a wheelchair which will help such people to operate their wheelchair easily , which will provide ease to the third person to control it as it will be controlled by android app.

Advance functionality like obstacle detection and pick and place will provide additional benefit as it will help them from getting hurt and will provide things kept nearby them and above all having these integrated functionality into one wheelchair will be cost effective.

CHAPTER : 04

# DESIGN

This project integrates Hardware as well as Software. Hardware is the robot that is the wheelchair which includes various components integrated with each other. Software in this project is the android app. The app is basically designed to control the movement of the robot.

## 4.1 COMPONENT DESCRIPTION:-

In hardware we are using various components that are:

- **ARDUINO UNO:** The 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 operating range of the arduino uno is between 6-20 V. However , we the is operated in range of 7-12 V for better and stable output. This power is either provided by the cable from the computer or an external DC/AC adapter is used. The chip ATmega328p is programmed with bootloader so that the arduino is directly connected to the computer using a cord for programming; no external programmer is required for coding the arduino. The software used to code the arduino is Arduino IDE 1.0 software in programming C language. For communication purpose the pin 0 (Rx) and pin 1 (Tx) is used.

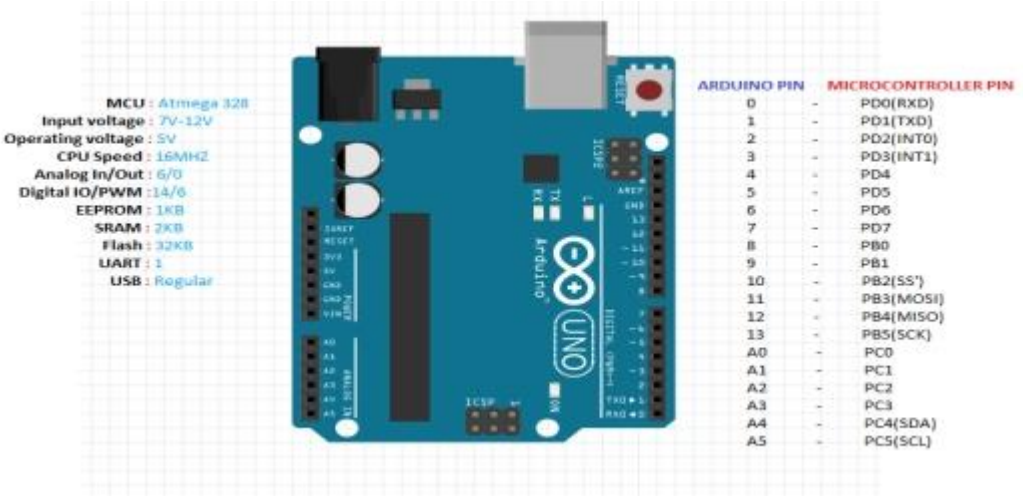


**FIG 4.1.1 : Pin diagram of arduino uno**

The above diagram shows the pin description of the arduino uno.

**Role in our project :**

In this project the Arduino UNO is the heart and soul of the hardware. It basically controls the input/output devices that are connected to it and to do so the arduino is programmed using the arduino IDE software. The coding is done in such a way that the obtained input from the android app is decoded and is converted in to specific and required voltage levels and is given to different components interfaced with the arduino. The different components in this project are the Bluetooth module, the IR sensor and the motor driver module.

- **BLUETOOTH MODULE:**

  Bluetooth module is a Serial Port Protocol module, which is used for the serial communication of data. It has data rate around 3 Mbps with 2.4 GHz frequency. It has integrated antenna which reduces the extra connections for interfacing of antenna to it. The Bluetooth module which fulfill requirement of our project is the Bluetooth module HC-05. This Bluetooth module is basically uses the concept of Master/Slave. Its operating range is 3.3V to 6V. The preferred value is 5V. Its default Baud rate is 9600. It has 6 pins. AT commands are used for programming of Bluetooth module which are present in the module by default.

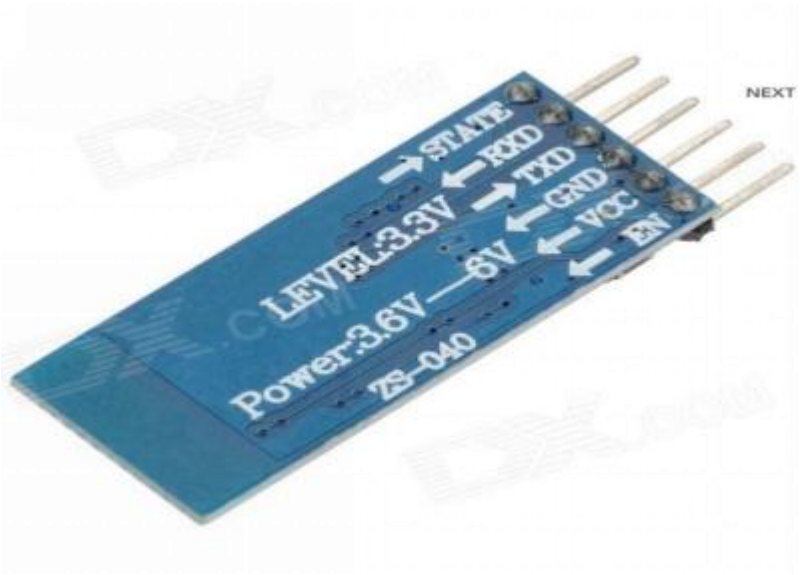


**FIG 4.1.2 : Bluetooth Module HC-5 pin diagram**

The above diagram shows the pin description of the Bluetooth Module, where the inward arrow shows that the pins are input whereas the outward arrow shows that the pins are the output pins.

**Role in our project:**

In this project the Bluetooth module HC-05 is the interfacing device which is used for communication of the arduino and the android app. The pins EN and STATE are not connected whereas all the other 4 pins are connected to the arduino. The input voltage given to the Bluetooth module is 5v and Rx and Tx pins are connected to the Tx and Rx pins of arduino respectively. GND of Bluetooth is connected to the GND of arduino. As the operating voltage of module should not exceed beyond 6v so the Rx pin of module is not directly connected to the Tx arduino and thus resistors are used to drop the voltage around it. The data is sent and received from the Bluetooth module is in serial form. The data from the bluetooth module is sent to arduino, arduino then decodes it by using the code present in it and give the desired output on desired pins of the arduino.

Interfacing diagram:

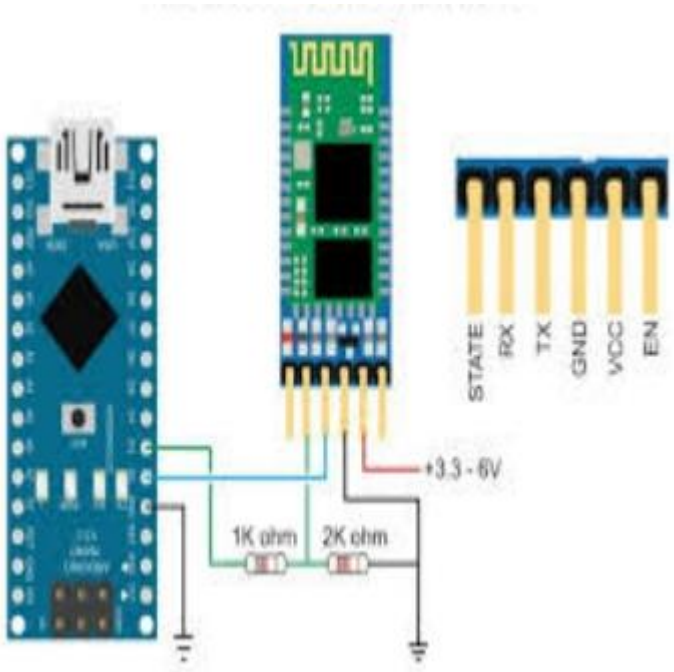


**FIG 4.1.3: Interfacing of Bluetooth with arduino**

- **DC MOTOR:**

The DC motors also called as the electric motors are used for the movement of any device. It works on the principle of motoring action which states that when current carrying conductor is placed in a magnetic field ,it experiences a torque and has tendency to move and even the direction of current is reversed the movement also gets reverse. When magnetic and electric field interacts with each other they produce mechanical movement. The DC motor has 2 pins i.e. with a positive polarity and another with the negative polarity.

**FIG 4.1.4: D.C. Motor**

**Role in our project:**

In our project we require in total of 4 motors including 2 for wheel i.e. for left and right wheels and 2 for arm i.e. for open/close of the mouth of arm and the up/down of the arm. All these motors are connected to 2 motor driver modules which is one for arm and other for robot movement.

- **MOTOR DRIVER MODULE:**

The motor driver module has the L293D IC as the brain of the module. It is used to drive the DC Motor. L293D is a typical Motor driver IC which allows DC motors to drive on either direction. L293D IC is a 16 pin IC that can control two DC motors at a same time in any directions. L293D uses the concept of H-bridge. H-bridge allows the flow of current in either direction which makes it capable of driving 2 DC motors independently and simultaneously.

This L293D IC is present in the motor driver module which has connections already done in it and the pin heads are present which can be used for direct external connections.

**FIG 4.1.5: Motor Driver module**

The above diagram shows the motor driver module in which the inputs are the +V and –V and outputs are the 4 terminals for the 2 motors connected to it. Rest 4 pins are the connection pins for arduino. The rest pins are the control pins which are not used in our project.

**Role in our project:**

The motor driver modules are connected to the arduino via the digital pins of the arduino which gives output in the form of 0 or 1. This output of arduino is fed to the motor driver module where the motor driver module process it and converts in the higher current and higher voltage level of at least 9v according to the DC motors connected to it.

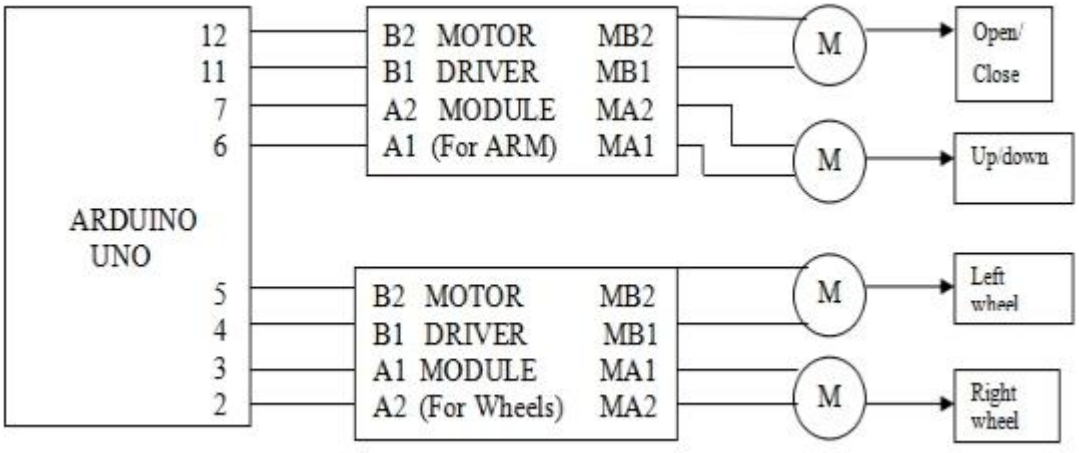


**FIG. 4.1.6: Interfacing motor driver modules and arduino**

- **IR SENSOR:**

  IR sensor or Infrared Sensor is a sensor which is used to detect the light of a specific wavelength in IR spectrum. This is basically used to detect if any obstacles are present. In this when LED emits light the sensor detects it but the sensor is set to a threshold value so that the sensor is able to differentiate between the normal input light from the LED and the light which it receives from the reflected light as the reflected light has much more intensity than the normal LED light. It has 3 pins and they are VCC , GND and OUTPUT. The operating voltage is 5v for IR sensor. When the IR sensor detects no obstacle i.e. no high intensity light which doesn't crosses the threshold value of the sensor gives the output as zero whereas when the obstacle detector detects an obstacle i.e. high intensity of light which crosses the threshold value of the sensor will give output as one. The range of IR sensor is 2-15 cm which can be varied by using the potentiometer that is present in the module.

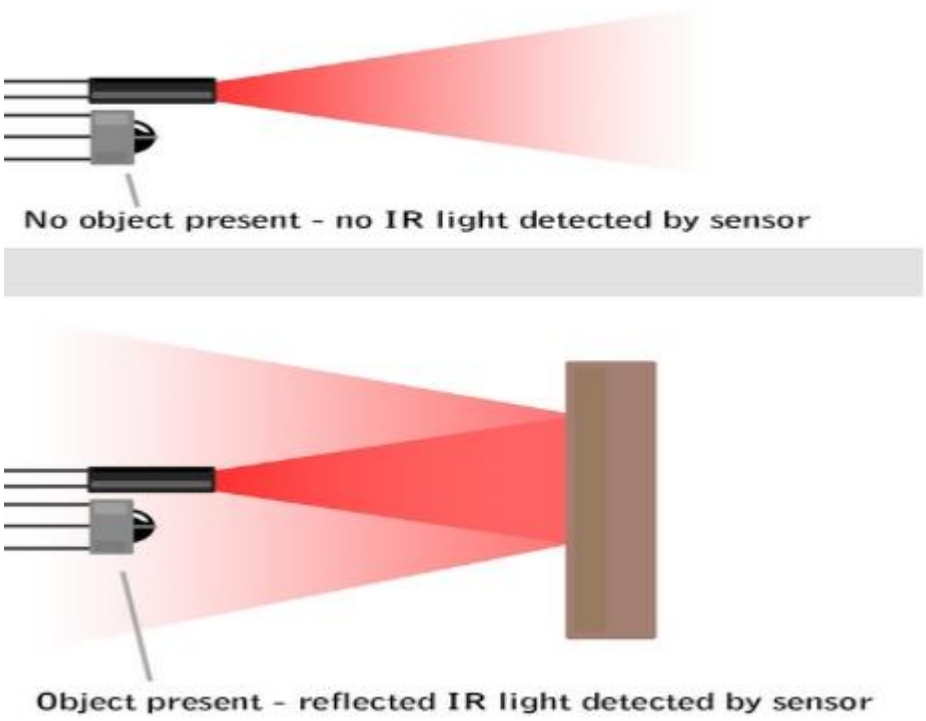


**FIG 4.1.7: Working principle of IR sensor**

**Role in our project:**

The IR sensor is connected to arduino UNO to detect if any obstacle comes in the way of robot on its movement. If the sensor detects any obstacle it first stops all

the operations and then moves a little bit backward and stops until and unless a new input is given and there is no obstacle in its way. The output is in the form of 0 or 1. These values are given to the arduino which is then processed and given to the motor driver modules to stops the motors.

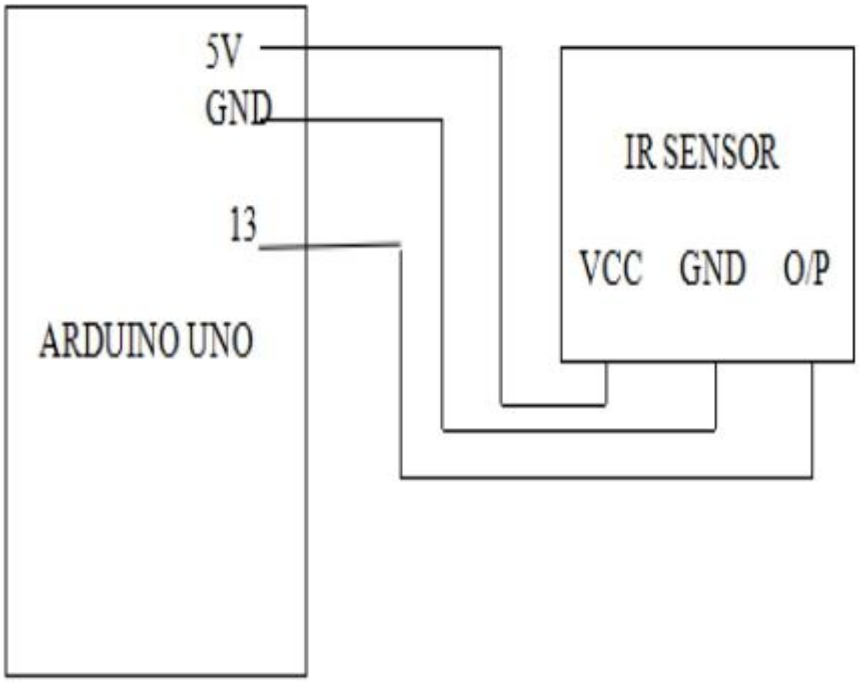


**FIG 4.1.8: Interfacing of IR sensor with Arduino**

## 4.2 WORKING

An android app is there which is having a G.U.I. showing direction arrows to move the robot and to move the arm as well. Instructions from app are transferred to Bluetooth module of ARDUINO uno after the connection of Bluetooth of android phone with the Bluetooth module interfaced with arduino is done. Bluetooth module receives the instruction and passes it to arduino, an arduino code is there inside arduino to understand the direction and to process the data which gives further instruction to the motor driver module which is controlling the d.c. motors connected to wheels as well as the arm. Obstacle detection module that is I.R. sensors is attached to arduino uno detects the obstacle and passes the instruction to arduino, which contains the code to process the instruction and passes the instruction to DC motors of wheels in order to stop the robot.

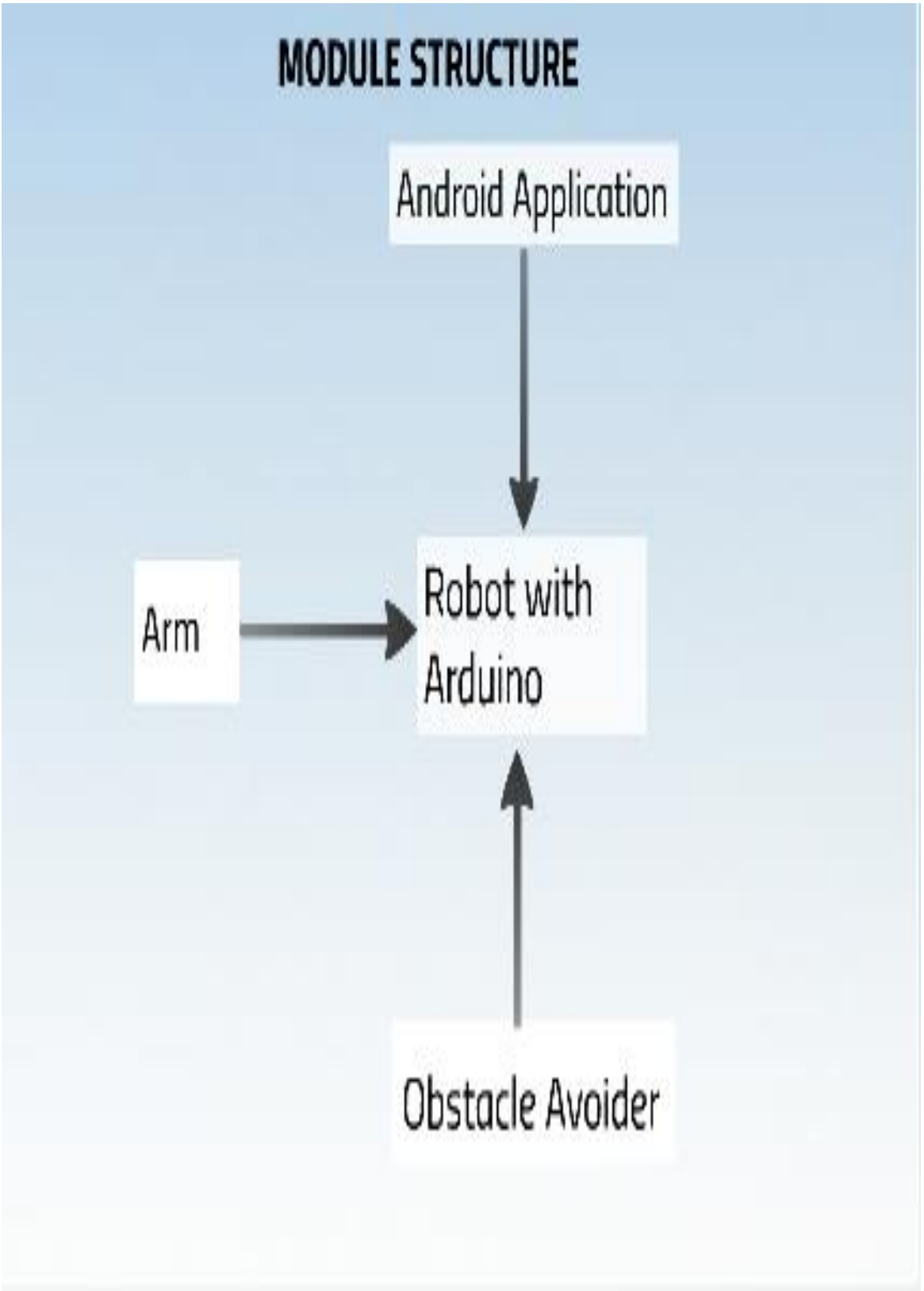


**FIG 4.2.1: Block Diagram**

### 4.2.2 Flow chart of wheel operation

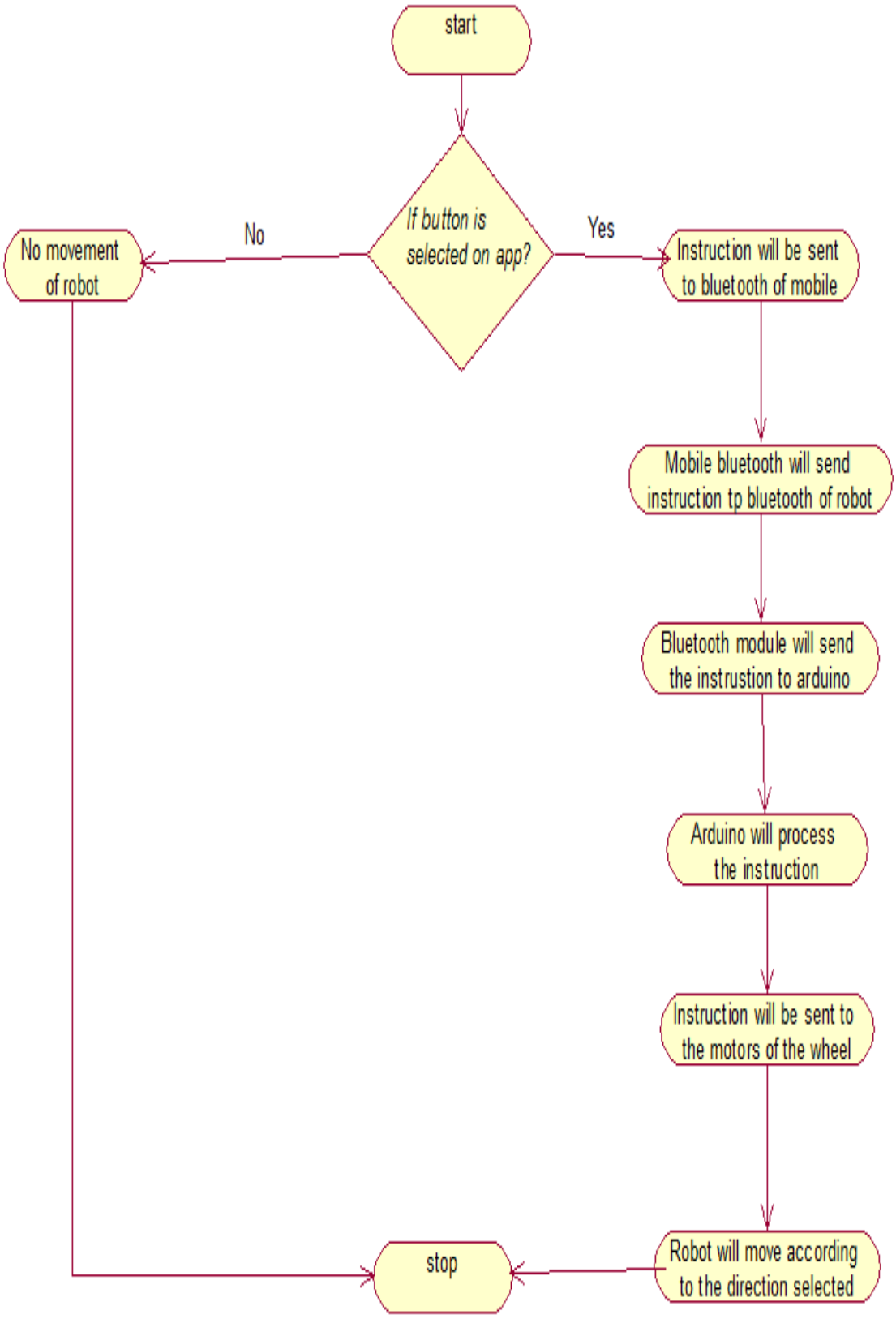


**FIG 4.2.2: Flow chart of wheel operation**

### 4.2.3 Flow chart of Hand operation

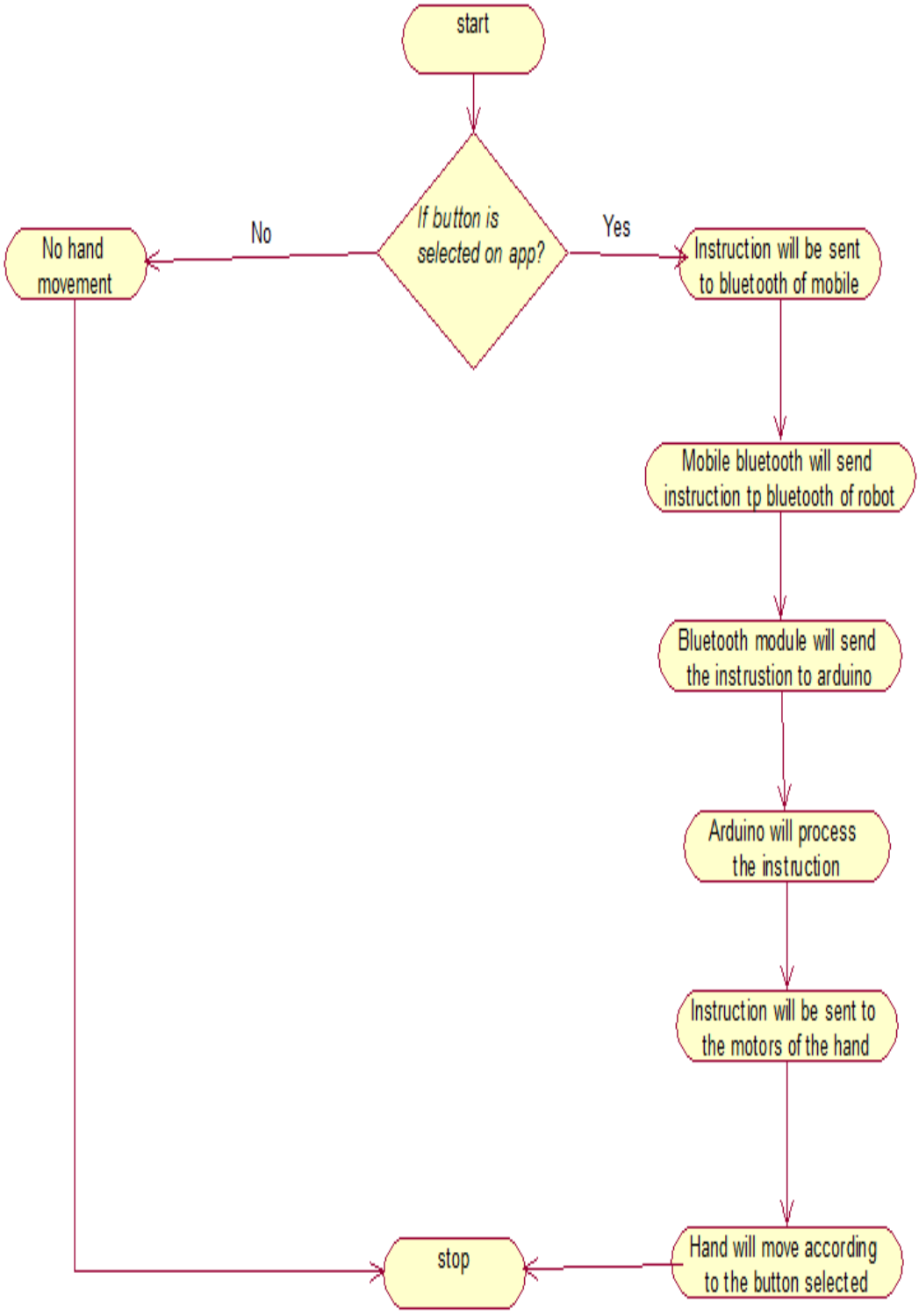


**FIG 4.2.3: Flow chart of hand operation**

### 4.2.4 Flow chart of Obstacle detection

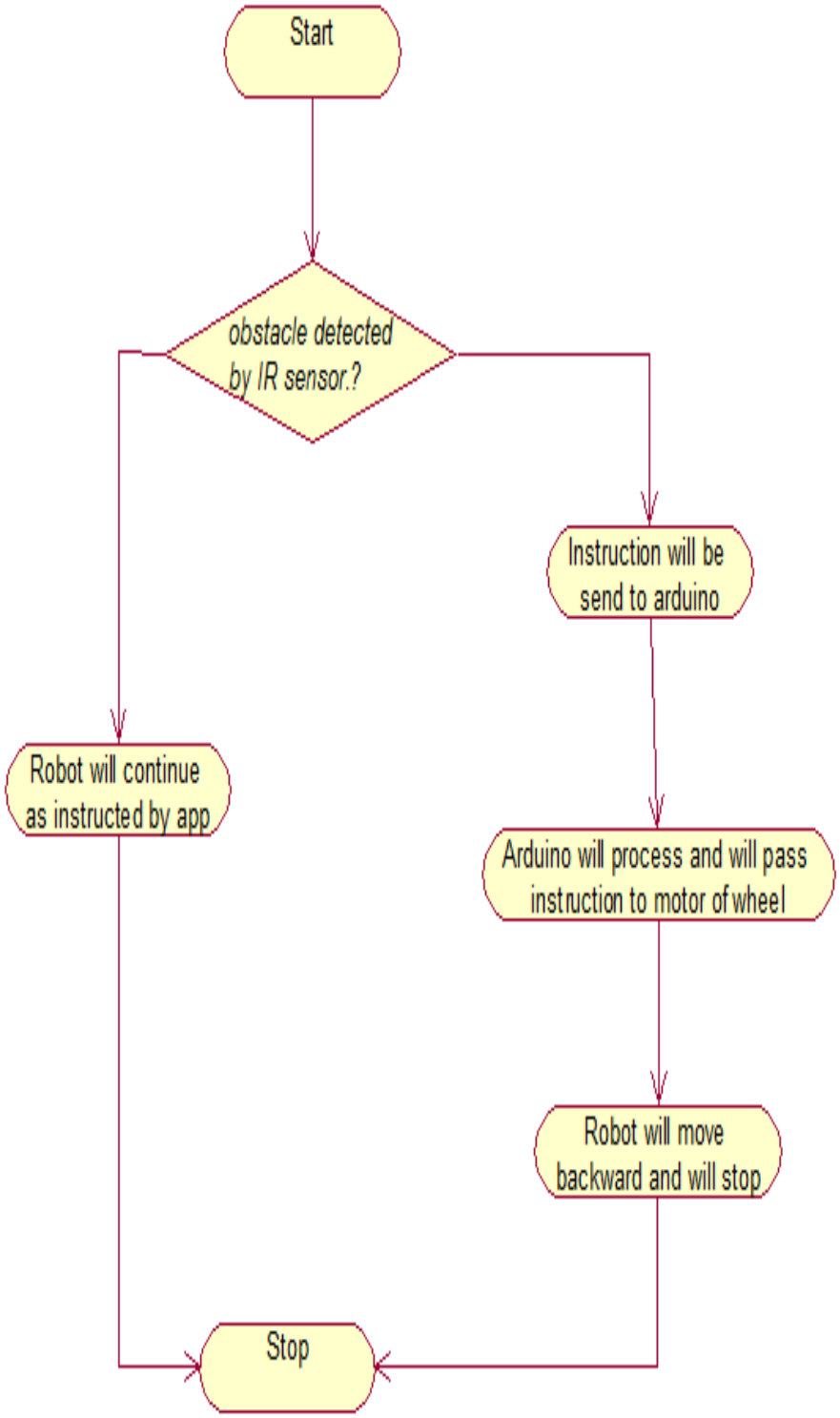


**FIG 4.2.4 : Flow chart of Obstacle detection**

## 4.3 UML DIAGRAMS

**4.3.1 Use case diagram:** The purposes of use case diagrams can be as follows:

- Used to gather requirements of a system.
- Used to get an outside view of a system.
- Identify external and internal factors influencing the system.
- Show the interacting among the requirements are actors.

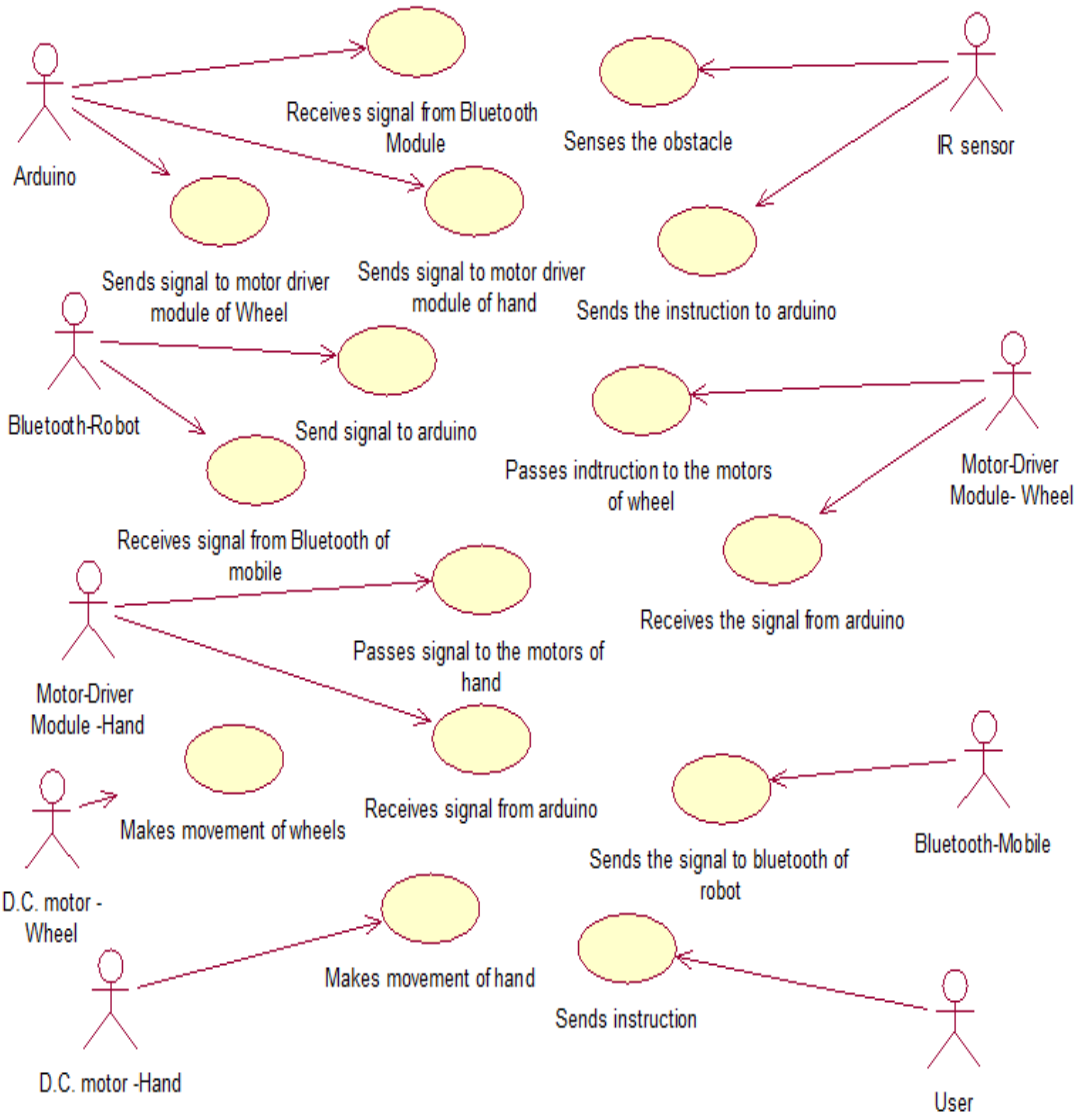

**FIG 4.3.1: Use case diagram**

**4.3.2 Class Diagram :** the purpose of the class diagram can be summarized as:

- Analysis and design of the static view of an application.
- Describe responsibilities of a system.
- Base for component and deployment diagrams.
- Forward and reverse engineering.

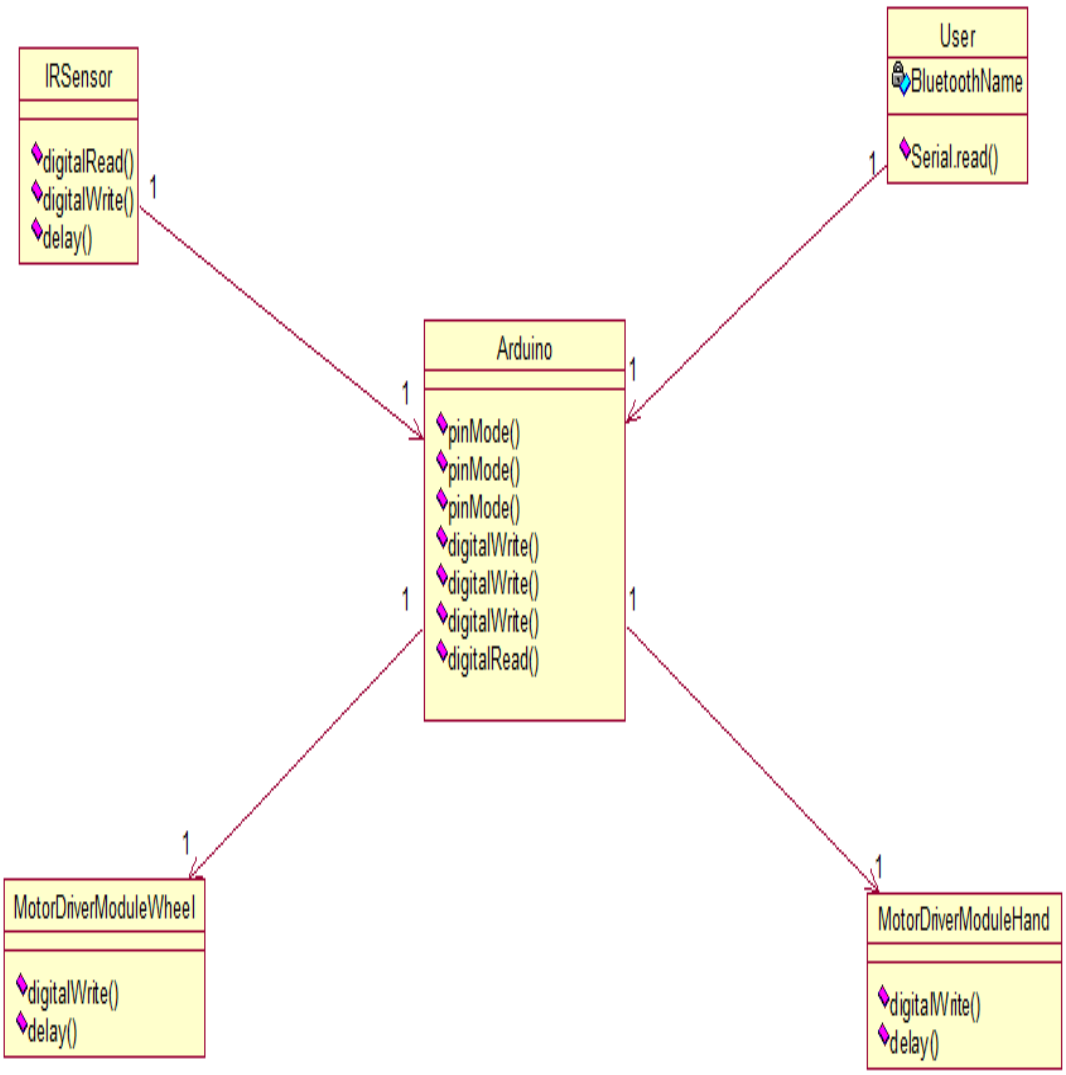


**FIG 4.3.2: Class diagram**

**4.3.3 Activity diagram :** the purposes can be described as:

- Draw the activity flow of a system.
- Describe the sequence from one activity to another.
- Describe the parallel, branched and concurrent flow of the system.

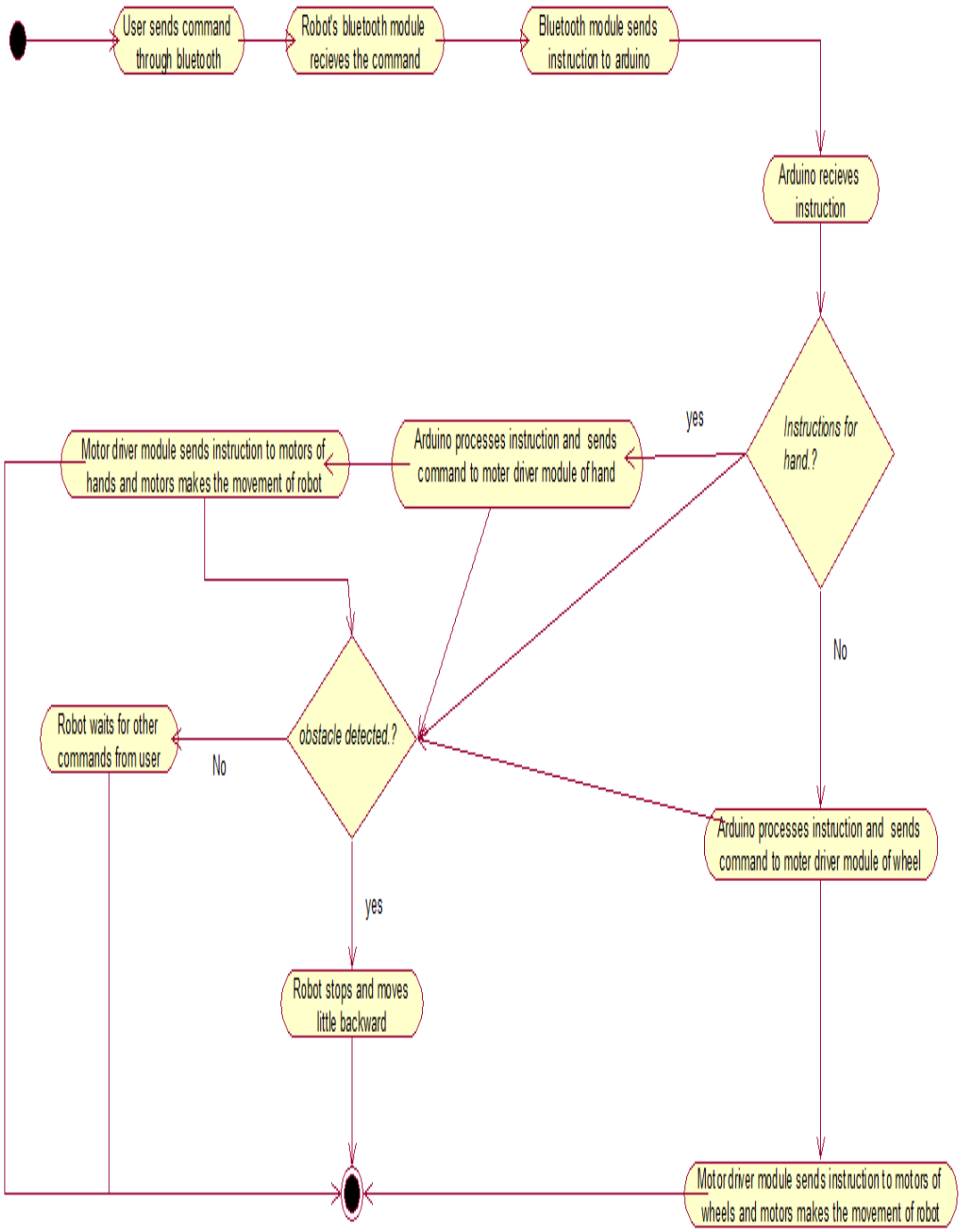


**FIG 4.3.3: Activity Diagram**

**4.3.4 Sequence Diagram:** The purposes of sequence diagram can be described as:

- To capture dynamic behaviour of a system.
- To describe the message flow in the system.
- To describe structural organization of the objects.
- To describe interaction among objects.

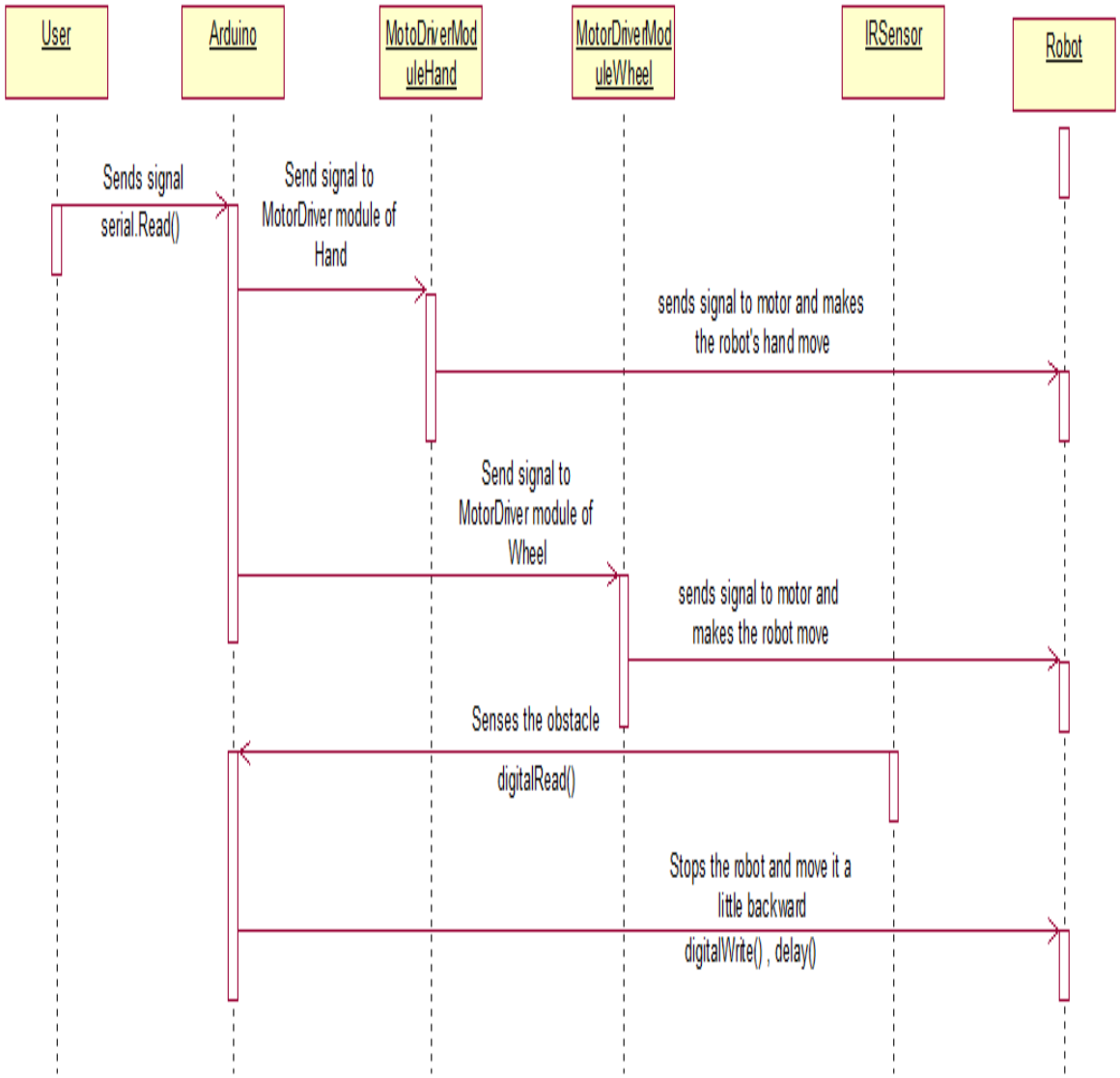


**FIG 4.3.4: Sequence Diagram**

**4.3.5 Collaboration Diagram** the purposes of collaboration diagram can be describes as:

- To capture dynamic behaviour of a system.
- To describe the message flow in the system.
- To describe structural organization of the objects.
- To describe interaction among objects.

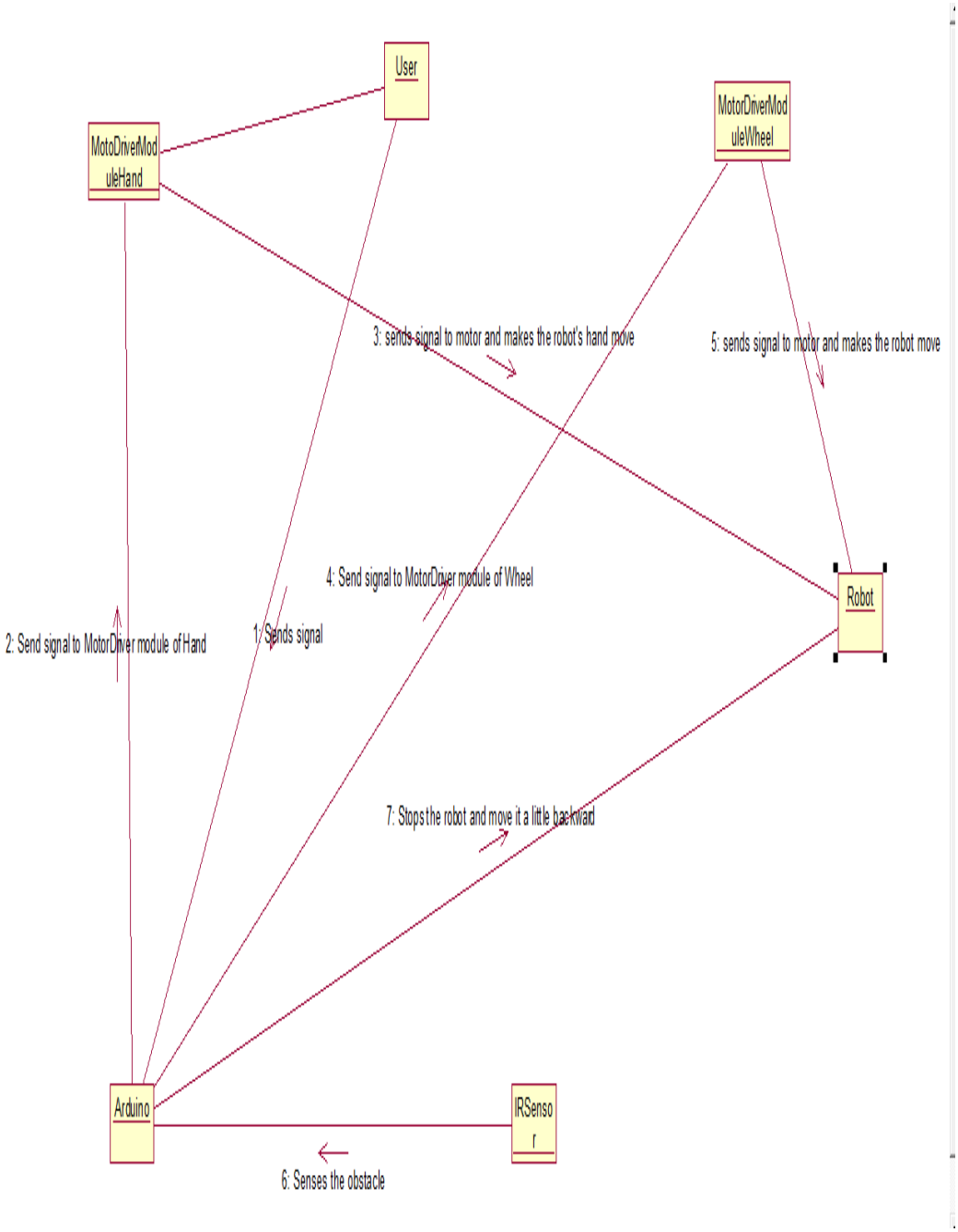


**FIG 4.3.5: Collaboration Diagram**

**4.3.6 State chart diagram:** The main purposes of using State chart diagrams:

- To model dynamic aspect of a system.
- To model life time of a reactive system.
- To describe different states of an object during its life time.
- Define a state machine to model states of an object.

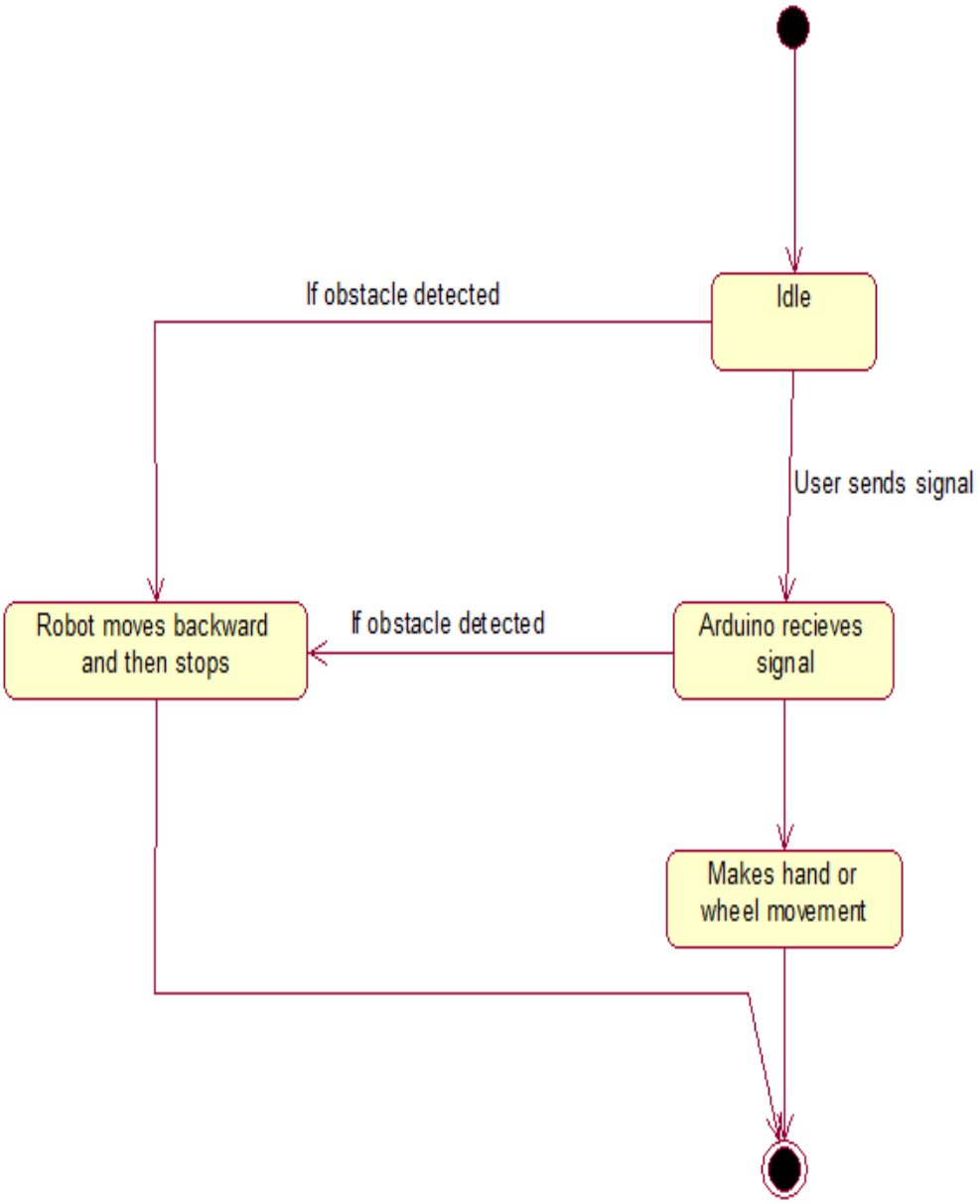


**FIG 4.3.6: State Chart Diagram**

**4.3.7 Component Diagram:** the purpose of the component diagram can be summarized as:

- Visualize the components of a system.
- Construct executables by using forward and reverse engineering.
- Describe the organization and relationships of the components.

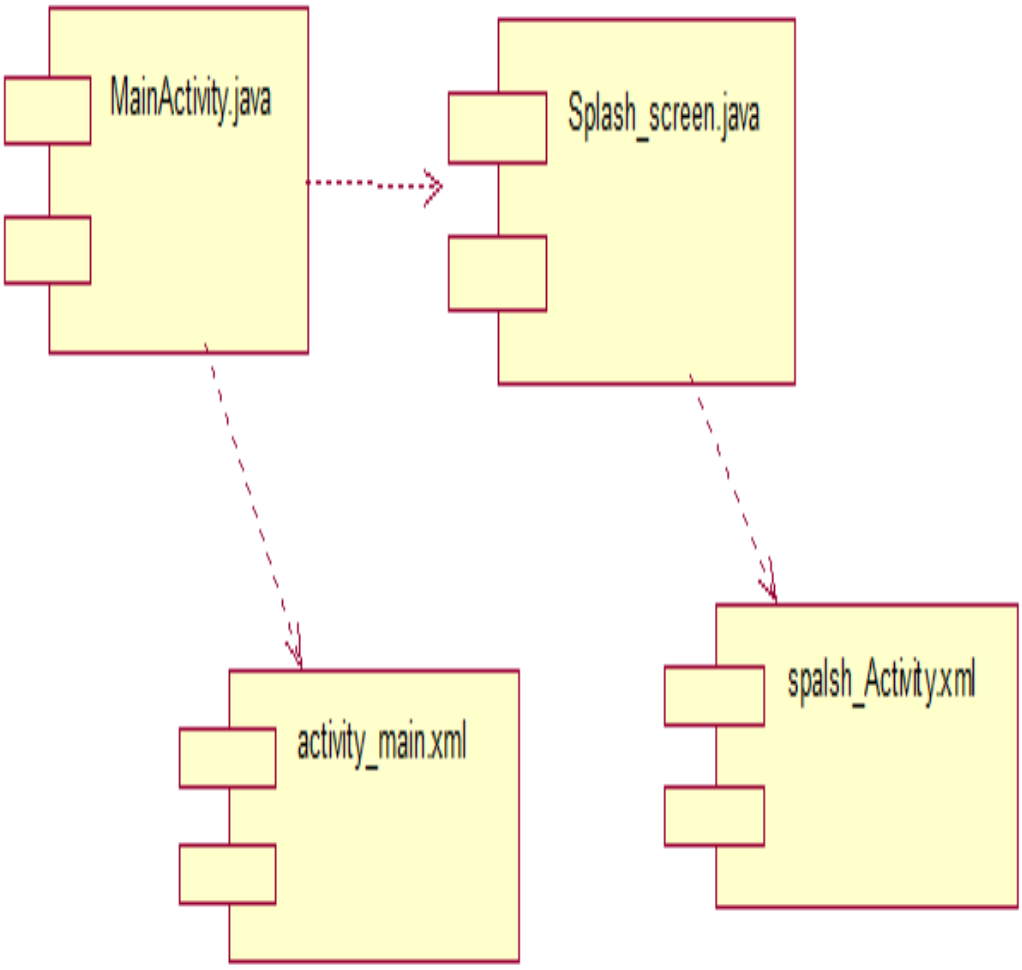


**FIG 4.3.7: Component Diagram**

**4.3.8 Deployment Diagram :** The purpose of deployment diagrams can be described as:

- Visualize hardware topology of a system.
- Describe the hardware components used to deploy software components.
- Describe runtime processing nodes.

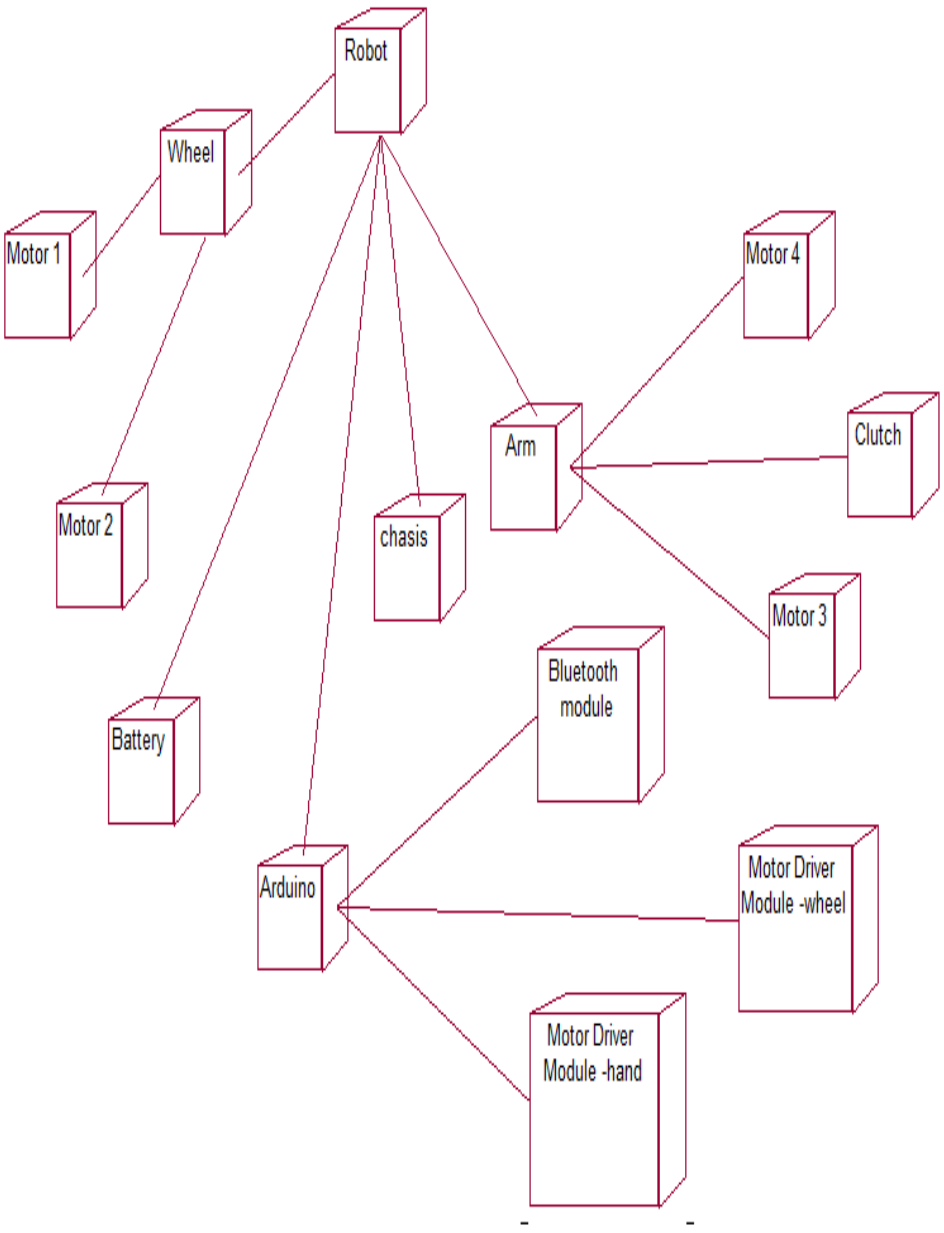


**FIG 4.3.8: Deployment Diagram**

CHAPTER : 05

# RESULT ANALYSIS:SNAPSHOTS

In android controlled robot, that is a prototype of wheelchair. A person can operate robot easily via android app, which is having directions to move robot and buttons to move arm which provides this project with the functionality of pick and place. In addition to this robot is capable enough to detect obstacle and stop automatically.

**5.1 HARDWARE:**

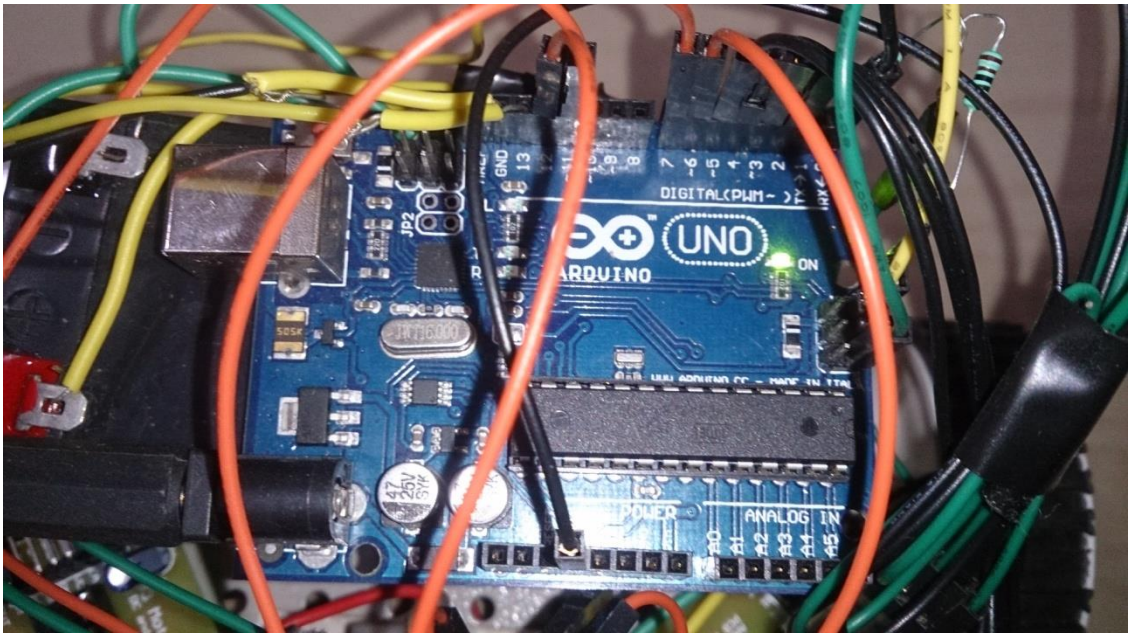


**FIG 5.1.1 : Arduino**

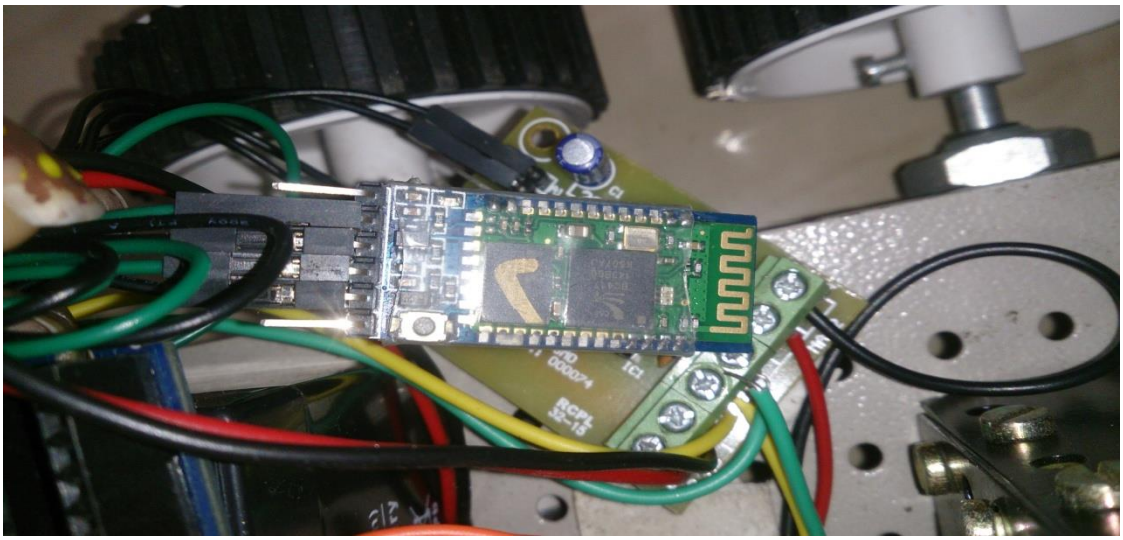

**FIG 5.1.2 : Bluetooth module**

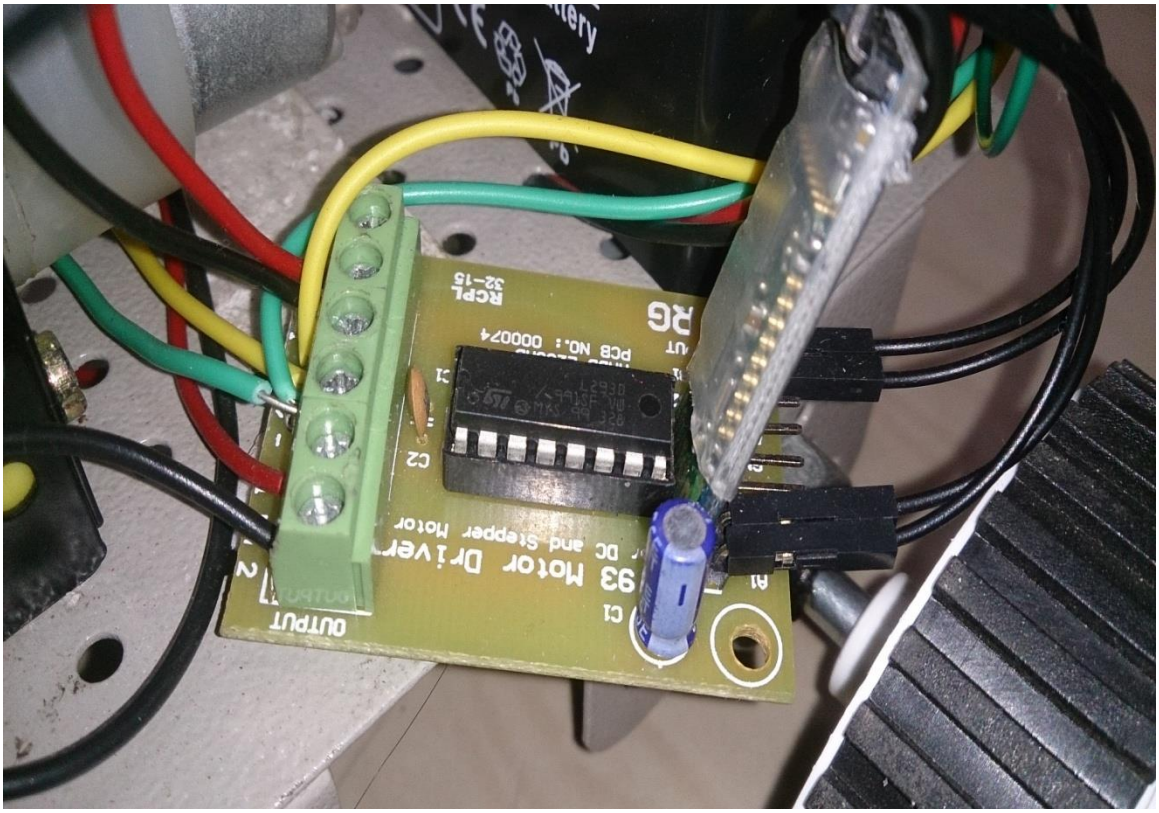


**FIG 5.1.3: Motor Driver Module**

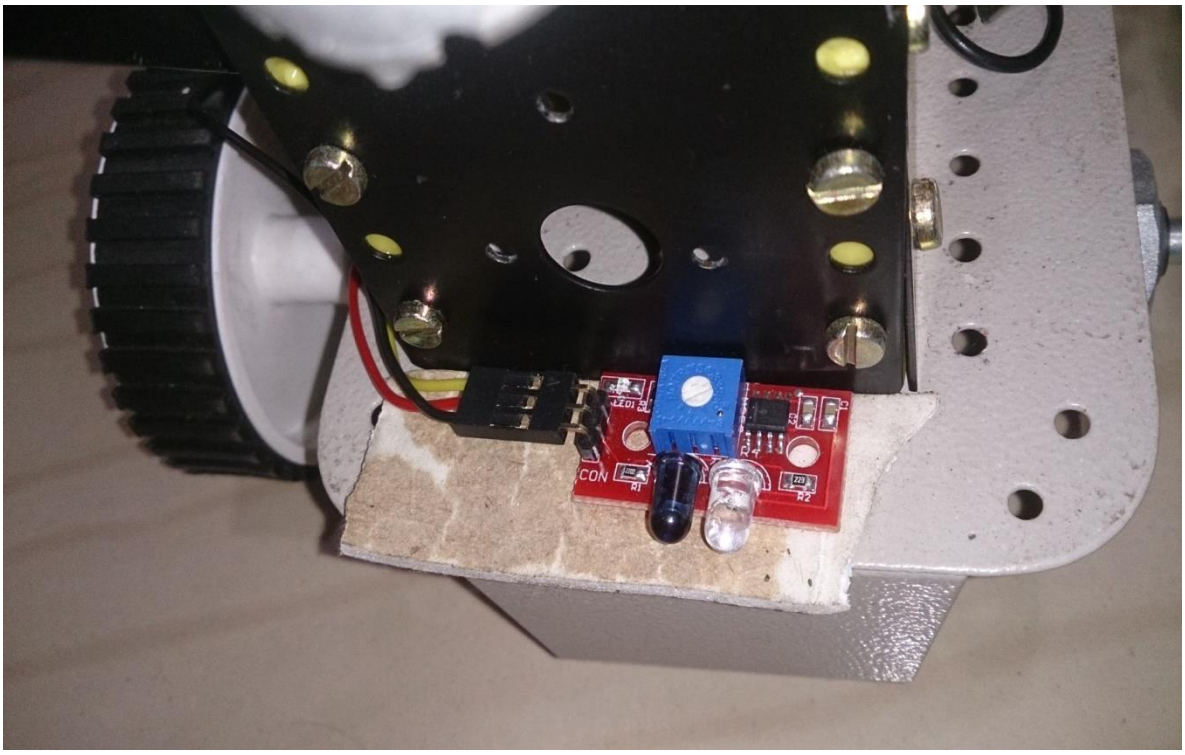

**FIG 5.1.4 : IR sensor**

**FIG 5.1.5 : Arm**

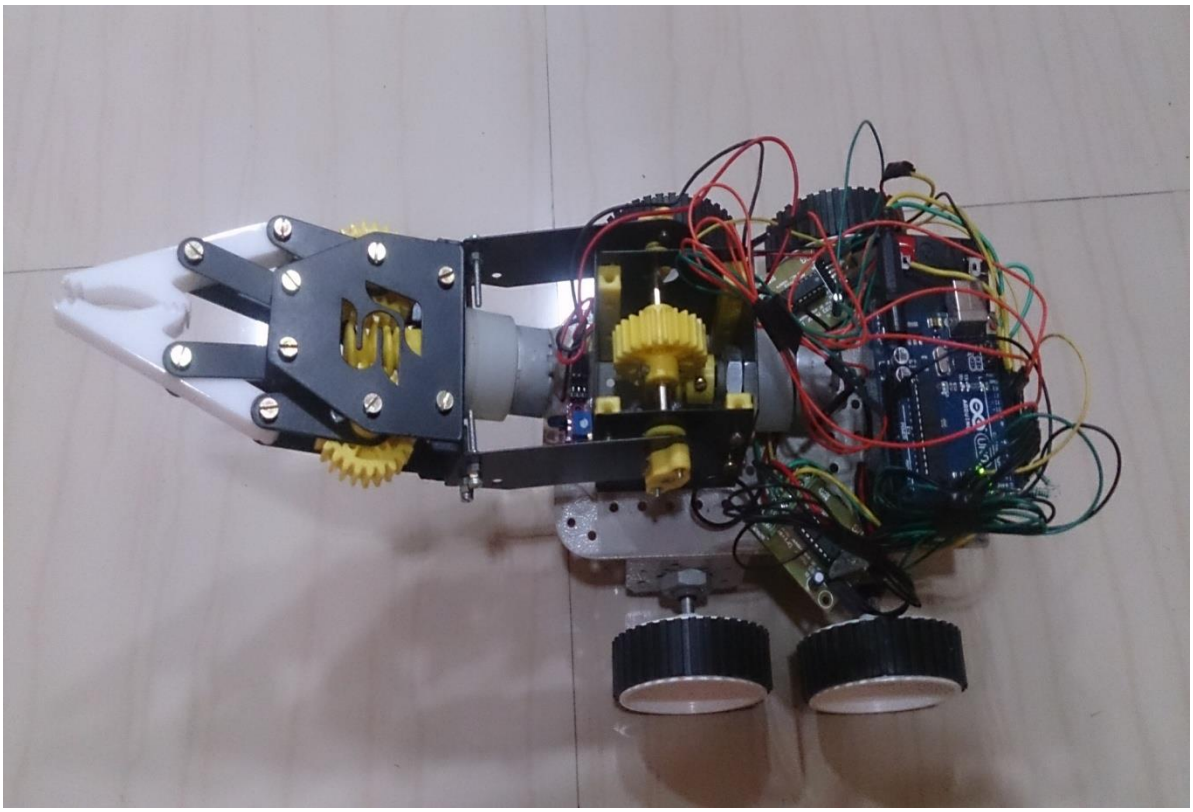

**FIG 5.1.6: Robot**

## 5.2 SOFTWARE:

### 5.2.1 App


FIG 5.2.1.1: Start

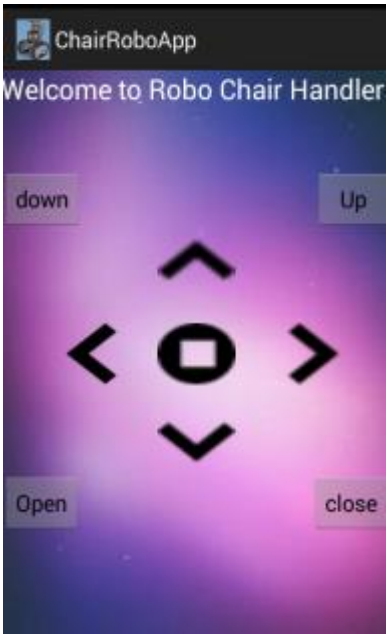


FIG 5.2.1.2: Main page

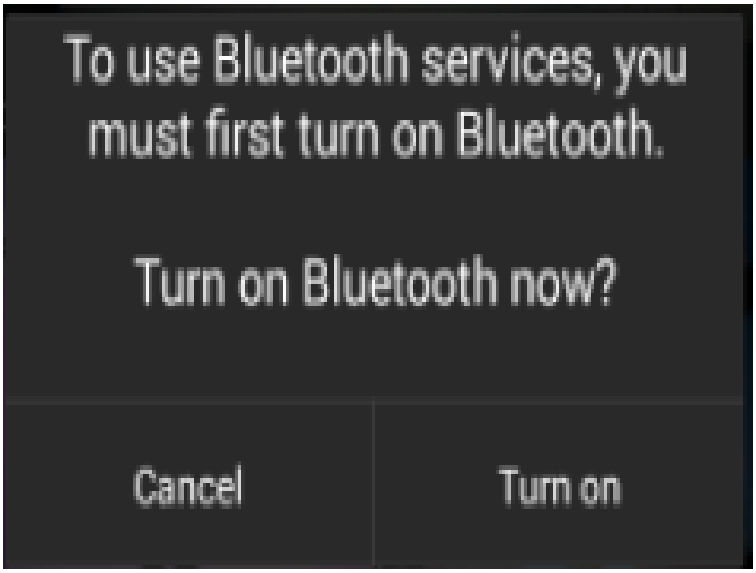


FIG 5.2.1.3 : Connect bluetooth

MainActivity.java | Splash_screen.java | ChairRoboApp Manifest | splash_activity.xml | activity_main.xml

```
 *  @version 1.1 (23.12.2015)

package com.chairrobotic.bluetoothbasedapp;

import java.io.IOException;

public class MainActivity extends Activity {
  private static final String TAG = "bluetooth1";

  Button btnOn, btnOff,up, down, left, right, frwrd, reverse,stop,opn,cls;

  private BluetoothAdapter btAdapter = null;
  private BluetoothSocket btSocket = null;
  private OutputStream outStream = null;

  // SPP UUID service
  private static final UUID MY_UUID = UUID.fromString("00001101-0000-1000-8000-00805F9B34FB");

  // MAC-address of Bluetooth module
  private static String address = "98:D3:31:40:42:B0";

  /** Called when the activity is first created. */
  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);
```

**FIG 5.2.1.4: MainActivity.java**

MainActivity.java | Splash_screen.java | ChairRoboApp Manifest | splash_activity.xml | activity_main.xml

```
package com.chairrobotic.bluetoothbasedapp;

import android.app.Activity;



public class Splash_screen extends Activity{

    // Splash screen timer
        protected void onCreate(Bundle savedInstanceState) {
            // TODO Auto-generated method stub
            super.onCreate(savedInstanceState);
            setContentView(R.layout.splash_activity);

            Thread timerThread = new Thread(){
                public void run(){
                    try{
                        sleep(3500);
                    }catch(InterruptedException e){
                        e.printStackTrace();
                    }finally{


                        Intent intent = new Intent(Splash_screen.this,MainActivity.class);
                        startActivity(intent);
                    }
                }
```

**FIG 5.2.1.5 : Splash_screen.java**

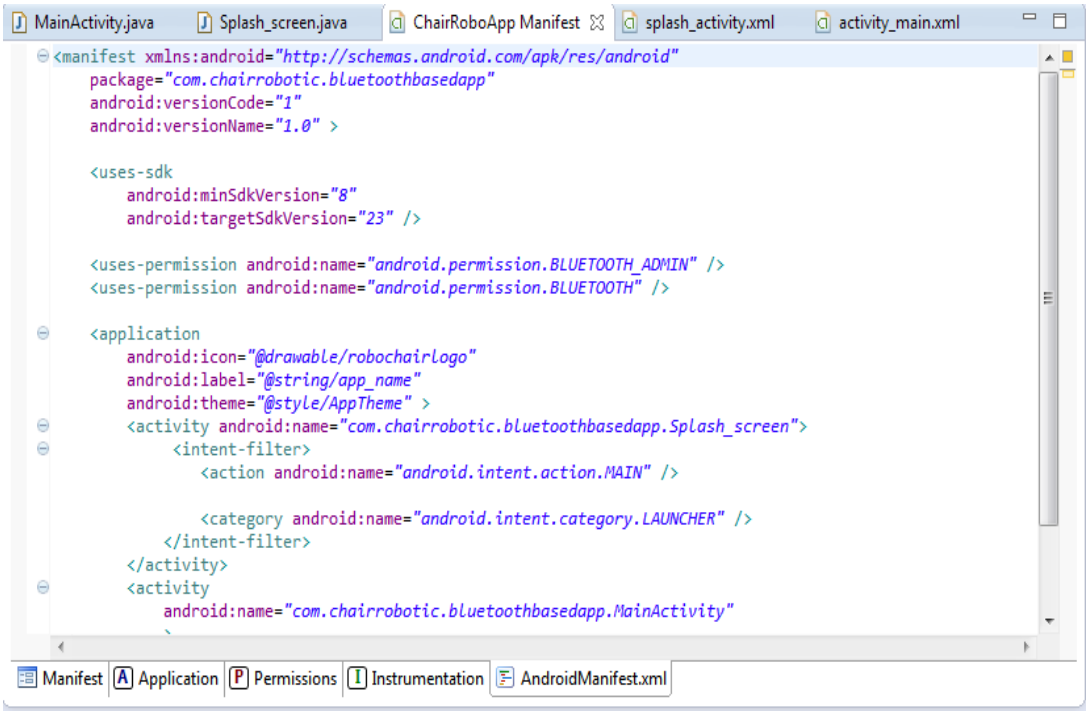


**FIG 5.2.1.6: ChairRoboApp Manifest**

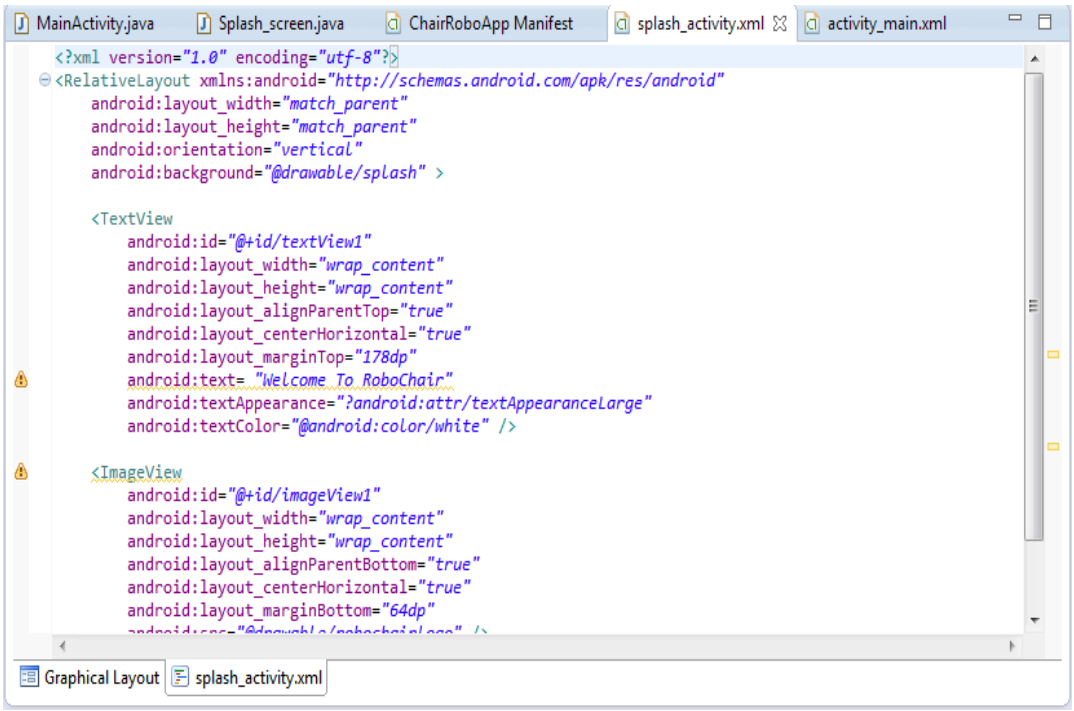


**FIG 5.2.1.7 : splash_activity.xml**


**FIG 5.2.1.8 : Activity_main.xml**

## Arduino Code

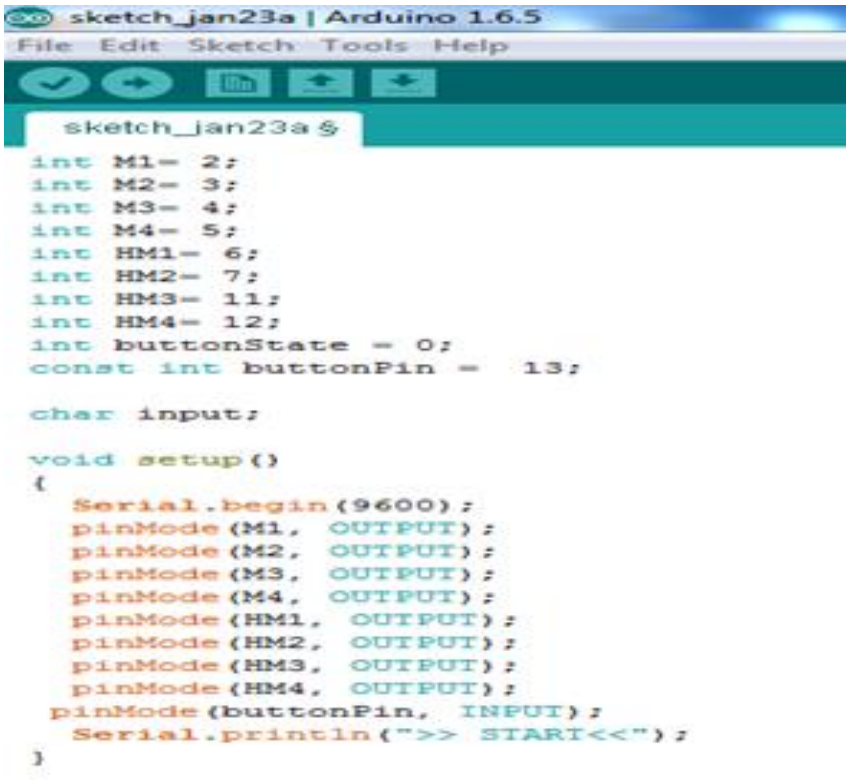


**FIG 5.2.2.1 : Initialization**

```
void loop()
{
buttonState = digitalRead(buttonPin);
  if(Serial.available()>0)
  {
    input= Serial.read();
    if(input=='2')
    {
      Serial.println("ON");
      digitalWrite(M1, HIGH);
      digitalWrite(M2, LOW);
      digitalWrite(M3, HIGH);
      digitalWrite(M4, LOW);
      delay(2);
    }
    else if(input=='8')
    {
      Serial.println("OFF");
      digitalWrite(M1, LOW);
      digitalWrite(M2, HIGH);
      digitalWrite(M3, LOW);
      digitalWrite(M4, HIGH);
      delay(2);
    }
```

**FIG 5.2.2.2: Initial States**

```
else if(buttonState == HIGH)
 {
   Serial.println("NO INPUT");
   Serial.println(input);
     digitalWrite(M1, LOW);
   digitalWrite(M2, HIGH);
   digitalWrite(M3, LOW);
   digitalWrite(M4, HIGH);
   digitalWrite(HM1, LOW);
   digitalWrite(HM2, LOW);
   digitalWrite(HM3, LOW);
   digitalWrite(HM4, LOW);
   delay(500);
   digitalWrite(M1, LOW);
   digitalWrite(M2, LOW);
   digitalWrite(M3, LOW);
   digitalWrite(M4, LOW);
}
```

**FIG 5.2.2.3 : Output states**

CHAPTER : 06

# TESTING

This document describes the plan for testing the modules of software as well as hardware as our project is integration of hardware as well as software, so for each module testing is performed. All major testing activities are specified here and additional testing may be performed later if necessary.

## 6.1 SOFTWARE TESTING

In software part, we have 2 parts to test that is one is to test app and second is to test arduino code as well as android code.

To test app we will use mobile application testing method and to test code we will use unit testing for which we will divide code into test cases.

### 6.1.1 Testing of app :-

In app we have G.U.I. asking for starting the bluetooth ,having two options first is turn on and second is cancel then we have arrows for directions for moving the robot and buttons for moving the arm of a robot. So app is tested by mobile application testing.

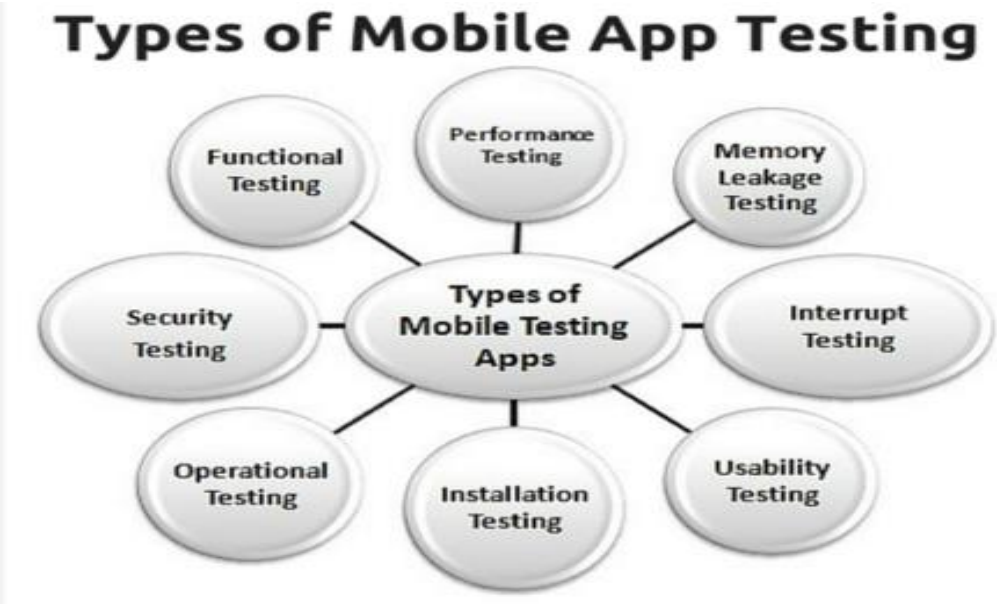


**FIG 6.1: Types of mobile testing app**

**Mobile application testing** is a process by which application software developed for hand held mobile devices is tested for its functionality, usability and consistency. Mobile application testing can be automated or manual type of testing. Mobile applications either come pre-installed or can be installed from mobile software distribution platforms.

There are various types of mobile application testing that is performed on our app:-

## I. Functional Testing:-

Functional testing performs on the functional behavior of the application to ensures that the application is working as per the requirements. In this project, functions of application are tested that whether directions and buttons are performing their tasks or not. Result of functional testing are:-

- Forward, backward, right, left directions when tapped are working accordingly.
- Open, close, up, down buttons when pressed are moving the arms in the required directions.
- Stop button when tapped, is stopping the robot.

## II. Performance Testing :

The testing process is carried out by tester to test the performance and actions of the applications that pass through various mobile device challenges like; low battery power due to heavy battery uses, network out of coverage area/poor bandwidth/changing internet connection mode (2G, 3G, or WiFi)/changing broadband connection, transferring heavy file, less memory, concurrent approach to the application's server by various users, etc. In this project testing is done to ensure the performance of app, that is to test app in various critical condition like low battery, direction limitation ,changing internet connections, so results of this testing on our application are:-

- App is still working when battery is 4%.
- App is working when distance between bluetooth module and mobile is maximum 10 meters.

- No change on performance of application is there due to changing of internet connections.

**III. Memory Leakage Testing:**

Memory leakage is one of the bad issues of the mobile application testing that directly affect on performance of the mobile devices. Due to memory leakage, process might slow down while transferring the file or in-between accessing any application mobile device might switch off automatically. That is to have an app with minimum memory is important to avoid memory leakage, so result of this testing on our application is:-

- Application is of 824 K.B. Because of which negligible memory is consumed and so performance is increased.

**IV. Interrupt Testing:**

Interrupt testing is a process of testing a mobile application that functions may get interrupted while using the application. Those interruptions can be; incoming and outgoing SMS incoming notifications, battery/cable insertion and removal for better uses, network outage and recovery, switch off/switch on of the media player and other connecting devices, Low memory warning, and device power cycle(like; low battery notification).results of this testing on our application are:-

- Application works efficiently even when an incoming message is there.
- There is no change on the working of application even when a notification arrives.
- No changes on application of insertion or removal of cables.
- Application does not stop working even when battery is low or phone is fully switched off.
- No changes on working of application while phone is on airplane mode

**V. Usability testing:**

Usability testing is used to test the mobile applications in terms of usability, flexibility, and friendliness. The testing process makes sure that the mobile app is now easy to

use and offers a suitable user experience to the customers. Results of this testing on our project are:-

- Due to direction arrows it is easy for user to predict that which arrow is for which kind of movement
- Due to buttons and label on buttons it is easy for user to use it.

**VI. Installation testing:**

Installation testing is used to test the particular application is installing, uninstalling, and updating properly without any interruption (user is smoothly and flexibly installing the application). Results of this testing on our project are :-

- It's easy for user to install it, as he/she just have to copy or receive .apk file and after that just have to click on INSTALL button
- It's easy for user to uninstall it, by just clicking on setting buttons --> apps --> phone storage/sd card --> app and then click uninstall button to uninstall it
- It's easy to even update the file as updation can be performed on laptop and then .apk file can be transferred to phone.

**VII. Operational testing:**

Any mobile OS and desktop OS provides in-built back-up and recovery operational functions that save or recover all files or doc of mobile devices or applications that had been lost due to some reason. Operational testing is used to test that the particular back-up and recovery process is working properly and responding as per the requirement. Results of this testing on our project are :-

- Our project do not require backup facility, but even if it is needed it can be easily performed by backup and restore app which is already there on phone by default.

**VIII. Security Testing:**

The purpose of security testing to test the application's data and network security to check the application's data and network security is responding as per the given requirement/guideline. Results of this testing on our project are :-

- App is secure as .apk file is not accessible by every user.
- Data which is transferred between bluetooth and arduino is converted into ASCII code which is not understandable by a normal user.
- Also app is locked by applock app, not to be used by any user

### 6.1.2. Testing of code

When input is received by arduino, arduino has predefined code to process the input and to produce results accordingly that is if a person tapped a forward button, it is sent by bluetooth to the bluetooth module and then to arduino. Arduino has code that will check value and then it is processed accordingly and instructions are sent to wheels to move in forward direction. Same is for hand movement also arduino code is having code for obstacle detection.

**Unit testing** is a type of testing that is performed by software developers. Unit testing follows white box testing approach where developer will test units of source code like statements, branches, functions, methods OR class, interface in OOP (object oriented programming).
Unit testing usually involves in developing stubs and drivers. Unit tests are ideal candidates for automation. Automated tests can run as Unit regression tests on new builds or new versions of the software.

#### 6.1.2.1 Unit testing for arduino code:-

In our project arduino code is tested before uploading it into arduino uno.
There is only one module for this code; we divided arduino uno into 2 units, in which division was in the basis of functions.

**TEST CASE 1**

Void setup: This method is tested separately by adding this method into another code and it worked correctly.

**TEST CASE 2**

Void loop: This method contains if else loop specifying that if various types of inputs are given then how output will get generated.
Pins of arduino uno are predefined and for various inputs, various outputs are generated, and so error rate is reduced.

**6.1.2.2 Unit testing for android code:-**

Android code is divided into different modules or we can say different test cases that are:-

**MODULE 1**

Main Activity.java file : Exception handling packages are imported that specifies that if any other input is given then how to treat that. Test cases for this file are:-

**TEST CASE 1**

If connection is not established than it throws exception that is “Could not create insecure connection”.

**TEST CASE 2**

If power on arduino is not there or due to any other mishap if bluetooth connection is not established than there is one exception handling method which throws error “Fatal Error”, same exception is there for each method.

**6.2 HARDWARE TESTING**

Various components of hardware are tested individually
1. Arduino Uno: It is checked by connecting it to laptop by USB Cable, if detected and green light is glowing on arduino uno then it’s working.

2. Bluetooth module: When bluetooth module is not connected with any of the component then it blinks frequently but when it is connected then blinking rate is reduced.

3. Motor driver module: We can check it by multimeter.

4. Battery : We can check it by multimeter.

5. IR Sensor : after all connections with arduino, if a light is blinking then IR sensor is working properly.

6. D.C. Motors: It is tested by giving positive and negative terminals on both the motors and then if it moves, then DC Motor is working.

Integrating all components and after making proper connection, robot can be tested by giving proper inputs and by checking that whether robot is moving according to directions or buttons specified or not.

CHAPTER : 07

# CONCLUSION & FUTURE WORK

## CONCLUSION

In this report , the prototype of wheelchair that is an android controlled robot and its working is presented .The key features of the project are that it is controlled by an app, it is having a functionality of pick and place and obstacle detection. It is found that this project is having better design as it will use processing power of android phone which will make it's functioning faster and is very much helpful for handicapped people as well as paralyzed people also it is cost effective.

We have developed a prototype of wheelchair, which is controlled by an android app and which has integrated functionalities into it like:-

Pick and place functionality to help paralyzed people to get the things kept nearby them.

Obstacle detection functionality which helps them from getting hurt.

Also our project is cost effective.

## FUTURE WORK

Artificial intelligence can be used so that the dependency on the another person is totally diminished that is the wheelchair traces it's on path by different algorithms

Different algorithms which will give minimum distance from source to destination can be used.

More advance sensors can be used for avoiding the obstacles including the stairs, pits or edges of the surface.

## REFERENCES

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[2] Prathyusha, M., K. S. Roy, and Mahaboob Ali Shaik. "Voice and touch screen based direction and speed control of wheel chair for physically challenged using arduino." *International Journal of Engineering Trends and Technology (IJETT)* 4.4 (2013)

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