

**Visvesvaraya Technological University**  
**Belgaum, Karnataka-590 018**



*A Project Report on*

**“Designing of a wireless gesture-controlled robot”**

*Project Report submitted in partial fulfillment of the requirement for the  
award of the degree of*

**Bachelor of Engineering**  
**In**  
**Electrical & Electronics Engineering**

*Submitted by*

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**2020-2021**

**CMR INSTITUTE OF TECHNOLOGY**  
**DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING**  
**AECS Layout, Bengaluru-560 037**



## Certificate

Certified that the project work entitled “**Designing of a wireless gesture controlled robot**” carried out by Mr. Gaurish Ninnekar,(**1CR16EE026**); Mr. Kumar Shubham, (**1CR15EE043**); Mr. Abhishek Kumar,(**1CR16EE002**) are bonafied students of CMR Institute of Technology, Bengaluru, in partial fulfillment for the award of Bachelor of Engineering in Electrical & Electronics Engineering of the Visvesvaraya Technological University, Belgaum, during the year 2020-2021. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library.

The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said Degree.

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**DECLARATION**

We, Mr. Gaurish Ninnekar (**1CR16EE026**); Mr.. Kumar Shubham (**1CR15EE043**); Mr. Abhishek Kumar (**1CR16EE002**) hereby declare that the report entitled “**Designing of a wireless gesture controlled robot**” has been carried out by us under the guidance of **ANJU DAS, Assistant professor** , Department of Electrical & Electronics Engineering, CMR Institute of Technology, Bengaluru, in partial fulfillment of the requirement for the degree of **BACHELOR OF ENGINEERING in ELECTRICAL & ELECTRONICS ENGINEERING**, of Visveswaraya Technological University, Belagaum during the academic year 2020-21. The work done in this report is original and it has not been submitted for any other degree in any university.

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# Abstract

Gesture Controlled Car is a robot which can be controlled by simple human gestures. The user just needs to wear a gesture device in which a sensor is included. The sensor will record the movement of hand in a specific direction which will result in the motion of the robot in the respective directions. The robot and the Gesture instrument are connected wirelessly through radio waves. User can interact with the robot in a more friendly way due to the wireless communication. We can control the car using accelerometer sensors connected to a hand glove. The sensors are intended to replace the remote control that is generally used to run the car. It will allow user to control the forward, backward, leftward and rightward movements, while using the same accelerometer sensor to control the throttle of the car. Movement of car is controlled by the differential mechanism. The mechanism involves the rotation of both forth & rear wheels of left or right side to move in the anticlockwise direction and the other pair to rotate in the clockwise direction which makes the car to rotate about its own axis without any kind of forward or backward motion. The main advantage of this mechanism is the car with this mechanism can take sharp turn without any difficulty. The design and implementation of a gesture control robotic arm using flex sensor is proposed. The robotic arm is designed in such a way that it consists of four movable fingers, each with three linkages, an opposing thumb, a rotating wrist and an elbow. The robotic arm is made to imitate the human hand movements using a hand glove.

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*The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of people, who are responsible for the completion of the project and who made it possible, because success is outcome of hard work and perseverance, but steady fast of all is encouraging guidance. So with gratitude we acknowledge all those whose guidance and encouragement served us to motivate towards the success of the project work.*

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# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

Hand gesture recognition system received great attention in the recent few years because of its manifoldness applications and the ability to interact with machine efficiently through human computer interaction.

Gesture recognition is a supportive requirement of disables and many other robotics works. So, the researchers and companies try to implement an algorithm and make some gradates in this purpose.

Hand gesture recognition is used in human-robot interaction (HRI) to create user interfaces that are natural to use and easy to learn. Sensors used for hand gesture recognition include wearable sensors such as data gloves and external sensors such as video cameras. Data gloves can provide accurate measurements of hand pose and movement, but they require extensive calibration, restrict natural hand movement, and are often very expensive. Video-based gesture recognition addresses these issues but presents a new problem: locating the hands and segmenting them from the background in an image sequence is a non-trivial task, in particular when there are occlusions, lighting changes, rapid motion, or other skin-colored objects in a scene. Depth images, either sensed directly with depth cameras such as the Microsoft Kinect, ASUS Xtion, or Mesa Swiss Ranger, or extracted from stereo video cameras, provide an alternative as they can function in several situations where video cameras cannot, such as in low or unpredictable lighting, and in environments with skin colored objects other than the hands (such as a face). However, there is no comprehensive study of the state of practice, such as reported in Watch's for applications of video-based hand gestures.



## 1.2 Background

Microcontroller Based Gesture Recognition and Angle Measurement without image processing involves 9dof Accelerometer gyroscope magnetometer. Which can measure the X and Y axes rotation and acceleration. The project was composed of main electronics circuits and electronic components such as:

- ❖ Arduino Uno
- ❖ L293D Motor Controller Driver
- ❖ DC motor
- ❖ 433khz Wireless Radio transmitter and receiver.
- ❖ The system can give you both the angle and gesture of forward, backward, right and left.

## 1.3 Goals and Objective

- ❖ Measure the hand gesture
- ❖ Identify the movement direction
- ❖ Encode the gesture data and send via RF transmitter
- ❖ Receive via RF transmitter and decode.
- ❖ Move the robot with decoded data.

## CHAPTER 2

### Literature Review

#### 2.1 Issues to Hand Gesture Recognition: Extraction Methods And Features

##### Extraction:

Most of the researchers classified gesture recognition system into mainly three steps after Acquiring the input image from camera(s), videos or even data glove instrumented device. These Steps are: extraction method, features estimation and extraction, and classification or recognition ss illustrated in figure 1

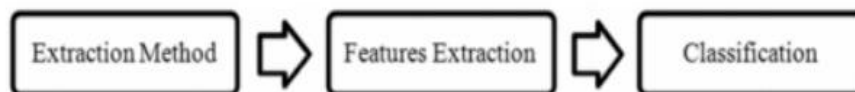


Figure 2.1: Gesture recognition system steps.

#### 2.2 Extraction Method And Image Pre-Processing:

Though we have not used image processing here, this section describes the hand gesture recognition with image processing. Segmentation process is the first process for recognizing hand gestures. It is the process of dividing the input image (in this case hand gesture image) into regions separated by boundaries. The segmentation process depends on the type of gesture, if it is dynamic gesture then the hand gesture need to be located and tracked, if it is static gesture (posture) the input image have to be segmented only. The hand should be located firstly, generally a bounding box is used to specify the depending on the skin color and secondly, the hand have to be tracked, for tracking the hand there are two main approaches; either the video is divided into frames and each frame have to be processed alone, in this case the hand frame is treated as a posture and segmented, or using some tracking information such as shape, skin color using some tools such as Kalman filter The common helpful cue used for segmenting the hand is the skin color , since it is easy and invariant to scale, translation, and rotation changes. Different tools and methods used skin and non-skin pixels to model the hand. These methods

are parametric and non-parametric techniques, Gaussian Model (GM) and Gaussian Mixture Model (GMM) are parametric techniques, and histogram based techniques are nonparametric.

Rafiqul Zaman Khan and Noor Adnan Ibraheem of the Department of Computer Science, A.M.U. Aligarh, India, in the International Journal of Intelligence and Artificial Applications (IJAIA) in July 2012 proposed hand signal recognition: a survey of writing. They said the hand motion recognition framework had an amazing consideration in the couple of years because of their complex applications and the ability to interact with the machine effectively through human collaboration with the PC. They showed a review of the frames of recognition of last-minute movements. The key issues of the hand signal recognition framework are given the difficulties of the structure of the movement.

Stefan Waldherr, Roseli Romero, Sebastian Thrun represents a movement interface for controlling a versatile robot with a controller. The interface uses a camera to follow a man and perceive signals that include arm movement. Subsequent and rapid calculation allows the robot to trace and reliably complete a man in office situations with varying lighting conditions.

## CHAPTER 3

### METHODOLOGY

#### 3.1 Full System Design:

The system methodology is described in the below mentioned block diagram Figure 2.

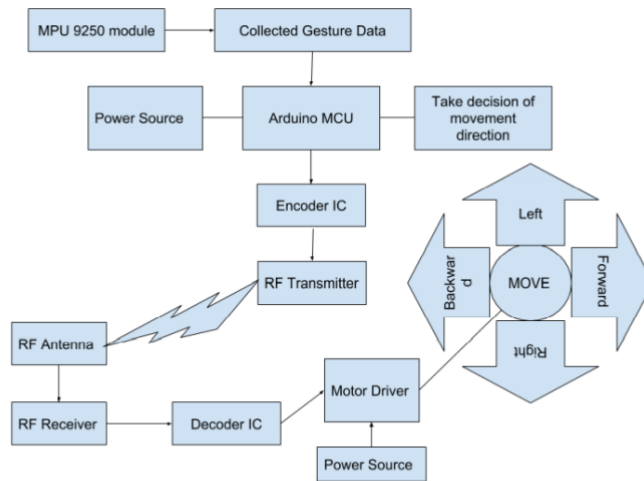


Figure 3.1: Gesture controlled robot block diagram

#### 3.2 Receiver Circuit Diagram:

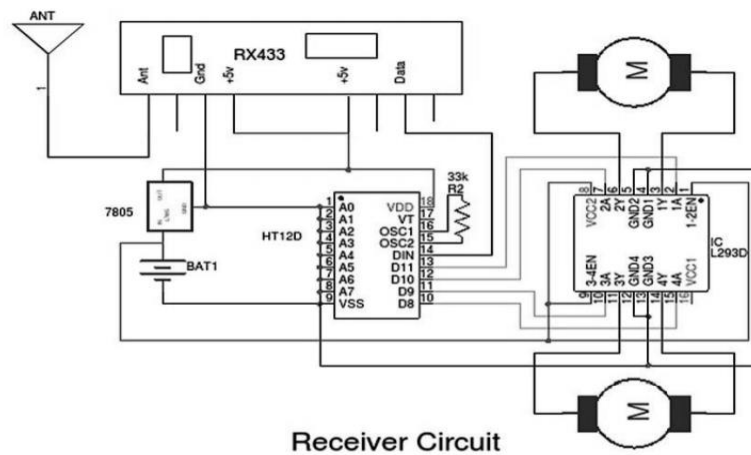
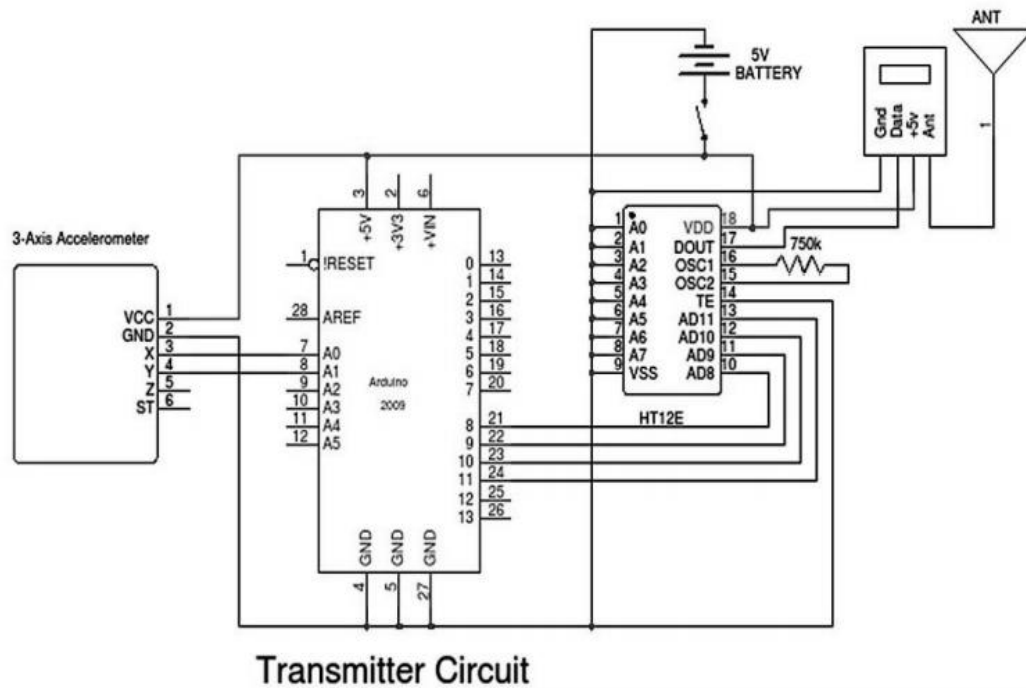


Figure 3.3: Receiver Circuit Diagram:

### 3.3 Transmitter Circuit Diagram:



### 3.4 System Algorithm:

The full system follows the following algorithm:

1. Sensed the hand gesture movement from hand to microcontroller.
2. MCU receives the data and make instructions for the robot. Sends the instruction to the encoder IC.
3. Encoded data transmits through the transmitter.
4. In the receivers end the receiver receives the encoded data.
5. Receiver sends the encoded data to the decoder.
6. Decoder decodes the data and sends to the motor driver.
7. Motor driver drives the motor in all movements by following the instruction and gestures.
8. Finally, the robot moves with the gestures.

## CHAPTER 4

### DESCRIPTION OF HARDWARE AND SOFTWARE

Different modules used in the project are discussed here thoroughly. The main hardware of this project is microcontroller chip. The programming is written in C language. The method involves Arduino microcontroller, MPU 6050, LCD monitor, etc. The tools that are used in the system can be dividing in the following:

- Hardware
- Software

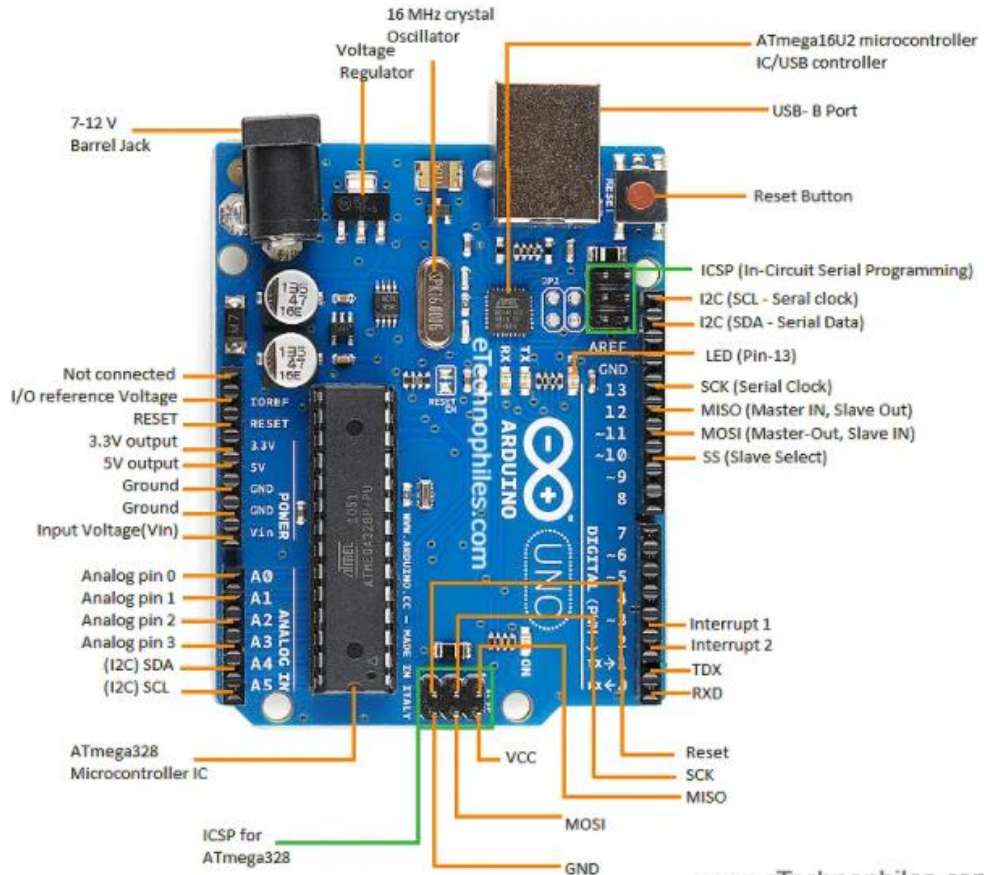
#### **HARDWARE:**

##### **4.1 Arduino Uno:**

The Arduino Uno R3 is a microcontroller board based on a removable, dual-inline-package (DIP) ATmega328 AVR microcontroller.

It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs).





Programs can be loaded on to it from the easy-to-use Arduino computer program. The Arduino has an extensive support community, which makes it a very easy way to get started working with embedded electronics. The R3 is the third, and latest, revision of the Arduino Uno.

This is the 3rd revision of the Uno (R3), which has a number of changes:

- The USB controller chip changed from ATmega8U2 (8K flash) to ATmega16U2 (16K flash). This does not increase the flash or RAM available to sketches.
- Three new pins were added, all of which are duplicates of previous pins. The I2C pins (A4, A5) have been also been brought out on the side of the board near AREF. There is a IOREF pin next to the reset pin, which is a duplicate of the 5V pin.
- The reset button is now next to the USB connector, making it more accessible when a shield is used.

More information about the Arduino Uno R3 is available on Arduino's website.

## 4.2 Power Supply:

**We used this power supply to charge our battery.**

**Power supply** is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a **power supply unit** or **PSU**. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others. Here in our application we need a 5v DC and 9-12v DC power supply for all electronics involved in the project.

### **Power regulator IC:**

Microcontroller needs +5 DC volt to operate. This is very essential for the microcontroller to keep the voltage rating constant. The microcontroller will burn out if the voltage supplied to it is exceeding its voltage rating. So to protect AT mega 8 IC there must be need a power supply 5 volt. Adaptor can supply Microcontroller +4 DC Page 28 of 60 volt but this creates a problem, because inside adaptor there is a transformer. If secondary side of the transformer draws more current than voltage level reduces due to eddy current and hysteresis loss. Thus Microcontroller cannot operate properly. So there need a power regulator IC which can gives continuous 5 volt. 7805 is a voltage regulator integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels. If there is any noise in input and output than the capacitor reduces the noise. The value of capacitors is chosen according to noise. If noise is high, the value of capacitors should be high and if noise is low than the value of capacitor should be low.



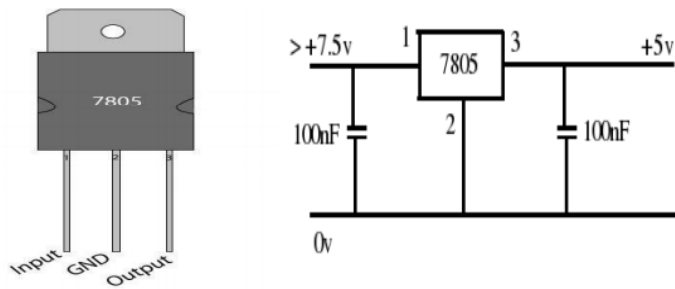


Fig 4.4: Power Regulator IC

This circuit can give +4V output at about 140 mA current, but it can be increased up to 1 A when good cooler is added to 7804 regulator chip. The circuit has overload and terminal protection. The capacitors must have enough high voltage rating to safely handle the input voltage feed to circuit.

### Circuit Diagram of Power Supply

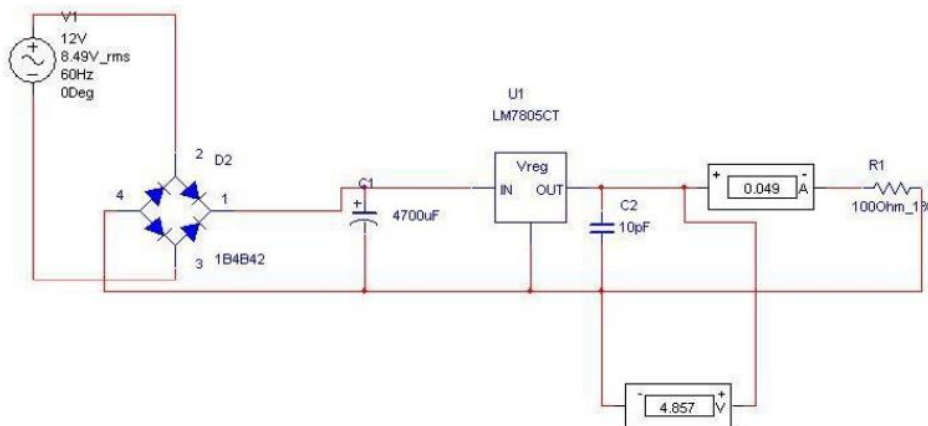


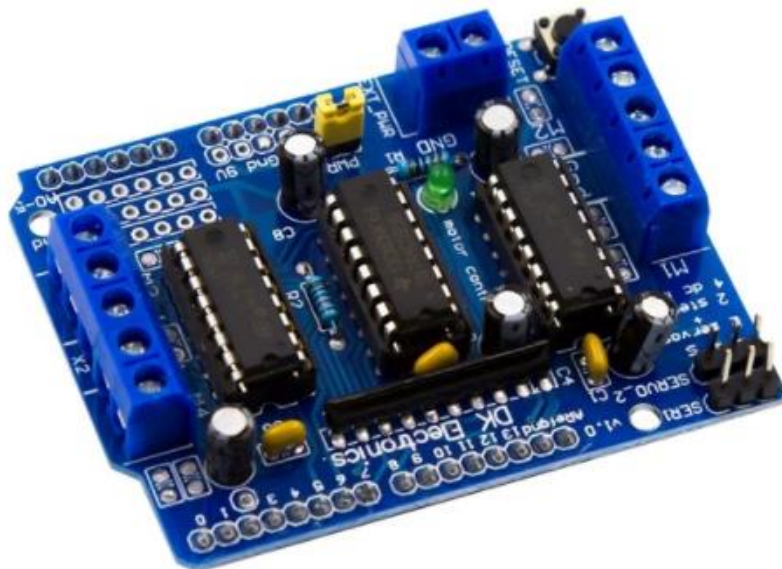
Figure 4.5: Circuit diagram of power supply

Output is not obtained in projects using this IC, engineers or technicians need to test this IC separately. A quick testing of this IC could save a lot of time in re-search labs and manufacturing industries of communication instruments. Here's a small and handy tester circuit for the DTMF IC It can be assembled on a multipurpose PCB with an 18-pin IC base. One can also test the IC on a simple breadboard.

For optimum working of telephone equipment, the DTMF receiver must be designed to recognize a valid tone pair greater than 40 ms in duration and to accept successive digit tone- pairs that are greater than 40

ms apart. However, for other applications like remote controls and radio communications, the tone duration may differ due to noise considerations. Therefore, by adding an extra resistor and steering diode the tone duration can be set to different values. The circuit is configured in balanced-line mode. To reject common-mode noise signals, a balanced differential amplifier input is used. The circuit also provides an excellent bridging interface across a properly terminated telephone line. Transient protection may be achieved by splitting the input resistors and inserting ZENER diodes (ZD1 and ZD2) to achieve voltage clamping. This allows the transient energy to be dissipated in the resistors and diodes and limits the maximum voltage that may appear at the inputs.

### 4.3 Motor controller driver: L293D:



The L293D is a dual-channel H-bridge motor driver that can control two DC motors or a stepper motor at one time. As there are two L293D ICs on the shield, it's technically capable of controlling a total of four DC motors.

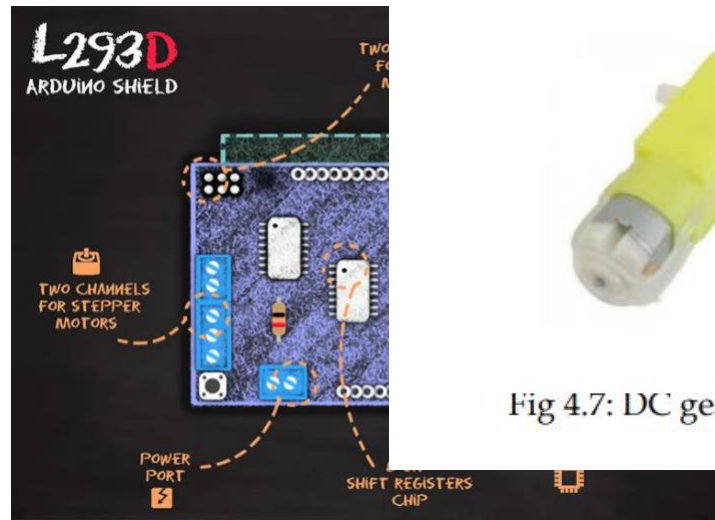


Fig 4.7: DC gear motor

The power supply to the shield can be used for both the shield and Arduino or the two can use separate power supplies. If sharing a common power supply, a power jumper must be placed on the shield. power supply can be provided through Arduino's USB port, its DC jack, or from the shield's 2-pin EXT-PWR block.

#### 4.4 DC motor with gear:

##### Description:

This gear motor wheel is perfect for your next robotics project. This gear motor is ideal for robotic car or line-tracing robot. With plastic construction and colored in bright yellow, the DC gear motor measures approx. 2.5 inch long, 0.85 inch wide and 0.7 inch thick . The wheel can be mounted on either side and the gearmotor works well between 4V to 7V (recommended 6 Volts). At a ratio of 1:48 you can get some really good torque at 5 Volts.

##### Specification:

Motor Specifications

Operating voltage: 3V ~ 6V DC (recommended value 5V)

Maximum torque: 800g.cm

Speed without load:  $90 \pm 10$ rpm

Reduction ratio: 1:48

No Load current: 190mA(max.250mA)

Stall Current: ~1A

Strong anti-interference on this motor keeps it safe around micro-controllers.

#### 4.5 various cables:

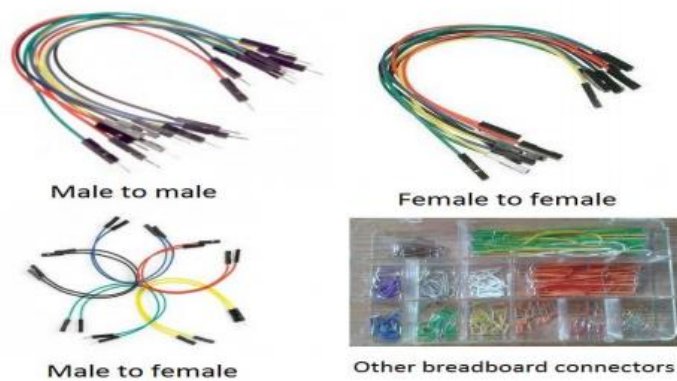


Fig 4.9: various cables

We have used those types of cables and Arduino data-cable.



Fig 4.10: Arduino programmer data cable

#### **4.6 433kHz transmitter and receiver:**

433MHz Superheterodyne 3400 RF Transmitter and Receiver Description is as follows:

##### **Transmitter Specs:**

Working voltage: 3V~12V

Working current:  $\max \leq 40\text{mA}$  (12V),  $\min \leq 9\text{mA}$ (3V)

Resonance mode: sound wave resonance (SAW)

Modulation mode: ASK /OOK

Working frequency: 315MHz-433.92MHz, customized frequency is available.

Transmission power: 25mW (315MHz at 12V)

Frequency error: +150kHz (max) Velocity:  $\leq 10\text{Kbps}$

Self-owned codes: negative

Aerial Length: 24cm (315MHz), 18cm(433.92MHz)

Dimensions: 43x12x5mm

Weight: 2g

## Receiver Specs:

Working voltage: 5.0VDC +0.5V

Working current:  $\leq 2.5\text{mA}$  (5.0VDC)

Working principle: superheterodyne

Working method: OOK/ASK

Operating frequency: 315MHz, 433.92MHz, customized frequency is available;

Bandwidth: 2MHz (315MHz, having result from testing at lowering the sensitivity 3dBm)

Sensitivity: excel  $-105\text{dBm}$  ( $50\Omega$ )

Output signal: TTL electric level signal entire transmit

Dimensions: 19x12x5.5mm

Weight: 1.6g

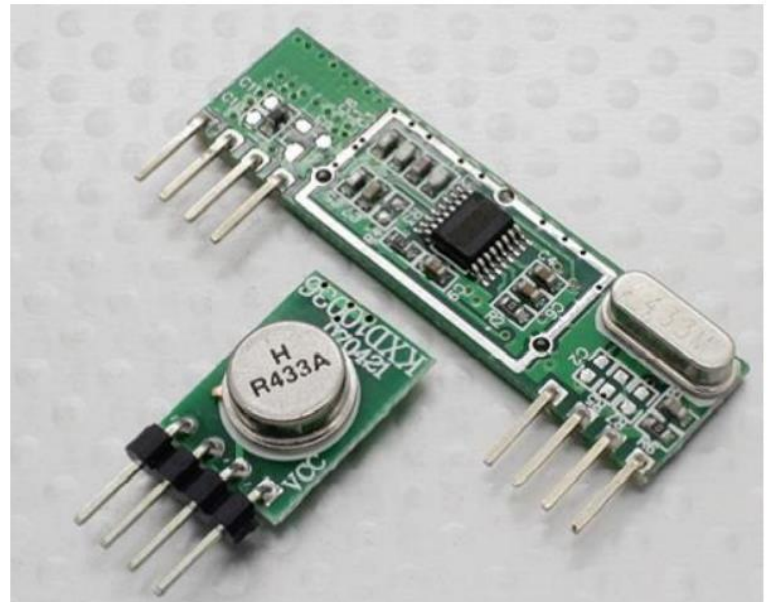


Figure 4.11: 433 kHz Transmitter and receiver

## 4.7 Robotic chassis:

We have also used robotic car frame, rechargeable battery as power supply, wheels, ball castor etc.



Fig 4.13: Robotic Chassis (2 Wheel) Model: ROB-00159

#### 4.8 Battery:

- Constant--9V Output till  
Metal Jacket Body  
Good Built Quality
- Hence Leakproof  
Easy to install and Replace  
Corrosion free
- Connector Point for long-term use
- 0% Mercury and Cadmium.
- Environment-friendly  
OEM Compatible.



## **4.9 Description of Software:**

I use here Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

### **Writing Sketches:**

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension: .ino. The editor has features for cutting/pasting and for searching/replacing text [28,29]. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

### **Verify**

Checks your code for errors compiling it.

### **Upload**

Compiles your code and uploads it to the configured board. See uploading below for details.

Note: If you are using an external programmer with your board, you can hold down the "shift" key on your computer when using this icon. The text will change to "Upload using Programmer".

### **New**

Creates a new sketch.

### **Open**

Presents a menu of all the sketches in your sketchbook. Clicking one will open it within the current window overwriting its content.



Note: due to a bug in Java, this menu doesn't scroll; if you need to open a sketch late in the list, use the File | Sketchbook menu instead.

## **Save**

Saves your sketch.

## **Serial Monitor**

Opens the [serial monitor](#).

Additional commands are found within the five menus: File, Edit, Sketch, Tools, Help. The menus are context sensitive, which means only those items relevant to the work currently being carried out are available.

## **File**

- **New**

Creates a new instance of the editor, with the bare minimum structure of a sketch already in place.

- **Open**

Allows to load a sketch file browsing through the computer drives and folders.

- **Open**

### **Recent**

Provides a short list of the most recent sketches, ready to be opened.

- **Sketchbook**

Shows the current sketches within the sketchbook folder structure; clicking on any name opens the corresponding sketch in a new editor instance.

- **Examples**

Any example provided by the Arduino Software (IDE) or library shows up in this menu

item. All the examples are structured in a tree that allows easy access by topic or library.

- **Close**

Closes the instance of the Arduino Software from which it is clicked.

- **Save**

Saves the sketch with the current name. If the file hasn't been named before, a name will be provided in a "Save as.." window.

- **Save as...**

Allows to save the current sketch with a different name.

- **Page Setup**

It shows the Page Setup window for printing.

- **Print**

Sends the current sketch to the printer according to the settings defined in Page Setup.

- **Preferences**

Opens the Preferences window where some settings of the IDE may be customized, as the language of the IDE interface.

- **Quit**

Closes all IDE windows. The same sketches open when Quit was chosen will be automatically reopened the next time you start the IDE.

## Edit

- **Undo/Redo**

Goes back of one or more steps you did while editing; when you go back, you may go forward with Redo.

- **Cut**

Removes the selected text from the editor and places it into the clipboard.

- **Copy**

Duplicates the selected text in the editor and places it into the clipboard.

- **Copy for Forum**

Copies the code of your sketch to the clipboard in a form suitable for posting to the forum, complete with syntax coloring.

- **Copy as HTML**

Copies the code of your sketch to the clipboard as HTML, suitable for embedding in web pages.

- **Paste**

Puts the contents of the clipboard at the cursor position, in the editor.

- **Select All**

Selects and highlights the whole content of the editor.

- **Comment/Uncomment**

Puts or removes the // comment marker at the beginning of each selected line.

- **Increase/Decrease Indent**

Adds or subtracts a space at the beginning of each selected line, moving the text one space on the right or eliminating a space at the beginning.

- **Find**

Opens the Find and Replace window where you can specify text to search inside the current sketch according to several options.

- **Find Next**

Highlights the next occurrence - if any - of the string specified as the search item in the

Find window, relative to the cursor position.

- **Find Previous**

Highlights the previous occurrence - if any - of the string specified as the search item in the Find window relative to the cursor position.

## Sketch

- **Verify/Compile**

Checks your sketch for errors compiling it; it will report memory usage for code and variables in the console area.

- **Upload**

Compiles and loads the binary file onto the configured board through the configured Port.

- **Upload Using Programmer**

This will overwrite the bootloader on the board; you will need to use Tools > Burn Bootloader to restore it and be able to Upload to USB serial port again. However, it allows you to use the full capacity of the Flash memory for your sketch. Please note that this command will NOT burn the fuses. To do so a Tools -> Burn Bootloader command must be executed.

- **Export Compiled Binary**

Saves a .hex file that may be kept as archive or sent to the board using other tools.

- **Show Sketch Folder**

Opens the current sketch folder.

- **Include Library**

Adds a library to your sketch by inserting #include statements at the start of your code. For more details, see libraries below. Additionally, from this menu item you can access the Library Manager and import new libraries from .zip files.

- **Add File...**

Adds a source file to the sketch (it will be copied from its current location). The new file appears in a new tab in the sketch window. Files can be removed from the sketch using the tab menu accessible clicking on the small triangle icon below the serial monitor one on the right side of the toolbar.

## Tools

- **Auto Format**

This formats your code nicely: i.e. indents it so that opening and closing curly braces line up, and that the statements inside curly braces are indented more.

- **Archive Sketch**

Archives a copy of the current sketch in .zip format. The archive is placed in the same directory as the sketch.

- **Fix Encoding & Reload**

Fixes possible discrepancies between the editor char map encoding and other operating systems char maps.

- **Serial Monitor**

Opens the serial monitor window and initiates the exchange of data with any connected board on the currently selected Port. This usually resets the board, if the board supports Reset over serial port opening.

- **Board**

Select the board that you're using. See below for descriptions of the various boards.

- **Port**

This menu contains all the serial devices (real or virtual) on your machine. It should automatically refresh every time you open the top-level tools menu.

- **Programmer**

For selecting a hardware programmer when programming a board or chip and not using the

onboard USB-serial connection. Normally you won't need this, but if you're burning a bootloader to a new microcontroller, you will use this.

- **Burn Bootloader**

The items in this menu allow you to burn a bootloader onto the microcontroller on an Arduino board. This is not required for normal use of an Arduino or Genuino board but is useful if you purchase a new ATmega microcontroller (which normally come without a bootloader). Ensure that you've selected the correct board from the Boards menu before burning the bootloader on the target board. This command also set the right fuses.

## Help

Here you find easy access to a number of documents that come with the Arduino Software (IDE). You have access to Getting Started, Reference, this guide to the IDE and other documents locally, without an internet connection. The documents are a local copy of the online ones and may link back to our online website.

## Sketchbook

The Arduino Software (IDE) uses the concept of a sketchbook: a standard place to store your programs (or sketches). The sketches in your sketchbook can be opened from the File > Sketchbook menu or from the Open button on the toolbar. The first time you run the Arduino software, it will automatically create a directory for your sketchbook. You can view or change the location of the sketchbook location from with the Preferences dialog. Beginning with version 1.0, files are saved with a .ino file extension. Previous versions use the .pde extension. You may still open .pde named files in version 1.0 and later, the software will automatically rename the extension to .ino.

## Tabs, Multiple Files, and Compilation

Allows you to manage sketches with more than one file (each of which appears in its own tab). These can be normal Arduino code files (no visible extension), C files (.c extension), C++ files (.cpp), or header files (.h).

## Uploading

Before uploading your sketch, you need to select the correct items from the Tools > Board and Tools > Port menus. The boards are described below. On the Mac, the serial port is probably something like `/dev/tty.usbmodem241` (for an Uno or Mega2560 or Leonardo) or `/dev/tty.usbserial-1B1` (for a Duemilanove or earlier USB board), or `/dev/tty.USA19QW1b1P1.1` (for a serial board connected with a Keyspan USB-to-Serial adapter). On Windows, it's probably COM1 or COM2 (for a serial board) or COM4, COM5, COM7, or higher (for a USB board) - to find out, you look for USB serial device in the ports section of the Windows Device Manager. On Linux, it should be `/dev/ttyACMx`, `/dev/ttyUSBx` or similar. Once you've selected the correct serial port and board, press the upload button in the toolbar or select the Upload item from the File menu. Current Arduino boards will reset automatically and begin the upload. With older boards (preDiecimila) that lack auto-reset, you'll need to press the reset button on the board just Page 46 of 60 before starting the upload. On most boards, you'll see the RX and TX LEDs blink as the sketch is uploaded. The Arduino Software (IDE) will display a message when the upload is complete, or show an error. When you upload a sketch, you're using the Arduino bootloader, a small program that has been loaded on to the microcontroller on your board. It allows you to upload code without using any additional hardware. The bootloader is active for a few seconds when the board resets; then it starts whichever sketch was most recently uploaded to the microcontroller. The bootloader will blink the on-board (pin 13) LED when it starts (i.e. when the board resets).

## Libraries

Libraries provide extra functionality for use in sketches, e.g. working with hardware or manipulating data. To use a library in a sketch, select it from the Sketch > Import Library menu. This will insert one or more `#include` statements at the top of the sketch and compile the library with your sketch. Because libraries are uploaded to the board with your sketch, they increase the amount of space it takes up. If a sketch no longer needs a library, simply delete its `#include` statements from the top of your code. There is a list of libraries in the reference. Some libraries are included with the Arduino software. Others can be downloaded from a variety of sources or through the Library Manager. Starting with version 1.0.5 of the IDE, you do can import a library from a zip file and use it in an open sketch. See these instructions for installing a third-party library. To write your own library, see this tutorial.

## Boards

The board selection has two effects: it sets the parameters (e.g. CPU speed and baud rate) used when compiling and uploading sketches; and sets and the file and fuse settings used by the burn bootloader command. Some of the board definitions differ only in the latter, so even if you've been uploading successfully with a particular selection you'll want to check it before burning the bootloader. You can find a comparison table between the various boards [here](#).

Arduino Software (IDE) includes the built in support for the boards in the following list, all based on the AVR Core. The Boards Manager included in the standard installation allows to add support for the growing number of new boards based on different cores like Arduino Due, Arduino Zero, Edison, Galileo and so on.

- **Arduino Yùn**

An ATmega32u4 running at 16 MHz with auto-reset, 12 Analog In, 20 Digital I/O and 7 PWM.

- **Arduino/Genuino Uno**

An ATmega328 running at 16 MHz with auto-reset, 6 Analog In, 14 Digital I/O and 6 PWM

- Arduino Diecimila or Duemilanove w/ ATmega168 An ATmega168 running at 16 MHz with auto-reset.

- Arduino Nano w/ ATmega328

An ATmega328 running at 16 MHz with auto-reset. Has eight analog inputs.

- Arduino/Genuino Mega 2560

An ATmega2560 running at 16 MHz with auto-reset, 16 Analog In, 54 Digital I/O and 15 PWM.

- Arduino Mega



An ATmega1280 running at 16 MHz with auto-reset, 16 Analog In, 54 Digital I/O and 15 PWM.

- Arduino Mega ADK

An ATmega2560 running at 16 MHz with auto-reset, 16 Analog In, 54 Digital I/O and 15 PWM.

- Arduino Leonardo

An ATmega32u4 running at 16 MHz with auto-reset, 12 Analog In, 20 Digital I/O and 7 PWM.

- Arduino Micro

An ATmega32u4 running at 16 MHz with auto-reset, 12 Analog In, 20 Digital I/O and 7 PWM.

- Arduino Esplora

An ATmega32u4 running at 16 MHz with auto-reset.

- Arduino Mini w/ ATmega328

An ATmega328 running at 16 MHz with auto-reset, 8 Analog In, 14 Digital I/O and 6 PWM.

- Arduino Ethernet

Equivalent to Arduino UNO with an Ethernet shield: An ATmega328 running at 16 MHz with auto-reset, 6 Analog In, 14 Digital I/O and 6 PWM.

- Arduino Fio

An ATmega328 running at 8 MHz with auto-reset. Equivalent to Arduino Pro or Pro Mini (3.3V, 8 MHz) w/ ATmega328, 6 Analog In, 14 Digital I/O and 6 PWM.

- Arduino BT w/

ATmega328 ATmega328 running at 16 MHz. The bootloader burned (4 KB) includes codes to initialize the on-board bluetooth module, 6 Analog In, 14 Digital I/O and 6 PWM..

- LilyPad Arduino USB

An ATmega32u4 running at 8 MHz with auto-reset, 4 Analog In, 9 Digital I/O and 4 PWM.

- LilyPad Arduino

An ATmega168 or ATmega132 running at 8 MHz with auto-reset, 6 Analog In, 14 Digital I/O and 6 PWM.

- Arduino Pro or Pro Mini (5V, 16 MHz) w/

ATmega328 An ATmega328 running at 16 MHz with auto-reset. Equivalent to Arduino Duemilanove or Nano w/ ATmega328; 6 Analog In, 14 Digital I/O and 6 PWM.

- Arduino NG or older w/ ATmega168

An ATmega168 running at 16 MHz without auto-reset. Compilation and upload is equivalent to Arduino Diecimila or Duemilanove w/ ATmega168, but the bootloader burned has a slower timeout (and blinks the pin 13 LED three times on reset); 6 Analog In, 14 Digital I/O and 6 PWM.

- Arduino Robot Control

An ATmega328 running at 16 MHz with auto-reset.

- Arduino Robot Motor

An ATmega328 running at 16 MHz with auto-reset.

- Arduino Gemma

An ATtiny85 running at 8 MHz with auto-reset, 1 Analog In, 3 Digital I/O and 2 PWM.

## **CODE:**

### **1) ADXL335 interfacing:**

```
#define x A0
#define y A1
#define z A2

int x_val;
int y_val;
int z_val;

void setup() {
  // put your setup code here, to run once:
  pinMode(x, INPUT);
  pinMode(y, INPUT);
  pinMode(z, INPUT);
  Serial.begin(9600);
}

void loop()
{
  // put your main code here, to run repeatedly:
  x_val = analogRead(x);
  y_val = analogRead(y);
  z_val = analogRead(z);

  Serial.print("X: ");
  Serial.println(x_val);
  Serial.print("Y: ");
  Serial.println(y_val);
  Serial.print("Z: ");
  Serial.println(z_val);
  Serial.println();
  Serial.println("-----");
  Serial.println();
  delay(1000);
}
```

### **2) ADXL335 tilt detection:**

```
#define x A0
#define y A1
#define z A2
```

```
int x_val;
int y_val;
int z_val;

int x_val2;
int y_val2;
int z_val2;

void setup() {
  // put your setup code here, to run once:
  pinMode(x, INPUT);
  pinMode(y, INPUT);
  pinMode(z, INPUT);
  Serial.begin(9600);
  x_val2 = analogRead(x);
  y_val2 = analogRead(y);
  z_val2 = analogRead(z);
}

void loop()
{
  // put your main code here, to run repeatedly:
  x_val = analogRead(x);
  y_val = analogRead(y);
  z_val = analogRead(z);

  int x_axis = x_val - x_val2;
  int y_axis = y_val - y_val2;
  int z_axis = z_val - z_val2;

  if(y_axis >= 45)
  {
    Serial.println("Forward");
  }
  else if(y_axis <= -45)
  {
    Serial.println("Backward");
  }
  else if(x_axis >= 45)
  {
    Serial.println("Right");
  }
  else if(x_axis <= -45)
  {
    Serial.println("Left");
  }
}
```

```
    else
    {
        Serial.println("Stop");
    }
    delay(1000);
}
```

### 3) HAND GESTURE INTERFACING:

```
#include <VirtualWire.h>
```

```
#define x A0
```

```
#define y A1
```

```
#define z A2
```

```
char *data;
```

```
int x_val;
```

```
int y_val;
```

```
int z_val;
```

```
int x_val2;
```

```
int y_val2;
```

```
int z_val2;
```

```
void setup()
```

```
{
```

```
vw_set_tx_pin(12);

vw_setup(2000);

pinMode(x, INPUT);

pinMode(y, INPUT);

pinMode(z, INPUT);

Serial.begin(9600);

x_val2 = analogRead(x);

y_val2 = analogRead(y);

z_val2 = analogRead(z);

}

void loop()

{

x_val = analogRead(x);

y_val = analogRead(y);

z_val = analogRead(z);

int x_axis = x_val - x_val2;

int y_axis = y_val - y_val2;

int z_axis = z_val - z_val2;

if(y_axis >= 45)
```

```
{  
  
    data="f";  
  
    vw_send((uint8_t *)data, strlen(data));  
  
    vw_wait_tx();  
  
    delay(500);  
  
    Serial.println("Forward");  
  
}  
  
else if(y_axis <= -45)  
  
{  
  
    data="b";  
  
    vw_send((uint8_t *)data, strlen(data));  
  
    vw_wait_tx();  
  
    delay(500);  
  
    Serial.println("Backward");  
  
}  
  
else if(x_axis >= 45)  
  
{  
  
    data="r";  
  
    vw_send((uint8_t *)data, strlen(data));  
  
    vw_wait_tx();  
  
    delay(500);  
  
    Serial.println("Right");  
  
}
```

```
    }  
  
    else if(x_axis <= -45 )  
  
    {  
  
        data="l";  
  
        vw_send((uint8_t *)data, strlen(data));  
  
        vw_wait_tx();  
  
        delay(500);  
  
        Serial.println("Left");  
  
    }  
  
    else  
  
    {  
  
        data="s";  
  
        vw_send((uint8_t *)data, strlen(data));  
  
        vw_wait_tx();  
  
        delay(500);  
  
        Serial.println("Stop");  
  
    }  
  
}
```

#### 4) RECEIVER INTERFACING:

```
#include <VirtualWire.h>
```

```
#define m1 2
```



```
#define m2 3

#define m3 4

#define m4 5

void setup()

{

    vw_set_rx_pin(11);

    vw_setup(2000);

    pinMode(m1, OUTPUT);

    pinMode(m2, OUTPUT);

    pinMode(m3, OUTPUT);

    pinMode(m4, OUTPUT);

    vw_rx_start();

    Serial.begin(9600);

}

void loop()

{

    uint8_t buf[VW_MAX_MESSAGE_LEN];

    uint8_t buflen = VW_MAX_MESSAGE_LEN;

    if (vw_get_message(buf, &buflen))
```

```
{  
  
  if(buf[0]=='f')  
  
    {  
  
      digitalWrite(m1,HIGH);  
  
      digitalWrite(m2,LOW);  
  
      digitalWrite(m3,HIGH);  
  
      digitalWrite(m4,LOW);  
  
      Serial.println("Forward");  
  
    }  
  
  else if(buf[0]=='b')  
  
    {  
  
      digitalWrite(m1,LOW);  
  
      digitalWrite(m2,HIGH);  
  
      digitalWrite(m3,LOW);  
  
      digitalWrite(m4,HIGH);  
  
      Serial.println("Backward");  
  
    }  
  
  else if(buf[0]=='r')  
  
    {  
  
      digitalWrite(m1,HIGH);  
  
      digitalWrite(m2,LOW);  
  
      digitalWrite(m3,LOW);  
  
    }  
  
}
```

```
        digitalWrite(m4,HIGH);

        Serial.println("Left");
    }

    else if(buf[0]=='l')
    {

        digitalWrite(m1,LOW);

        digitalWrite(m2,HIGH);

        digitalWrite(m3,HIGH);

        digitalWrite(m4,LOW);

        Serial.println("Right");
    }

    else if(buf[0]=='s')
    {

        digitalWrite(m1,LOW);

        digitalWrite(m2,LOW);

        digitalWrite(m3,LOW);

        digitalWrite(m4,LOW);

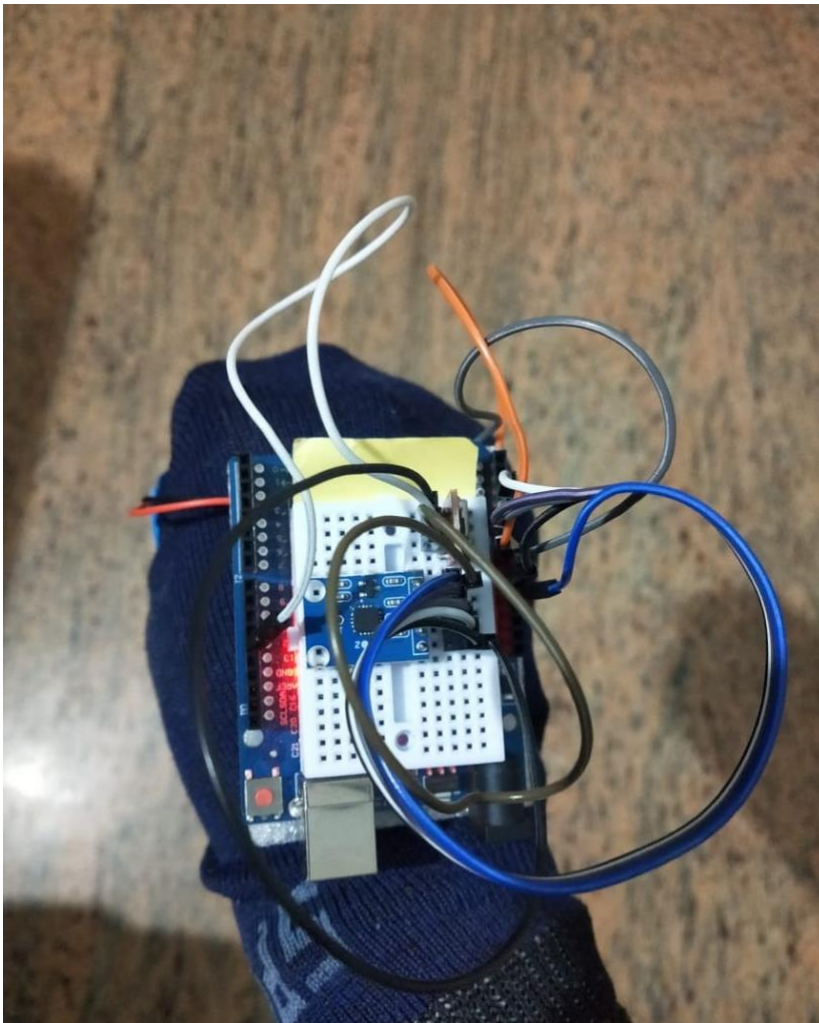
        Serial.println("Stop");
    }
}

}
```

## CHAPTER 5

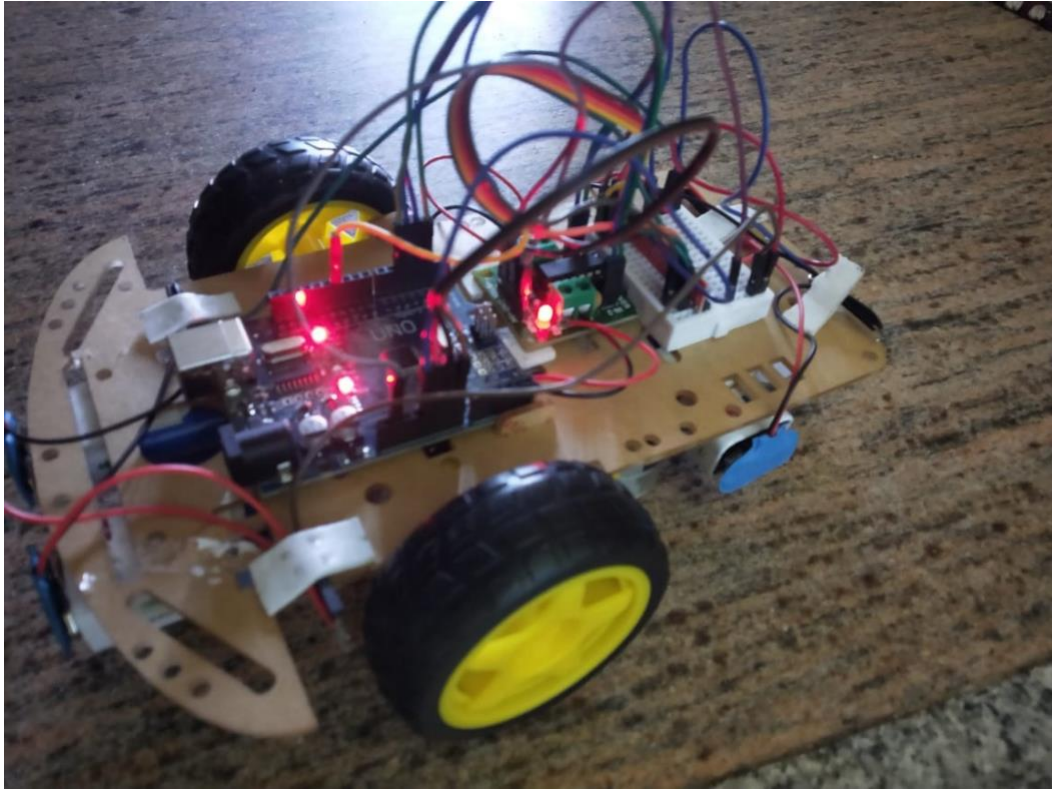
### RESULT

We were able to make receiver and transmitter circuit successfully and we tested the circuit on breadboard, it was found that mcu was able to receive data and sends the instruction to encoder ic also this encoded data transmits through transmitter and the receiver was able to receive encoded data. Following pictures are the final product of our project.

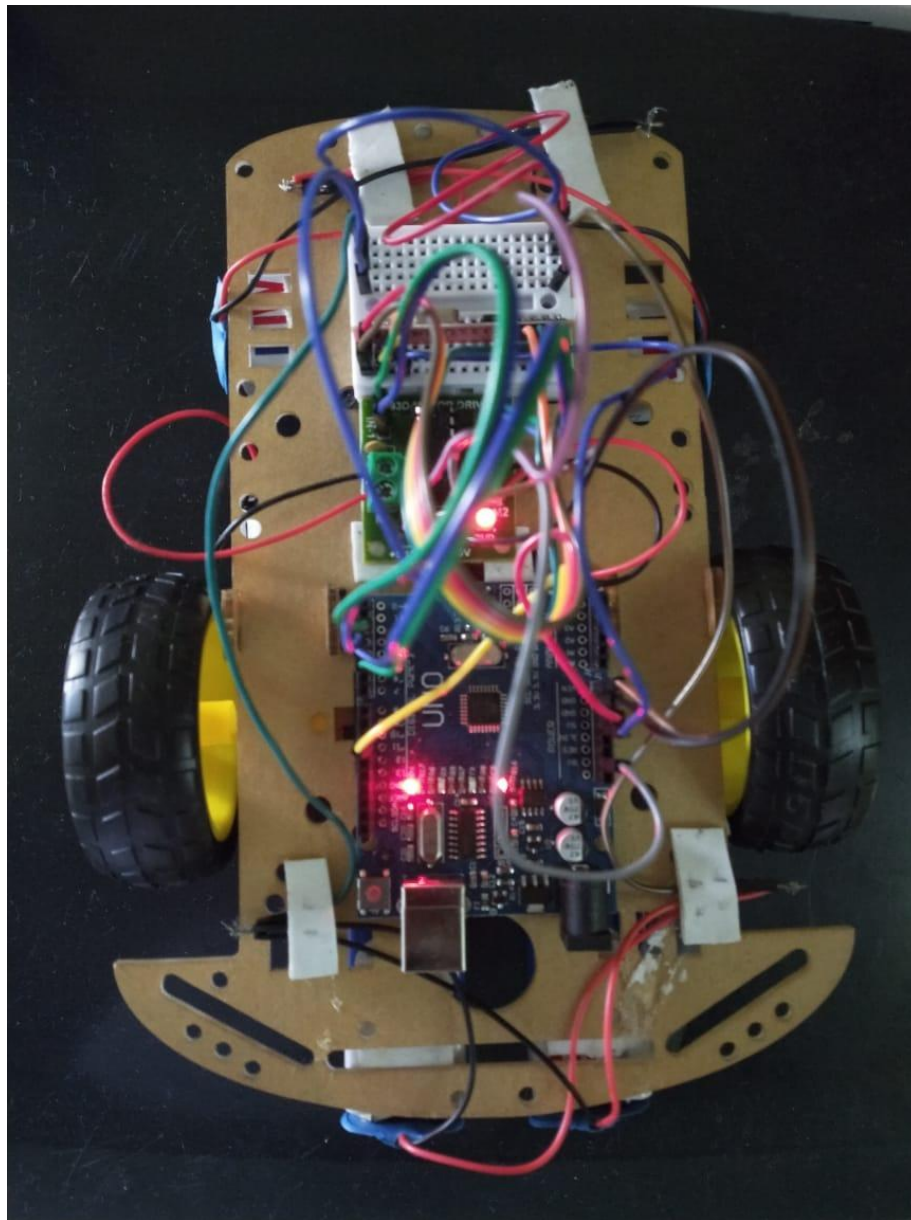


**Fig. 5.1 Hand controller**

**Fig 5.1. Portrait view of car**



**Fig 5.2. Top view of car**



## CHAPTER-6

### CONCLUSION

The purpose of project is to control a toy car using accelerometer sensors attached to a hand glove. The sensors are intended to replace the remote control that is generally used to run the car. It will allow us to control the forward and backward, and left and right movements, while using the same accelerometer sensor to control the throttle of the car. based on the hand movements. By using the above mentioned components the hardware was setup, thus resulting in the formation of a robot. In order to implement the experiment a Dell laptop was used, whose web camera acted as the input device for capturing the video. The software part was developed in Java for image processing wherein the hand gestures were analyzed to extract the actual direction. Eclipse Ide was used for developing the java code. The direction thus identified was send as characters to the robot with the help of Zigbee. XBee S2 version of Zigbee was used for enabling the communication. The final movement of the robot can be concluded as follows: At the beginning the robot was in a stop mode. As the hand moved from bottom to top, the robot moved in the forward direction. As the hand moved from top to bottom, the robot moved in the backward direction. As the hand was shown as an acute angle towards the left, the robot moved towards the left direction. As the hand was shown as an acute angle towards the right, the robot moved towards the right direction. As the hand is kept stationary with respect to the environment, the robot was in the stop mode. From the experiment, about 80% of the implementation worked according; the remaining was less due to background interference which is a negative marking to the implementation. Hand Gesture Controlled Robot System gives a more natural way of controlling devices. The command for the robot to navigate in specific direction in the environment is based on technique of hand gestures provided by the user. Without using any external hardware support for gesture input unlike specified existing system, user can control a robot from his software station.



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