# A
# Project Report
# On
# "Hand Gesture Controlled Robot Car using ARDUINO Lilypad "


**Prepared by**
**Ms. Kshitij Antani (18DCS005)**
**Ms. Rutika Mehta (18DCS045)**
**Ms. Mansi Nakrani (18DCS053)**
**Ms. Nidhi Patel (18DCS076)**

**Under the guidance of**

Prof. Drashti Garadharia,
Prof. Radhika Patel,
Prof. Harshil Joshi


A Report Submitted to

Charotar University of Science and Technology

for Partial Fulfillment of the Requirements for the

4th Semester Software Group Project-I (CE255)

**Submitted at**



**CSE**

**DEPSTAR**

**At: Changa, Dist: Anand – 388421**


**MAY 2020**

# CERTIFICATE

This is to certify that the report entitled "**Hand Gesture Controlled Robot Car using Arduino Lilypad**" is a bonafied work carried out by **Ms.Kshitij Antani(18DCS005),Ms.RutikaMehta(18DCS045),Ms.MansiNakrani(18DCS053),Ms.Nidhi Patel(18DCS076)** under the guidance and supervision of **Prof.Drashti Garadharia,Prof.Radhika Patel,Prof. Harshil Joshi** for the subject CS255-**Software Group Project-II** (CSE) of 4th Semester of Bachelor of Technology in **DEPSTAR** at Faculty of Technology & Engineering – CHARUSAT, Gujarat.

To the best of my knowledge and belief, this work embodies the work of candidate himself, has duly been completed, and fulfills the requirement of the ordinance relating to the B.Tech. Degree of the University and is up to the standard in respect of content, presentation and language for being referred to the examiner.

| | |
|---|---|
| Prof. Drashti Garadharia,<br>Prof. Radhika Patel,<br>Prof. Harshil Joshi<br>Branch Name(CSE)<br>DEPSTAR, Changa, Gujarat. | Prof. Parth Goel<br>Branch Name(CSE)<br>DEPSTAR, Changa, Gujarat |
| Dr. Amit Ganatra<br>Principal, DEPSTAR<br>Dean, FTE<br>CHARUSAT, Changa, Gujarat. | |

# ABSTRACT

Comfort is becoming a major priority in the 21st century. So the revolutions of computing and smart environment came into existence. Some technologies like Ubiquitous/pervasive and ambient intelligence satisfy the maximum need of smart world but these technologies are not tightly coupled with the internet, so the people need another technology extension. Internet of Things (IoT) is an ideal buzzing technology to influence the internet and communication technologies. IoT allows people and things to be connected anytime, anyplace, with anything and anyone, by using ideally in any path/network and any service.

This paper proposes a style of hand gesture controlled automaton victimization Arduino Lilypad. The model projected is controlled through a motion device that is mounted on the hand gloves. This style helps physically challenged folks and additionally for sure tasks educated by human. The most aim of this style is to manage the automaton victimization hand gesture. Measuring device utilized in the planning senses the direction of hand movement and sends an indication to Arduino Lilypad. Four main Hand gesture movements like FORWORD, BACKWORD, LEFT and RIGHT area unit detected and enforced. Keywords: Arduino Lilypad, Accelerometer, hand gesture, wireless robot, physically challenged.

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.

# ACKNOWLEDGEMENT

We are privileged to have this opportunity to express our gratitude and acknowledge everyone's never ending support and valuable contributions for our project.

Prima facie, we would like to express our sincere gratitude to our advisor **Prof. Drashti Garadharia, Prof. Radhika Patel and Prof. Harshil Joshi** for the continuous support of our project and related research, motivation and immense knowledge.

Our sincere thanks also go to **Dean Dr. Amit Ganatra and HoD Prof. Parth Goel** who provided us an opportunity to work on a project and be able to present the same.

Last but not the least; we would like to thank our friends and family for supporting us spiritually throughout this project and for always being a constant source of inspiration.

We also place on record, our sense of gratitude to one and all, who directly or indirectly, have lent their hand in this venture.

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# Chapter 1: PROJECT DEFINITION

People would like to regulate everything with their hands! Sitting in the chair and dominating things just like a BOSS. Thus we finally came out with a hand gesture recognition automation, which might follow the commands created by hand gestures. Sounds crazy however we promise it's terribly easy. The automation is split into 2 necessary elements, transmitter circuit and receiver circuit. Here we'd like to program the transmitter circuit. Let's see deep part operation of style of Hand Gesture Controlled automation using Arduino Lilypad.

The traditional wired buttons controlled robot becomes very bulgy and it also limits the distance the robot goes. The Wireless Hand controlled Robot will function by a wearable hand glove from which the movements of the hand can be used as the input for the movement of the robot. The basic idea of our project is to develop a system (Robot) which can recognize the Human Interaction with it to accomplish the certain tasks assigned to it. In our project we will design a wearable Hand Glove which will contain the sensors mounted on it to capture the movement of the hand and convert the raw mechanical data into electrical form. This data will be further processed and converted into an understandable format for the lilypad mounted on the Glove. This lilypad will act as a transmitter of the data for wireless communication purpose. Once the transmitted data is received by the receiver module which will be connected to the Microcontroller, it will be processed and further sent to the Microcontroller. Microcontroller will deduce the commands and accordingly it will actuate the motor drivers to control the Motors for various tasks on the robot.

Nowadays, robotics is becoming one of the most advanced in the field of technology. A Robot is an electro-mechanical system that is operated by a computer program. Robots can be autonomous or semi-autonomous. An autonomous robot is not controlled by human and acts on its own decision by sensing its environment. Majority of the industrial robots are autonomous as they are required to operate at high speed and with great accuracy. But some applications require semi-autonomous or human controlled robots. Some of the most commonly used control systems are voice recognition, tactile or touch controlled and motion controlled. A Gesture Controlled robot is a kind of robot which can be controlled by your hand gestures not by old buttons. You just need to wear a small transmitting device in your hand which included an acceleration meter. This will transmit an appropriate command to the robot so that it can do whatever we want. The transmitting device included a ADC for analog to digital conversion and an encoder IC (HT12E) which is use to encode the four bit data and then it will transmit by an RF Transmitter module. At the receiving end an RF Receiver module receives the encoded data and decodes it by and decoder IC (HT12D). This data is then processed by a microcontroller and finally our motor driver to control the motors. The applications of robotics mainly involve in automobiles, medical, construction, defence and also used as a fire fighting robot to help the people from the fire accident. But, controlling the robot with a remote or a switch is quite complicated. So, a new project is developed that is, an accelerometer based gesture control robot. The main goal of this project is to control the movement of the robot with hand gesture using accelerometer. The robot is usually an electro-mechanical machine that can perform tasks automatically. Some robots require some degree of guidance, which may be done using a remote control or with a computer interface. Robots can be autonomous, semi-autonomous or remotely controlled. Robots have evolved so much and are capable of mimicking humans that they seem to have a mind of their own.

# Chapter 2: DESCRIPTION

## 2.1 Project Summary

Gesture controlled robot works on the principle of accelerometer which records hand movements and sends that data to the comparator which assigns proper voltage levels to the recorded movements. That information is then transferred to a encoder which makes it ready for RF transmission. On the receiving end, the information is received wirelessly via RF, decoded and then passed onto the microcontroller which takes various decisions based on the received information. These decisions are passed to the motor driver ic which triggers the motors in different configurations to make the robot move in a specific direction. The following block diagram helps to understand the working of the robot: We have divided our task into two parts to make the task easy and simple and to avoid complexity and make it error free.

The first is the transmitting section which includes the following components:

- Arduino
- Accelerometer
- Comparator IC
- Encoder IC
- RF Transmitter

The second is the receiving end which comprises of following main components:

- RF Receiver Module
- Decoder IC 9

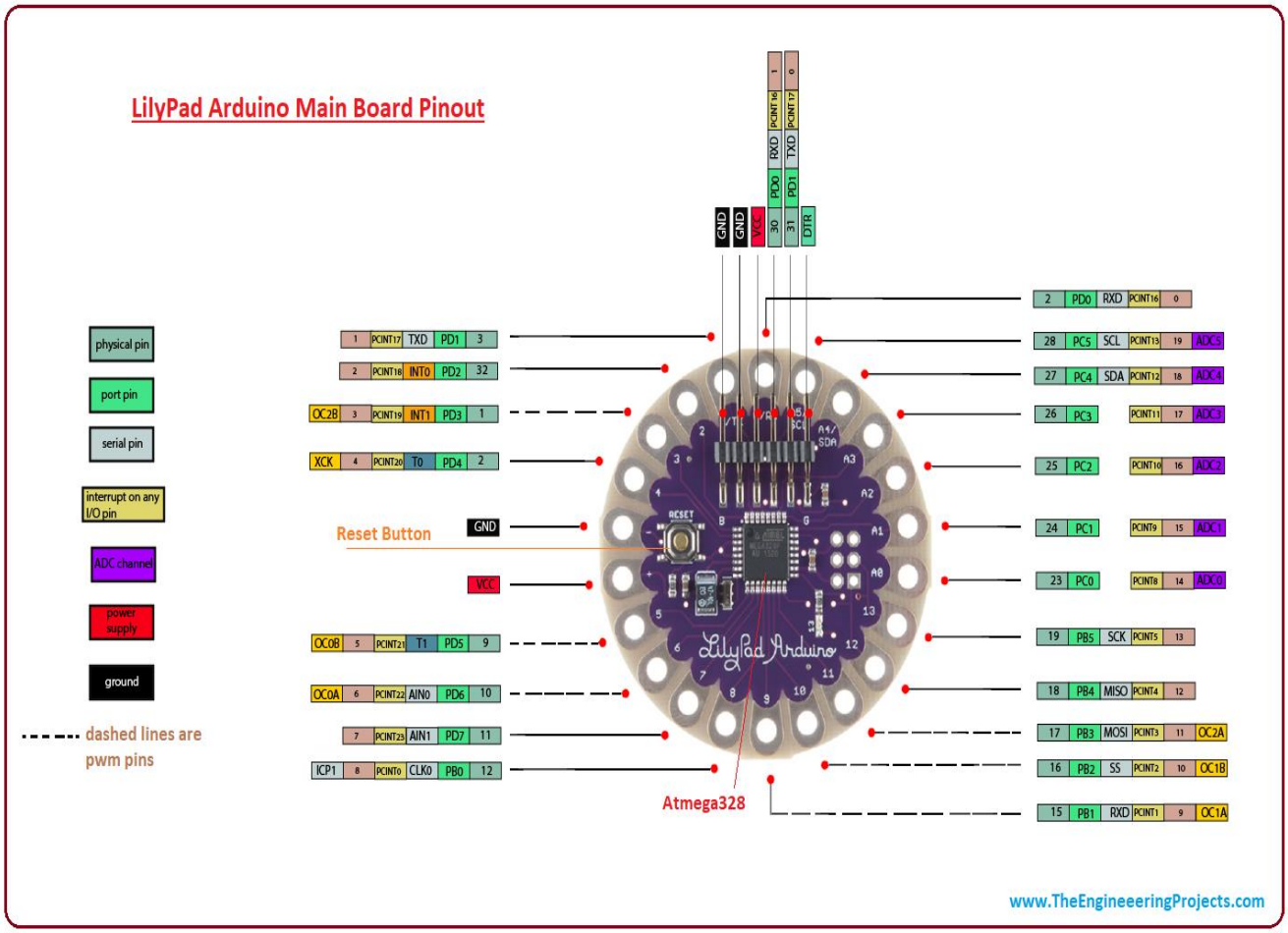
## 2.2 Purpose

The aim of the project is to develop a human machine interface used for control robot arm. Our objective is to make this device simple as well as cheap so it can be produced and used for number of purposes. The objective of this project is to build a car that can be controlled by gesture wirelessly. In this project user is also able to control motions of the car by wearing controller glove and performing predefined gestures. This can be also used in many potential applications such as wireless controller car racing etc.

# Chapter 3: SYSTEMS REQUIREMENTS STUDY

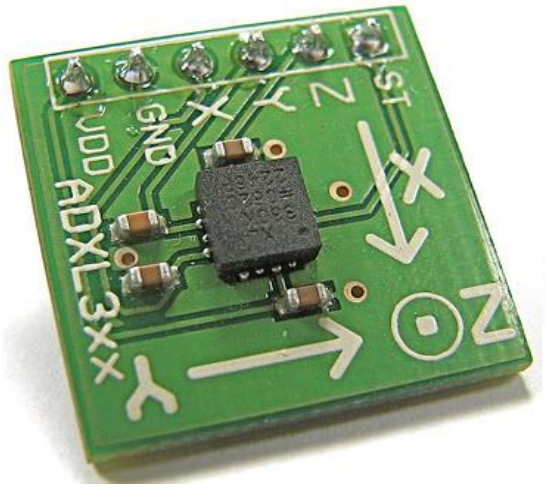
## 3.1 Hardware Requirements:

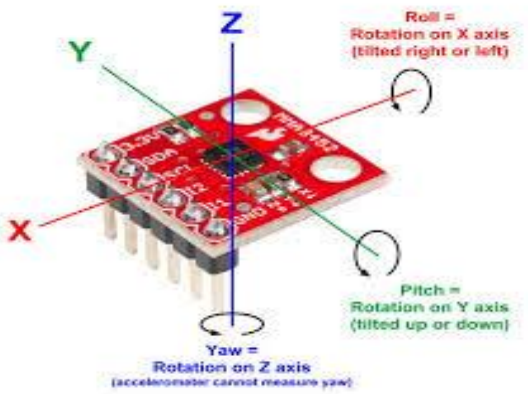
- **Arduino Lilypad**




- **Accelerometer**

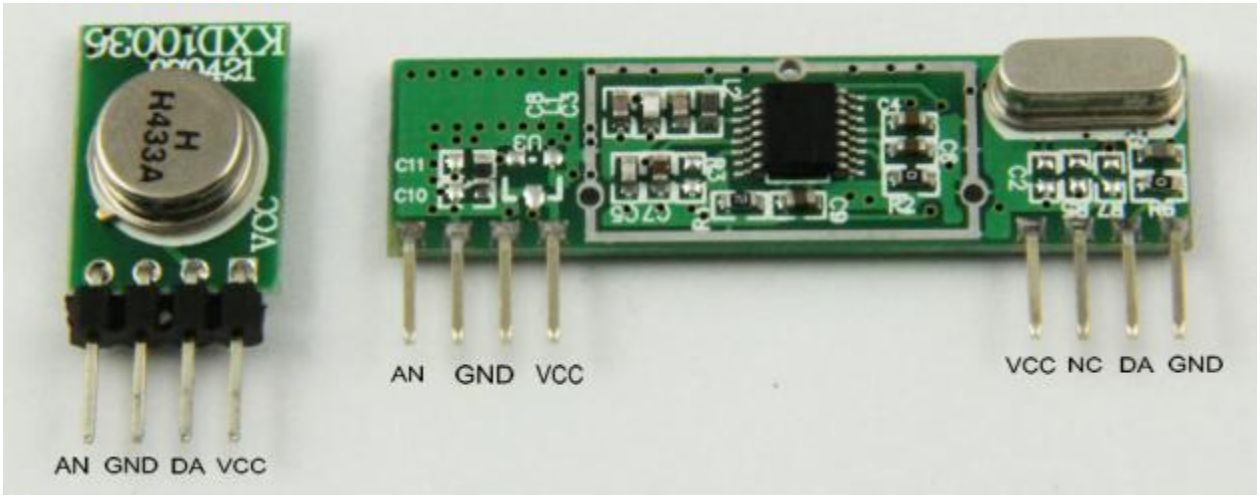
An accelerometer is a one type of sensor and it gives an analog data while moving in the direction of X, Y and Z. These directions depend on the type of sensor. The diagram of accelerometer is shown below. This sensor consists of arrow directions, if we tilt the sensor in one direction, then the data at the particular pin will change in the form of analog. The accelerometer consists of six pins, where the function of each pin is discussed below.



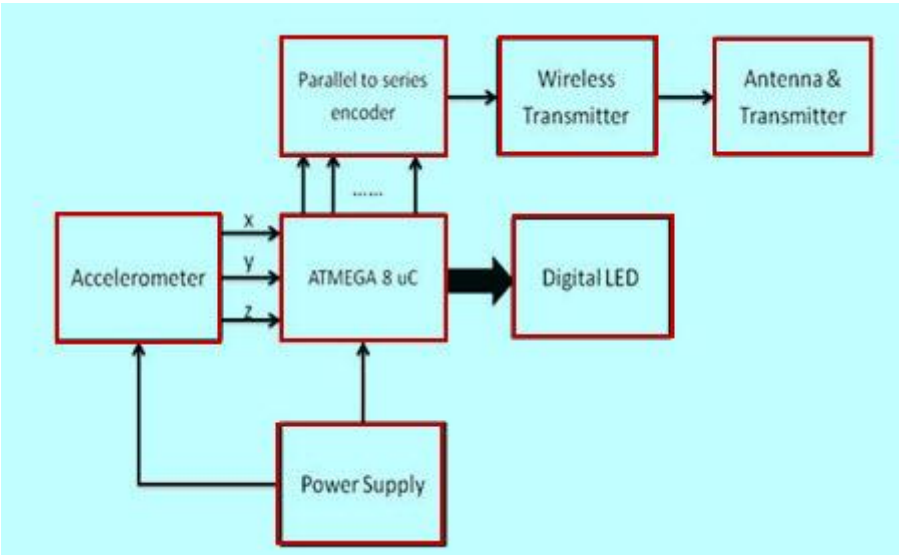
- Pin-1: VDD pin is used to give +5V supply to this pin
- Pin-2: GND pin is connected to the ground for the purpose of biasing
- Pin-3: X pin will receive the data in the X direction
- Pin-4: Y pin will receive the data in the Y direction
- Pin-5: Z pin will receive the data in the Z direction
- Pin-6: ST pin is used to adjust the sensitivity of the accelerometer 1.5g or 2g or 3g or 4g

- **RF 433 Module**




**RF Transmitter:** The RF TX module works with 433MHz frequency and this module is easily availablein the market with low cost.

The major components used in the receiving section include receiver, decoder, microcontroller and motor driver.




Transmitter Section

**RF receiver:** The RF receiver of this project will receive the data which is transferred by the transmitting device.

- **HT12E and HT12D**

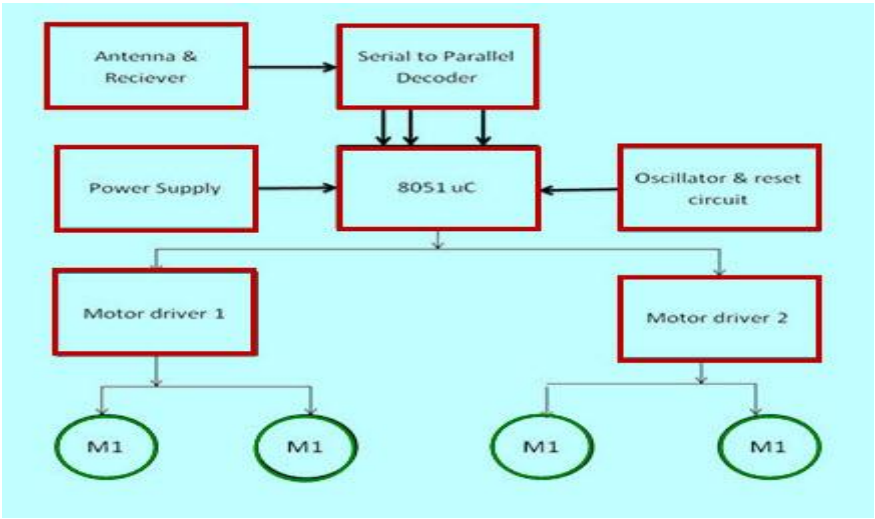
**HT12E: This** encoder is used to encode the 4-bit data and transmits by using an RF transmitter module.

**HT12D**: The decoder is used to change the serial data into parallel data which is received from the RF receiver module.

- **Motor Driver L293DNE**

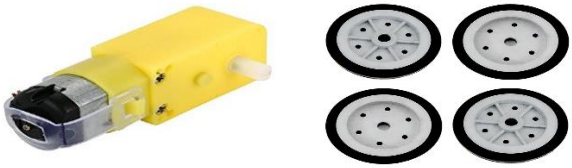
  The motor driver is a device which gives the movement to do a task like a motor. So we require motor driver to run them through the controller. The interface between motor & microcontroller can be done using an L293D motor driver IC in this circuit.

  At the receiver section, an RF receiver module receives the data from the transmitter. The received data can be decoded by an IC HT12D. The received data can be processed by AT89S51 microcontroller and motor driver is used to control the motor.


Receiver Section

- **BO Motor and Wheels**



- **Prototyping Board**

- **Battery and Jumper wires**


**3.2 Software Requirements:**

- **Arduino IDE – 1.6.4**

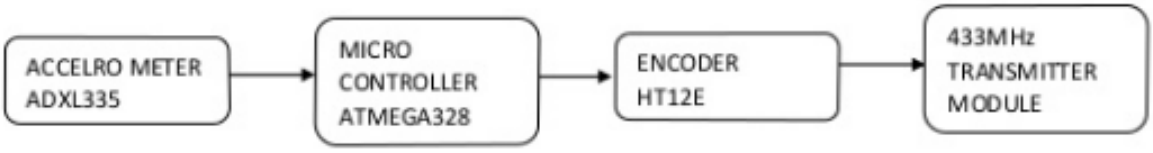
  Arduino is an open-source platform used for building electronics projects consists of both a physical programmable circuit board(often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

  This program uses the functions pin Mode (), digital Write (), and delay (), which are provided by the internal libraries included in the IDE environment. The program is usually loaded in the Arduino by the manufacturer. Arduino IDE and C language allow the programming of the low level registers in the atmega328P. Instructions like DDRB=0b00000001 for changing PORTB input/output pins are allowed. Fig 4.1 shows the basic program of Arduino IDE.

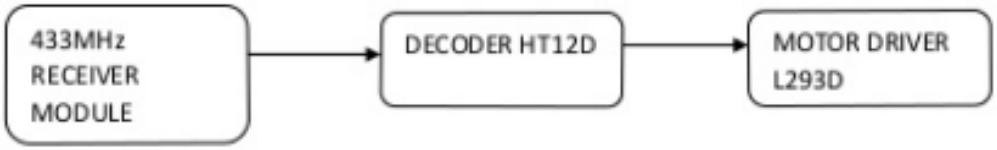
# Chapter 4: MAJOR FUNCTIONALITY

Our gesture controlled Car works on the principle of accelerometer which records hand movements and sends that data to the comparator which assigns proper voltage levels to the recorded movements. That information is then transferred to encoder which makes it ready for RF transmission. On the receiving end, the information is received wirelessly via RF, decoded and then passed onto the microcontroller which takes various decisions based on the received information. These decisions are passed to the motor driver IC which triggers the motors in different configurations to make the robot move in a specific direction. We divided our task into two parts to make the task easy and simple and to avoid complexity and make it error free. The first is the transmitting section which includes the following components: 1) Accelerometer 2) Atmega328(MCU) 3) Encoder IC 4) RF Transmitter Module The second is the receiving end which comprises of following main components: 1) RF Receiver Module 2) Decoder IC ACCELRO METER ADXL335 433MHz receiver module motor driver L293D transmitter module decoder HT12D encoder HT12E

## Chapter 5: FLOW CHART (GRAPHICAL REPRESENTATION OF OUR PROJECT)

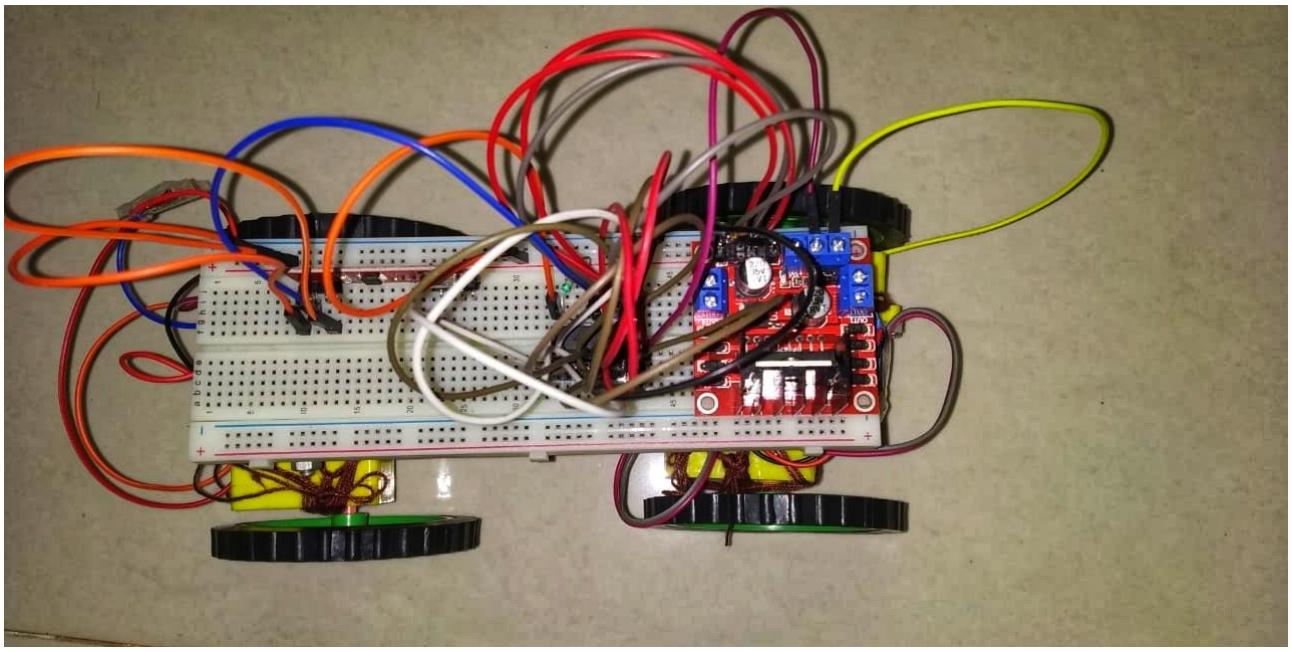


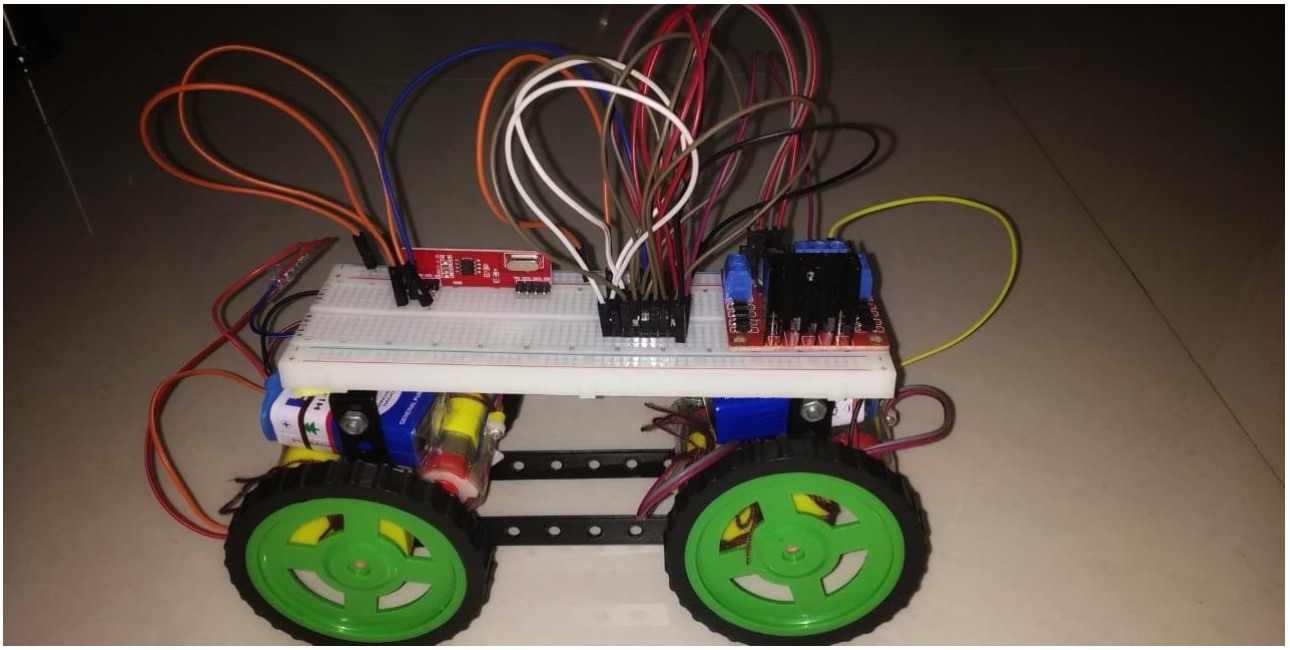

**(A)** TRANSMITTER




**(B)** RECEIVER

# Chapter 6: SCREENSHOTS OF YOUR PROJECT OUTPUT





# Chapter 7: LIMITATIONS OF PROJECT

- The on-board batteries occupy a lot of space and are also quite heavy. We can either use some alternate power source for the batteries or replace the current DC Motors with ones which require less power.
- Secondly, as we are using RF for wireless transmission, the range is quite limited; nearly50- 80m. This problem can be solved by utilizing a GSM module for wireless transmission. The GSM infrastructure is installed almost all over the world. GSM will not only provide wireless connectivity but also quite a large range.
- Thirdly, an on-board camera can be installed for monitoring the robot from faraway places. All we need is a wireless camera which will broadcast and a receiver module which will provide live streaming.

# Chapter 8: OUTCOME

The sign transmission through the radio recurrence segment which has better capacity contrast with IR (infrared) .And primary favourable position of utilizing RF, which can transmit the sign through longer separations this aches extend application, and furthermore sign can travel if there any obstacle between TX and RX. The working recurrence of transmitter and beneficiary is 433MHz and Radio transmitter recipient through the receiving wire stick. The sequential information is transmitted through radio wire and recipient gets the information and changes over to unique type of sign and move to engine driver and engine driver works the engine according to the client hand movement.

- Wireless controlled robots are very useful in many applications like remote surveillance, military etc.
- Hand gesture controlled robot can be used by physically challenged in wheelchairs.
- Hand gesture controlled industrial grade robotic arms can be developed.

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. 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.

# Chapter 9: FUTURE ENHANCEMENT

- The proposed system is applicable in hazardous environment where a camera can be attached to the robot and can be viewed by the user who is in his station. This system can also be employed in medical field where miniature robot are created that can help doctors for efficient surgery operations For more efficient response, threshold values can be used to detect gesture and advanced features such as finger counts that provide different functional commands can be used.
- Wireless controlled robots are very useful in many applications like remote surveillance, military etc.
- Hand gesture controlled robot can be used by physically challenged in wheelchairs.
- Hand gesture controlled industrial grade robotic arms can be developed.
- Entertainment applications – Most video games today are played either on game consoles, arcade units or PCs, and all require a combination of input devices. Gesture recognition can be used to truly immerse players in the game world like never before.
- Automation systems – In homes, offices, transport vehicles and more, gesture recognition can be incorporated to greatly increase usability and reduce the resources necessary to create primary or secondary input systems like remote controls, car entertainment systems with buttons or similar.
- An easier life for the disabled – Gesture recognition technology can eliminate a lot of manual labor and make life much easier for those who aren't as fortunate as most of us are.
- Gesture recognition technology is actually dominated by the videogame industry.

# Chapter 10: REFERENCES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