HAND GESTURE CONTROL ROBOT

Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in

Electrical and Electronics Engineering

by

ABHAY VERMA - 40140001 - EEE

KOWSALYA S - 40140020 - EEE

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI – 600 119

APRIL 2023

SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE
www.sathyabama.ac.in

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **ABHAY VERMA** (Reg. No. 40140001) and **KOWSALYA S** (Reg. No. 40140020) who carried out the project entitled **"HAND GESTURE CONTROL ROBOT"** under our supervision from January 2023 to April 2023.

21/4/2023.

Dr. M. Kavitha
Internal Guide

Dr.V.SIVACHIDAMBARANATHAN
Head of the Department

Submitted for Viva Voce Examination held on 20.04.2023

Name: Dr. P. Sivagami

Signature:

Internal Examiner

External Examiner

DECLARATION

ABHAY VERMA (Reg. No. 40140001) and **KOWSALYA S** (Reg. No. 40140020) who herby declare that the Project Report entitled **"** HAND GESTURE CONTROL ROBOT**"** done by us under the guidance of

Dr. M. Kavitha is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Electrical and Electronics Engineering.

S. Kowsalya

SIGNATURE OF THE CANDIDATE

DATE: 20.04.2023

PLACE: Chennai

ACKNOWLEDGEMENT

We are pleased to acknowledge our sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. We are grateful to them.

We convey our thanks to **Dr. N. M. Nandhita., Dean, School of Electrical and Electronics Engineering** and **Dr. V. Sivachidambaranathan, Head of the Department, Dept. of Electrical and Electronics Engineering** for providing us necessary support and details at the right time during the progressive reviews.

We would like to express our sincere and deep sense of gratitude to our Project Guide **Dr.M. Kavitha** for his valuable guidance, suggestions and constant encouragement paved way for the successful completion of our project work.

We wish to express our thanks to all Teaching and Non-teaching staff members of the Department of Electrical and Electronics Engineering who were helpful in many ways for the completion of the project.

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.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 GENERAL BACKGROUND

Nowadays, robotics are 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 Arduino Nano, Accelerometer(MPU6050), RF Transmitter, HT-12E Encoder. At the receiving end an RF Receiver module receives the encoded data and decode it by and decoder IC(HT12D). This data is then processed by an Arduino UNO and finally our motor driver to control the motor's. Now it’s time to break the task in different module's to make the task easy and simple any project become easy or error free if it is done in different modules. As our project is already divided into two different part transmitter and receiver. The applications of robotics mainly involve in automobiles, medical, construction, defense 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.

1.2 GLOBAL SCENARIO ON HAND GESTURE CONTROL ROBOT

Wires were used to operate robots in the early stages of robotics. This was the physical connection between the robot and the Stoner controller. As a result, the range depends on the length of the cable. Originally, humans and Stoner issued commands by hand and captured them with the camera, so the images from the robot's camera are reused and passed to Stoner. The command will be provided to the robot if the picture has already been registered in the library, and the command will be respected and passed to the robot if the optimized library provides a replacement command. The hardest part of this concept is when you have a true library of hand movements. Capturing and sending hand gestures to cross-reference with the photos in the library will take some time thanks to the various instructions that exist in the library.

The new proposed system aims to compile a list of the power meter system's flaws and limitations. The robot in the proposed method is constantly controlled by human hand movements. The accelerometer detector in the transmitter circuit detects the stoner's hand tilt position and outputs a unique analogue reading that is relayed to the receiver through the RF transmitter. These values are sent to the robot's motor via the AT89C51 MCU on the receiver side. This allows the robot to move back and forth and left and right.

1.3 PROBLEM STATEMENT

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.

1.4 OBJECTIVES

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.

1.5 SCOPE

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 videogames 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 a player 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 – One of the biggest challenges faced today is providing separate and equally non cumbersome services to the differently abled and handicapped. While there are special provisions around the world, there's still huge room for improvement to bring all lives on equal footing. 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.

These are just a handful of the places and situations in which gesture recognition technology can be implemented, and as is evident, can totally change the way we interact with the world around us, not only at home, but in commercial venues as well.

CHAPTER 2

LITERATURE SURVEY

Moniruzzaman Bhuiyan and Rich Picking in Centre for Applied Internet Research (CAIR), Glyndŵr University, Wrexham, UK, proposed a review of the history of Gesture controlled user interface, and identifies trends in technology, application and usability. Their findings conclude that GCUI[1]affords realistic opportunities for specific application areas, and especially for users who are uncomfortable with more commonly used input devices. They have tried collated chronographic research information which covers the past 30years. They investigated different types of gestures, its users, applications, technology, issues addressed, results and interfaces from existing research. They consider the next direction of gesture-controlled user interfaces as rich user interface using gestures seems appropriate for current and future ubiquitous and ambient devices. Moniruzzaman Bhuiyan, Rich Picking of Institute of Information technology, University of Dhaka, Dhaka, Bangladesh; Centre for Applied Internet Research, Glyndwr University, Wrexham, United Kingdom on September 2011 in Journal of Software Engineering and to meet the challenges of ubiquitous computing, ambient technologies and an increasingly older population, researchers have been trying to break away from traditional modes of interaction. A history of studies over the past 30 years reported in this paper suggests that Gesture Controlled User Interfaces (GCUI) now provide realistic and affordable opportunities, which may be appropriate for older and disabled people. They have developed a GCUI prototype application, called Open Gesture, to help users carry out everyday activities such as making phone calls, controlling their television and performing mathematical calculations. Open Gesture uses simple hand gestures to perform a diverse range of tasks via a television interface. They describes Open Gesture and reports its usability evaluation. They conclude that this inclusive technology offers some potential to improve the independence and quality of life of older and disabled users along with general users, although there remain significant challenges to be overcome. Stefan Waldherr, Roseli Romero, Sebastian Thrun describes a gesture interface for the control of a mobile robot equipped with a manipulator. The interface uses a camera to track a person and recognize gestures involving arm motion. A fast, adaptive tracking algorithm enables the robot to track and follow a person reliably through office environments with changing

lighting conditions. Two alternative methods for gesture recognition are compared: a template-based approach and a neural network approach. Both are combined with the Viterbi algorithm for the recognition of gestures defined through arm motion (in addition to static arm poses). Results are reported in the context of an interactive clean-up task, where a person guides the robot to specific locations that need to be cleaned and instructs the robot to pick up trash. This paper discusses a proposed hand gesture-based control design for mobile robots. Mobile robots can move in response to hand gestures that convey control signals. Image processing, image counter processing, and other techniques are used to recognize gestures. The control of a mobile robot is based on information that has been recognized and decoded. The user's gestures direct the movement of the mobile robot in this project. This model consists of transmitter unit with PIC Microcontroller for recognition of gestures. The instructions will be followed by the receiver unit (mobile robot) with PIC Microcontroller. This system was created at a low cost and with a high level of efficiency. The goal of this project is to use hand gestures to operate a mobile robot. To do this, the recorded hand pictures are processed using a circular Hough transform-based method to determine the appropriate targets. Then, to regulate the robot's motion, control signals are supplied to the receiver unit. This paper describes how humans can communicate with robots using basic hand gestures. This can be done using a Leap motion sensor. We suppose that the robot is capable of emotional interaction in this scenario. This study helps us to understand how human can interact with a robot using effective hand gestures. In this paper, they show a hand-gesture-based control interface for navigating a car-robot. A three-axis accelerometer records the user's hand motions. Any form of connection is used to provide data wirelessly to a microcontroller. The received signals are then converted into one of six car-robot navigational control commands. This paper presents a method of controlling an automata with hand gestures using the Arduino Lilypad. A motion device attached on the hand gloves is used to control the projected model. This style's major goal is to control the robot victimisation hand gesture. The main purpose of this project is to control the robotic arm's movement using an accelerometer/gyroscope-based gesture controller, that's far more convenient than using a joystick or keyboard. This paper's main contribution is the development of a simple and effective object detection system on the robot's physical model. The experimental results are used to assess the suggested object detection algorithm and gesture controller. In this paper, hand gestures are used to operate a robot. They proposed a new user hand detection method, as well as hand gesture detection that relies on the robot's camera to recognize the hand in successive frames. They were able to get the robot to follow the detected hand. In future study subjects, the detection rate of the hand will be raised.

CHAPTER 3

PROJECT DESCRIPTION

3.1 BLOCK DIAGRAM

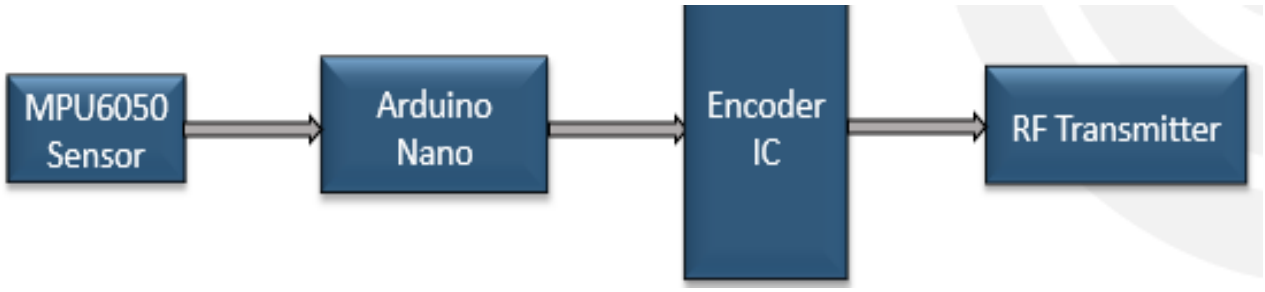

Figure 3.1: Block diagram of transmitter

Figure 3.2: Block diagram of receiver

3.2 PROPOSED METHODOLOGY

3.2.1 METHODOLOGY FOR COMMUNICATION SIGNAL

3.2.1.1 TRANSMITTER MODULE

An RF transmitter module is a small PCB i.e., printed circuit board sub-assembly capable of transmitting a radio wave and modulating that wave to carry data. Transmitter modules are usually implemented alongside a micro controller which will provide data to the module which is transmitted. RF transmitters are usually subject to regulatory requirements which dictate the maximum allowable transmitter power output, harmonics and band edge requirement.

3.2.1.2 RECEIVER MODULE

An RF Receiver module nRF24L01 is 433 MHz radio receiver receives the modulated RF signal, and then it demodulates . There are two types of RF receiver module. Super-regenerative modules are usually of low cost and low power designs using a series of amplifiers use to extract modulated data from a carrier wave. Super-regenerative modules are generally imprecise as their frequency of operation varies in a fair amount with temperature and power supply voltage. Super heterodyne receivers having a performance advantage over super-regenerative; they offer increased an accuracy and stability over a large voltage and temperature range. This stability comes from a fixed crystal design which in turn leads to a comparatively more expensive product. Radio receiver which receives the transmitted coded from the remote place these codes are converted to digital format and output is available to the pin no 2 of the ic2 master microcontroller; this is the pin of inbuilt art of the microcontroller. We Based on the input codes master will give command to slave microcontroller and robot will behave as follows.

- Moves in forward direction
- Moves in reverse direction,
- Speed controls in both the direction
- It can even turn left or right while moving forward or in reverse direction.
- In case of bump, moves reverse turn left or right and wail for the next instruction.
- On the spot left or right turn to pass through the narrow space
- We have also added head light, back light and turning lights to left a right .

3.2.2 METHODOLOGY FOR MOTION CONTROL

L298N is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers as they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L298N contains two inbuilt H-bridge driver circuits. In common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state. This project controls a remote robot through RF. The ordinary 433 MHz RF modules are used in this project. Arduino microcontroller is used in this project. These robots are used basically for industrial applications. This is an improved version of the joy stick control robot which has been designed years ago. Intelligent spy robot project has been designed for the spying purpose .it is radio controlled and can be operated at a radial distance of 100m radius. Most probably our army youth need to venture into the enemy area just to track their activities. Which is often a very risky job and may cost precious life? Such dangerous job could be done using small spy robot all the developed and advance nations are in the process of making it, a robot that can fight against enemy. Our robot us just a step towards similar activity. Heart of our robot is microcontroller, we are using ARDUINO uno, ARDUINO nano in these two microcontrollers the first microcontroller which acts as a transmitter micro controller, encodes all the commands to RF transmitter. Then, the RECEIVER Microcontroller is responsible for executing all the commands from the transmitter through the RF transmitter and it gives the command to moto driver circuit which drives 4 Nos. of. Motors. Transmission through RF (Radio frequency) is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line Of sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (TX/RX) pair operates at a frequency of 433MHz an RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps-10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.

CHAPTER 4

SIMULATION AND HARDARE

4.1 LIST OF COMPONENTS

- MPU6050
- ARDUINO NANO
- HT-12E
- RF TRANSMITTER
- RF RECEIVER
- HT-12D
- ARDUINO UNO
- L298 MOTOR DRIVER

4.2 COMPONENTS DESCRIPTION

4.2.1 MPU6050

The MPU6050 is a Micro Electro-Mechanical Systems (**MEMS**) which consists of a 3-axis Accelerometer and 3-axis Gyroscope inside it. This helps us to measure acceleration, velocity, orientation, displacement and many other motions related parameter of a system or object. This module also has a (DMP) Digital Motion Processor inside it which is powerful enough to perform complex calculation and thus free up the work for Microcontroller.

The module also have two auxiliary pins which can be used to interface external IIC modules like a magnetometer, however it is optional. Since the IIC address of the module is configurable more than one **MPU6050 sensor** can be interfaced to a Microcontroller using the AD0 pin. This module also has well documented and revised libraries available hence it's very easy to use with famous platforms like Arduino. So if you are looking for a sensor to control motion for your **RC Car**, **Drone**, **Self-balancing Robot**, **Humanoid**, **Biped** or something like that then this sensor might be the right choice for you.

Figure 4.1: MPU6050

4.2.1.1 MPU6050 FEAUTURES

- ✓ MEMS 3-aixs accelerometer and 3-axis gyroscope values combined
- ✓ Power Supply: 3-5V
- ✓ Communication : I2C protocol
- ✓ Built-in 16-bit ADC provides high accuracy
- ✓ Built-in DMP provides high computational power
- ✓ Can be used to interface with other IIC devices like magnetometer
- ✓ Configurable IIC Address
- ✓ In-built Temperature sensor
- ✓

4.2.2 ARDUINO NANO

Arduino Nano is one type of microcontroller board, and it is designed by Arduino.cc. It can be built with a microcontroller like Atmega328. This microcontroller is also used in Arduino UNO. It is a small size board and also flexible with a wide variety of applications. Other Arduino boards mainly include Arduino Mega, Arduino Pro Mini, Arduino UNO, Arduino YUN, Arduino Lilypad, Arduino Leonardo, and Arduino Due. This board has many functions and features like an Arduino Duemilanove board. However, this Nano board is different in packaging. It doesn't have any DC jack so that the power supply can be given using a small USB port otherwise straightly connected to the pins like VCC & GND. This board can be supplied with 6 to 20volts using a mini-USB port on the board.

Figure 4.2: Arduino Nano

4.2.2.1 FEATURES

- ✓ ATmega328P Microcontroller is from 8-bit AVR family
- ✓ Operating voltage is 5V
- ✓ Input voltage (Vin) is 7V to 12V
- ✓ Input/Output Pins are 22
- ✓ Analog i/p pins are 6 from A0 to A5
- ✓ Digital pins are 14

4.2.2.2 ARDUINO NANO PINOUT

Power Pin (Vin, 3.3V, 5V, GND): These pins are power pins

- Vin is the input voltage of the board, and it is used when an external power source is used from 7V to 12V.
- 5V is the regulated power supply voltage of the nano board and it is used to give the supply to the board as well as components.
- 3.3V is the minimum voltage which is generated from the voltage regulator on the board.
- GND is the ground pin of the board

RST Pin(Reset): This pin is used to reset the microcontroller

Analog Pins (A0-A7): These pins are used to calculate the analog voltage of the board within the range of 0V to 5V

I/O Pins (Digital Pins from D0 – D13): These pins are used as an i/p otherwise o/p pins. 0V & 5V

Serial Pins (Tx, Rx): These pins are used to transmit & receive TTL serial data.

External Interrupts (2, 3): These pins are used to activate an interrupt.

PWM (3, 5, 6, 9, 11): These pins are used to provide 8-bit of PWM output.

SPI (10, 11, 12, & 13): These pins are used for supporting SPI communication.

Inbuilt LED (13): This pin is used to activate the LED.

IIC (A4, A5): These pins are used for supporting TWI communication.

AREF: This pin is used to give reference voltage to the input voltage

4.2.3 HT-12E

HT12E is an **encoder integrated circuit** of 2^{12} series of encoders. They are paired with 2^{12} series of decoders for use in remote control system applications. It is mainly used in interfacing RF and infrared circuits. The chosen pair of encoder/decoder should have same number of addresses and data format. Simply put, HT12E converts the parallel inputs into serial output. It encodes the 12-bit parallel data into serial for transmission through an RF transmitter. These 12 bits are divided into 8 address bits and 4 data bits. HT12E has a transmission enable pin which is active low. When a trigger signal is received on TE pin, the programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium. HT12E begins a 4-word transmission cycle upon receipt of a transmission enable. This cycle is repeated as long as TE is kept low. As soon as TE returns to high, the encoder output completes its final cycle and then stops.

4.2.3.1 FEATURES

- ✓ 12-bit Encoder IC to be used with HT12D
- ✓ Encoded data has 4 Data bits and 8 Address bits (8+4=12-bits)
- ✓ Commonly used for RF and IR wireless transmission

- ✓ Wide supply voltage range from 2.4V to 12V, typically 5V is used
- ✓ Low stand by current of 0.1uA at Vcc=5V
- ✓ Available in 16-pin DIP, 20-pin SOP

4.2.4 RF MODULES (RF TRANSMITTER AND RF RECEIVER)

The RF modules are very small in dimension and have a wide operating voltage range i.e. 3V to 12V. Basically the RF modules are 433 MHz RF transmitter and receiver modules. The transmitter draws no power when transmitting logic zero while fully suppressing the carrier frequency thus consume significantly low power in battery operation. The data is sent serially from the transmitter which is received by the tuned receiver. Transmitter and the receiver are duly interfaced to two microcontrollers for data transfer. In many projects, we use RF modules to transmitting and receive the data because it has a high volume of applications than IR. RF signals travel in the transmitter and receiver even when there is an obstruction. It operates at a specific frequency of 433MHz. RF transmitter receives serial data and transmits to the receiver through an antenna which is connected to the 4th pin of the transmitter. When logic 0 applied to transmitter then there is no power supply in the transmitter. When logic 1 is applied to transmitter then the transmitter is ON and there is a high-power supply in the range of 4.5mA with 3V voltage supply.

Figure 4.3: RF Receiver and Transmitting Pair

4.2.4.1 FEATURES

- ✓ Receiver frequency 433MHz
- ✓ Receiver typical frequency 105Dbm
- ✓ Receiver supply current 3.5mA
- ✓ Low power consumption
- ✓ Receiver operating voltage 5v

- ✓ Transmitter frequency range 433.92MHz
- ✓ Transmitter supply voltage 3v~6v
- ✓ Transmitter output power 4v~12v

4.2.5 HT-12D

HT12D is a 212 series decoder IC (Integrated Circuit) for remote control applications manufactured by Holtek. It is commonly used for radio frequency (RF) wireless applications. By using the paired HT12E encoder and HT12D decoder we can transmit 12 bits of parallel data serially. HT12D simply converts serial data to its input (may be received through RF receiver) to 12-bit parallel data. These 12-bit parallel data is divided in to 8 address bits and 4 data bits. Using 8 address bits we can provide 8-bit security code for 4-bit data and can be used to address multiple receivers by using the same transmitter. HT12D is a CMOS LSI IC and is capable of operating in a wide voltage range from 2.4V to 12V. Its power consumption is low and has high immunity against noise. The received data is checked 3 times for more accuracy. It has built in oscillator; we need to connect only a small external resistor. As HT12E, it is available in 18 pin DIP (Dual Inline Package) and 20 pin SOP (Small Outline Package) as given below.

4.2.5.1 FEATURES

- ✓ Operating voltage: 2.4V~12V.
- ✓ Low power and high noise immunity CMOS technology.
- ✓ Low standby current.
- ✓ Capable of decoding 12 bits of information.
- ✓ Binary address setting.
- ✓ Received codes are checked 3 times.
- ✓ Address/Data number combination.
- ✓ HT12D: 8 address bits and 4 data bits.

4.2.6 ARDUINO UNO

The Arduino Uno is one kind of microcontroller board based on ATmega328, and Uno is an Italian term which means one. Arduino Uno is named for marking the upcoming release of microcontroller board namely Arduino Uno Board 1.0. This board includes digital I/O pins-14, a power jack, analog i/ps-6, ceramic resonator-

A16 MHz, a USB connection, an RST button, and an ICSP header. All these can support the microcontroller for further operation by connecting this board to the computer. The power supply of this board can be done with the help of an AC to DC adapter, a USB cable, otherwise a battery. This article discusses what is an Arduino Uno microcontroller, pin configuration, Arduino Uno specifications or features, and applications. The ATmega328 is one kind of single-chip microcontroller formed with Atmel within the megaAVR family. The architecture of this Arduino Uno is a customized Harvard architecture with 8-bit RISC processor core. Other boards of Arduino Uno include Arduino Pro Mini, Arduino Nano, Arduino Due, Arduino Mega, and Arduino Leonardo.

Figure 4.4: Arduino UNO

4.2.6.1 FEATURES

- ✓ The operating voltage is 5V
- ✓ The recommended input voltage will range from 7v to 12V
- ✓ The input voltage ranges from 6v to 20V
- ✓ Digital input/output pins are 14
- ✓ Analog i/p pins are 6
- ✓ DC Current for each input/output pin is 40 mA
- ✓ DC Current for 3.3V Pin is 50 mA
- ✓ Flash Memory is 32 KB
- ✓ SRAM is 2 KB
- ✓ EEPROM is 1 KB
- ✓ CLK Speed is 16 MHz

4.2.6.2 ARDUINO UNO PINOUT

The 14 digital pins on the Arduino Uno can be used as input & output with the help of the functions like pinMode(), digitalWrite(), & Digital Read().

Pin1 (TX) & Pin0 (RX) (Serial): This pin is used to transmit & receive TTL serial data, and these are connected to the ATmega8U2 USB to TTL Serial chip equivalent pins.

Pin 2 & Pin 3 (External Interrupts): External pins can be connected to activate an interrupt over a low value, change in value.

Pins 3, 5, 6, 9, 10, & 11 (PWM): This pin gives 8-bit PWM o/p by the function of analogWrite().

SPI Pins (Pin-10 (SS), Pin-11 (MOSI), Pin-12 (MISO), Pin-13 (SCK): These pins maintain SPI-communication, even though offered by the fundamental hardware, is not presently included within the Arduino language.

Pin-13(LED): The inbuilt LED can be connected to pin-13 (digital pin). As the HIGH-value pin, the light emitting diode is activated, whenever the pin is LOW.

Pin-4 (SDA) & Pin-5 (SCL) (I2C): It supports TWI-communication with the help of the Wire library.

AREF (Reference Voltage): The reference voltage is for the analog i/p's with analogReference().

Reset Pin: This pin is used for reset (RST) the microcontroller.

4.2.7 L298 MOTOR DRIVER

L298N module is a high voltage, high current dual full-bridge motor driver module for controlling DC motor and stepper motor. It can control both the speed and rotation direction of two DC motors. This module consists of an L298 dual-channel H-Bridge motor driver IC. This module uses two techniques for the control speed and rotation direction of the DC motors. These are PWM – For controlling the speed and H-Bridge – For controlling rotation direction. These modules can control two DC motor or one stepper motor at the same time. L298 is a high voltage, high current dual full-bridge motor driver IC. It accepts standard TTL logic levels (Control Logic) and controls inductive loads such as relays, solenoids, DC and Stepper motors. This is a 15 pin IC. According to the L298 datasheet, its operating voltage is +5 to +46V, and the maximum current allowed

to draw through each output 3A. This IC has two enable inputs, these are provided to enable or disable the device independently of the input signals.

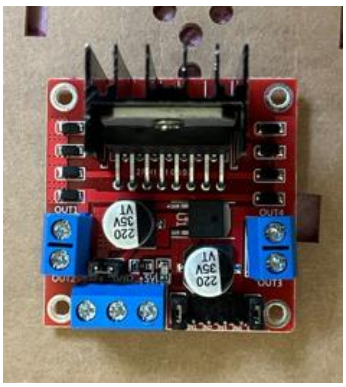

Figure 4.5: L298 Motor Driver

4.2.7.1 FEATURES

- ✓ Operating supply voltage up to 46v.
- ✓ Low saturation voltage.
- ✓ Total dc current up to 4a.
- ✓ Logical \"0\" input voltage up to 1.5 v (high noise immunity)
- ✓ Overtemperature protection.

4.3 SIMULATION

4.3.1 WORKING

- ➢ In this project, a mobile robot that is controlled by the gestures made by the hand, is designed. The working of the robot is explained here,
- ➢ As mentioned earlier, the gesture-controlled robot is a wireless operated robot and has two parts: Transmitter and Receiver. When the robot is powered on, the transmitter part, which consists of Arduino Nano, MPU6050 , Encoder and RF Transmitter, will continuously monitor the MPU6050 sensor.
- ➢ This data is captured by the Arduino Nano, which then transmits a corresponding data to the Encoder, based on the orientation of the MPU6050 Sensor. The parallel data received by the encoder is converted into serial data and this serial data is transmitted by the RF Transmitter.

- At the receiver section, the RF Receiver receives the serial data and transmits it to the Decoder IC. Decoder will convert the serial data to parallel data and this parallel data is given to the Arduino UNO. The Arduino UNO continuously receives the data from the receiver. The Arduino UNO will send the appropriate signals to the motor driver IC. Based on the data, the movement of the motors, and hence the movement of the robot is defined.

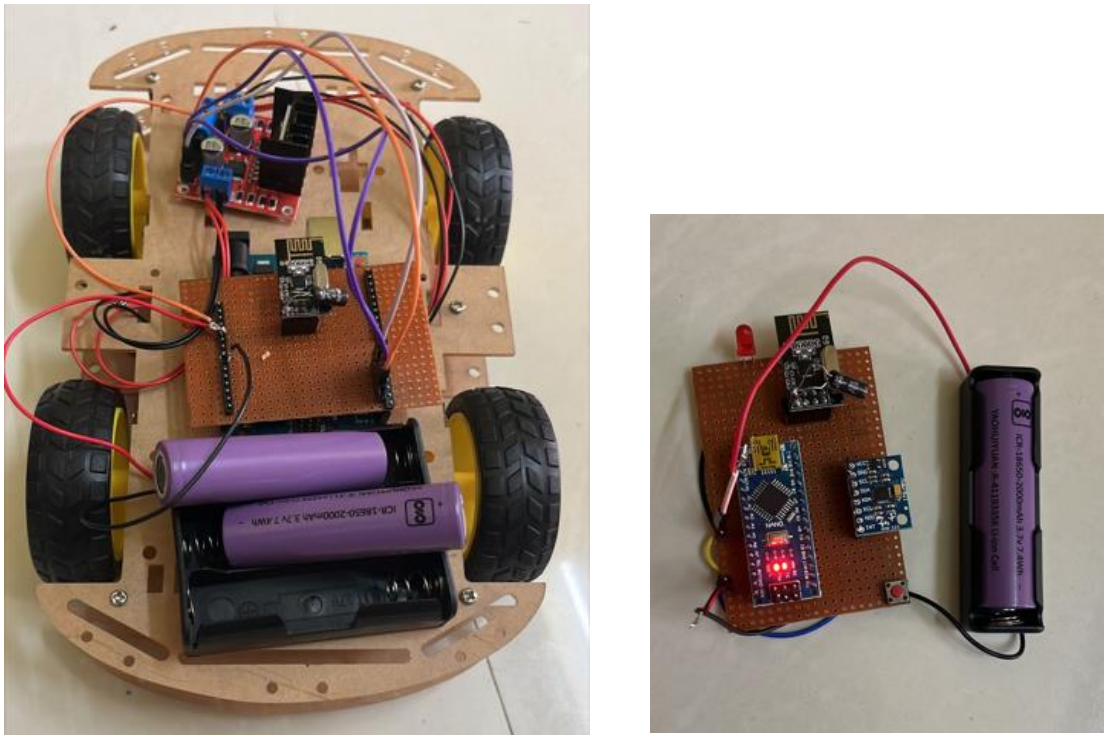

Figure 4.6: Hand Gesture Control Robot

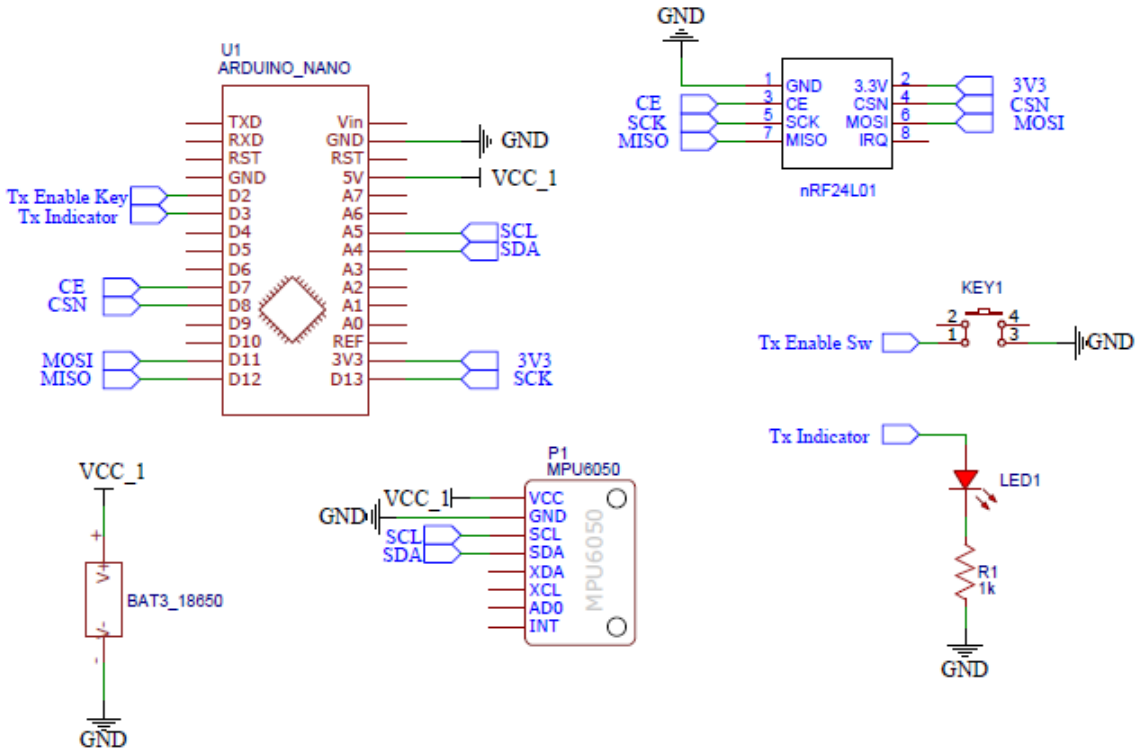

Figure 4.7 Schematic Diagram of Transmitter

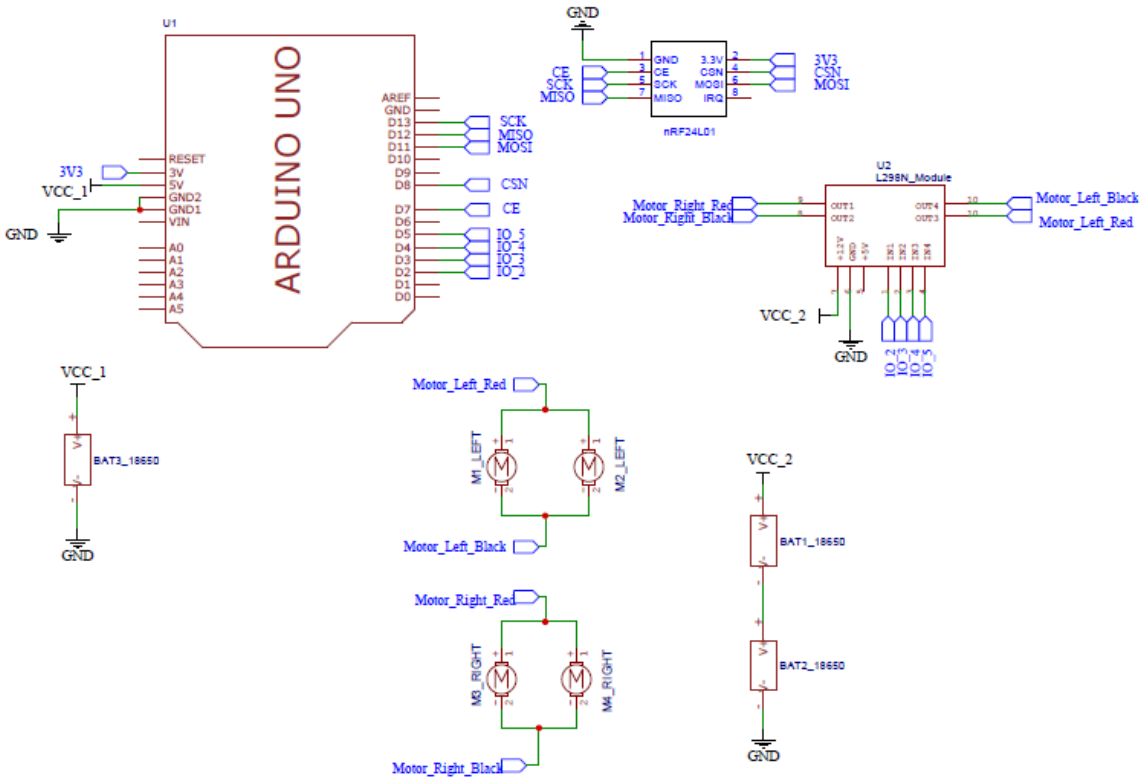

Figure 4.7 Schematic Diagram of Receiver

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

4.1 SUMMARY

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 analysed 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.

4.2 FUTURE SCOPE

- 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.

- 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.
- **Entertainment applications –** Most videogames 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 a 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.

REFERENCES

1. Nitin and Naresh, "Gesture Controlled Robot PPT", URL Available [http://seminarprojects.com/s/hand-gesturecontrolled-robot-ppt
2. Naveet Kumar, Neeraj Purohit, "Gesture Controlled Tank Toy User Guide" URL Available [http://www.slideshare.net/neeraj18290/wireless-gesturecontrolled-tank-toy-transmitter]Accessed 13 October 2013.
3. Jochen Triesch and Christoph Von Der Malsburg "Robotic Gesture Recognition (1997)"URL Available [http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.37.5427] Accessed 15 October 2013.
4. "Real-Time Robotic Hand Control Using Hand Gestures" by Jagdish Lal Raheja, Radhey Shyam, G. Arun Rajsekhar and P. Bhanu Prasad.
5. Bhosale Prasad S., Bunage Yogesh B. and Shinde Swapnil V. "Hand Gesture Controlled Robot" URL Available
6. [http://www.engineersgarage.com/contribution/accelero meter-based-hand-gesture-controlled-robot] Accessed 3 November, 2013.
7. [http://www.robotplatform.com/howto/L293/motor_driver_1.html] Accessed 5 November, 2013.
8. [http://en.wikipedia.org/wiki/Gesture_interface]Accessed 5 November, 2013.
9. [http://www.wisegeek.com/what-is-a-gear-motor.htm] Accessed 6 November, 2013.
10. [http://www.scribd.com/doc/98400320/InTech-RealTime-Robotic-Hand-Control-Using-Hand-Gestures]Accessed 6 November, 2013.