RC BASED AUTONOMOUS REAL ELECTRIC CAR

A thesis submitted by:

1. Faraz Ali Shaikh(G.L) (18ES116)
2. Abdul Samad (18ES34)
3. Abdul Wajid (18ES112)

Supervisor

Engr.Qudsia Memon

Co-Supervisor

Dr. Fateh Abbasi/Dr Sanam Narejo

Submitted in the Partial Fulfillment of the requirements for the degree of Bachelor of Electronics Engineering.

Department Of Electronics Engineering

MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY, JAMSHORO

October, 2022

CERTIFICATE

This is to certify that Project/Thesis Report on **"RC-based autonomous real electric car"** is submitted in partial fulfillment of the requirement for the degree of Bachelor of Electronic Engineering by the following students:

Name of Students:	Roll No:
1. Faraz Ali Shaikh(G.L)	18ES116
2. Abdul Samad	18ES34
3. Abdul wajid Jan	18ES112

Engr. Qudsia memon

Project/Thesis Supervisor

Prof.Dr fateh abbasi/Mam Sanam Narejo

Project/Thesis Co-Supervisor

____

(Chairperson, Department of Electronic Engineering)

Dated: ______________

ACKNOWLEDGEMENT

All the Greetings, prayer and submissions are for Allah, the only omnipotent and sustainer of the Universe, Who bestowed us with his mercy to carry out this dissertation, practical requirement for the Degree of Bachelors of Electronics Engineering.

This dissertation would not have come into being without the guidance of our supervisor

Engr. Qudsia Memon, She has been very supportive and her feedback has greatly improved our work. We also thank her for directing us to other people involved in making of "RC BASED AUTONOMOUS REAL ELECTRIC CAR" all of whom we have learned much from:

Prof. Dr. Fateh Muhammad Abbasi and Mam. Sanam Narejo: Our Co-Supervisors, who provided us such a wonderful idea that enhanced our thinking in making this project and helped us in all possible ways, providing us hardware plans and programming plans which made creation of "RC BASED AUTONOMOUS REAL ELECTRIC CAR" much easier. We also thank him for granting us access to his equipment's, access to all the laboratories and his earlier projects.

We all members would express profound gratitude to prof. Dr Mukhtiar Uner Dean Faculty of Electrical, Electronics and Computer Engineering (FEECE) for supporting us and providing us facilities, without them we could not have completed this creation.

We are thankful and fortunate enough to get constant encouragement from Chairperson Prof. Dr Nighat, support and guidance from all Faculty members and staff specially Mam Attiya Baqai head of Projects of the Electronics Engineering Department who helped us in successfully completing our project work. We are in debt of all of them for their support.

Abstract

Since practically everything in the modern world is designed to be easily accessible to people, just a small fraction is taken from it and put into practice using current technology. Today, moving from one place to another in urban areas is challenging due to the daily increase in traffic; it can take hours to travel a few kilometers. These types of situations are more challenging for manual car drivers because the disabled have trouble driving the vehicle to the destination place and the drivers must drive slowly in conditions of major traffic jams. We have developed an "RC autonomous vehicle" to help prevent this issue and give drivers and individuals with disabilities some relief.

CONTENTS

Table of figure

ABBREVIATIONS

RC: REMOTE CONTROLLER

LIDAR: LIGHT DETECTION AND RANGING

RADAR: RADIO DETECTION AND RANGING

PMW: PULSE WIDTH MODULATION

SDGs: SUSTAINABLE DEVELOPMENT GOALS

THESIS LAYOUT:

This thesis consists of five chapters as mentioned below:

Chapter 1 consists of the introduction.

Chapter 2 consists of the details about the literature review and research gap surveyed.

Chapter 3 consists of the design methodology for our project.

Chapter 4 consists of the results and discussion portion.

Chapter 5 consists of the conclusion and future recommendation part or summary.

CHAPTER 1

INTRODUCTION

1.1 Introduction

In the fast-paced world of today, advancements are made at every level. Speaking of the vehicle, it has advanced to the point where many automobile kinds, from little prototypes to larger electric vehicles, are now visible in the real world. Each vehicle has unique requirements depending on the situation. Moving backward a little, we have seen large, heavy cars with numerous components that are larger in weight, the cause of environmental heat impacts, and not automatically working. A disabled person has difficulty moving around and operating a vehicle to operate the vehicle that effectively, they require a second person. The issue is that the outdated technology caused friction, necessitating the purchase of oil lubricants. Most autos still contain these two items. However, the fuel consumption of cars was the main problem, which contributed to greater costs in Pakistan today. For this reason, the idea of the electric automobile was invented, which generates power to move or start the car using charging electricity. The principles for voltages were significantly altered, and solar panels were included inside the cars. These cars worked effectively in that they could travel during the day using heat or sunlight to generate electricity, and at night they could move with the help of a charged system. The battery is charged and electricity is generated throughout the day so that it can be used at night. Isn't it fantastic how the introduction of electric automobiles with solar capacity has solved the issue of gasoline consumption? This vehicle is introduced and addresses a further difficulty for disabled people who do not drive. The vehicle's foundation is RC Autonomous. This vehicle is operated automatically, manually, and both with and without a driver. The car is simple to move, and this system is useful for those with disabilities.

The majority of the globe is implementing all of these vehicle advancements, which are currently in their development stage, with the overall goal of finding a more straightforward answer to the manually driven vehicle problem.

1.2 Problem statement:

The problem is always best discovered by first providing a thorough description of it. By keeping an eye on the current surroundings. Since we have been concentrating on people with disabilities, we are aware that most people are unaware of how to drive. Most accidents in these situations can happen if someone is rushing to go somewhere and the driver is not available. Both of these groups struggle with the difficulties of not knowing how to drive or being unable to drive. The second research gap we've included in our problem statement circle is about replacing vehicles with greater fuel consumption ones. These are the problem statements that we have taken into our consideration and have worked on in order to resolve these problems.

1.3 PROJECT IDEA:

The RC-based system is the solution to this problem. We had developed the model named "RC based autonomous electric real car" that can be a solution for a handicapped person mostly and also for those people who could not learn driving or are afraid to drive a car due to some reason or incidents.

1.4 MOTIVATION:

The motivation behind our project idea is primarily to focus on people who are differently abled or handicapped because driving a car is becoming increasingly difficult for everyone, including normal people, as a result of increased traffic on the roads. As a result, these individuals don't fully enjoy their lives like normal people or encounter problems in their daily lives. The second focus in our background was on those who don't know how to drive or don't want to learn because they are either afraid to drive because of past experiences or don't have an interest in doing so. We observed and concentrated on these challenges faced by regular people and developed a solution.

We purchased an RC-based autonomous electric car with automated driving for those who are unable to drive as well as for those who choose to focus on driving or have manual driving skills and do not wish to acquire an automatic driving feature to be used. Additionally, solar panels are used to power the system.

1.5 AIM AND OBJECTIVES

1.5.1 AIM

The aim of our project is to build the" RC based autonomous electric real car" that can help the handicapped person and also helping those people who don't know driving.

1.6 OBJECTIVES

- To design a model of light weighted car.
- To control breaks and accelerator of designed car.
- To control the steering of designed car.
- To convert it on autonomous and manual RC.
- Test this vehicle over the roads

CHAPTER 2

LITERETURE REVIEW

2.1 Introduction

Recent work on an autonomous real-world electric automobile based on RC is included in this section. Numerous studies have defined the fundamental operating principle of the RC-based autonomous real electric car. The RC-based system can be controlled in two different ways: remotely and manually. The second way is autonomous control. The range of an RC base that is manually operated by a remote control is limited (up to 1km). The automobile is fully controlled in autonomous mode and the brakes and steering are automatically applied. The signal from the sensor is sent to an Arduino Mega, which then relays it to the motor. This project is an actual, autonomous electric car that runs on RC. This chapter reviews the outcomes of both manual and autonomous car.

2.2 Literature review

In order to deliver secure and system-compliant performance in crowded, complex environments while emulating the unpredictable interactions with other traffic participants, planning approaches must be developed. Additionally, difficulties with dependability and safety are brought up by new paradigms like interactive planning and end-to-end learning that need to be addressed. Machine learning is used in this research. [1]

This research examined a wide range of vision cameras, LiDAR sensors, and radar sensors as well as the various operational scenarios in which they may be utilized in autonomous cars in order to assess the technical performance and capabilities of these sensors. We give a quick review of the three main types of sensor calibration, look into the open-source multi-sensor calibration tools that are currently available, and see how well they work with different commercial sensors. Along with the most recent multi-sensor fusion techniques and algorithms for object recognition in autonomous driving applications, we also discuss the three primary approaches to sensor fusion. As a result, the present work offers a comprehensive analysis of the hardware and software techniques needed for sensor fusion object detection. [2]

Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
NO Automation All driving duties will be carried out by a human driver. For example, steering and acceleration.	**Driver Assistance** The vehicle features a single automated system driver assistance, such as steering or acceleration/declaration and with the anticipated that the human driver performs all remain aspects of the driving task.	**Partial Automation** ADAS, the vehicle performs steering and accelerating /declaration. However, the human driver is required to monitor the driving environment and can take control at any time.	**Conditional Automation** The vehicle can detect obstacles in the driving environment and can perform most driving tasks. Through human over side is still required.	**High Automated** The vehicle can perform all aspects of the dynamic driving task under specific scenario. Geo fencing is required. Human override is still an option.	**Full Automated** The vehicle perform sell driving tasks under all condition and scenario without human intervention
The human drivers monitor the driving environment			**The Automated system monitor the driving environment**		

This study is based on a car interface built with Arduino and the Arduino IDE. The smartphone app and other sensors were connected to this Arduino. Carefully checking the logic to reduce hardware loss or damage. Customers will need to utilize an android application that we must create in order to communicate with the Arduino-powered vehicle. The interface is easy to use, and the Arduino CPU replies via Bluetooth after receiving instructions from the user for a variety of tasks through the interface. We'll use Android Studio to build the Android application, which gives us additional capacity and stability. We tested this after finishing it [3].

This article discusses the development of a robotic vehicle with hardware control, lane detection, mapping, localization, and path planning capabilities. Our goal is to create a fully autonomous, dependable, and potent system that can find the best route along a single lane of white-lined track. We use two more strategies to identify the track borders. A polyline technique that uses simple image processing and a road model and a RANSAC method that approximates the lines using random splines sampling. By combining Odom try and visual data, a simultaneous localization and mapping method based on particle filters is used to map the surroundings.4]

We examine the effectiveness of incorporating these sensors into a prototype robotic model in this research and present the corresponding findings. According to the findings, IR sensing can successfully replace RADAR-based systems for object recognition and forward route guidance. Proportional-integral (PI) control is employed on the Raspberry Pi computer due of its effectiveness and simplicity. In this work, we show the operational properties of IR sensors based on the physical assumption that the measured distance is inversely proportional to the IR sensor voltage output. The research's experimental phase has demonstrated that this provides a reliable sensing technique that is device autonomous. As a result, it is predicted that the indicated course of action will work. [5]

The Android RC, a remote-control car (RC) gadget run by an Android-powered smartphone, is the foundation of this study. When a natural disaster strikes, the vehicle will be used for search and rescue activities. It is intended to avoid obstructions that the user driver is unable to see on its own. [6]

This research has resulted in the development of a small-scale autonomous vehicle prototype using an RC car and a Jetson Nano single-board computer, which can be operated with a joystick and can receive and store data on steering angle, vehicle speed, and camera images. [7]

According to this research, despite the project's initial goal of implementing autonomous continuous circular drift in a real RC car, we were unable to fully realize it because of hardware issues. Therefore, we fully believe the results can be easily recreated on a real RC car once the necessary hardware is acquired. This is because we were successful in identifying a robust and stable sustained circular drift controller with the simulator. [8]

This essay describes the creation of A remote-control car from scratch. This comprises hardware development, two cutting-edge vision systems, SLAM, and localization algorithms. The use of multiple CCPP implementation techniques leads to autonomous drive. The line analysis, mapping, and localization systems have been tried, and the outcomes are satisfactory. [9]

The creation of a single device with many applications for driving an Arduino-based robot automobile has been presented in this study using an Android mobile application and hand gesture detection. It is possible to program the robot automobile to react to situations and carry out the relevant activities. The proposed system mainly consists of two operational modes, the first of which uses a hand gesture detection technology to control the robot car (car moves similarly to the direction and position of hand). This system, which has been improved upon, is used to construct the robot car's second mode. This mode utilizes a mobile application with touch buttons and voice recognition. The mentioned technologies can recognize obstructions in front of the car. [10]

2.3 Conclusion

By reviewing all the researches and projects we collected some important points that they all used the Arduino Uno with Ultra Sonic sensors on the robot cars to detect objects and some of the researches also uses the Remote control.

Chapter 03

DESIGN AND METHODOLOGY

3.1 Design components:

The following main components have been used in this project:

- 8 Channel 30A Relay Module
- Arduino Mega
- LM2596 DC-DC Buck Converter
- Ultrasonic Sensors
- Limit Switches
- BTS 7960 43A high power Motor Driver Module
- Arduino UNO
- Potentiometer
- Stepper motor
- Steering motor

3.1 8 CHANNEL 30A RELAY MODULE

This 8-channel, 3A relay module can manage a high current of 30A (250V AC/30V DC) for a variety of appliances and other equipment. It can be directly controlled by the Arduino Mega microcontroller. To control the module, 5V of power and 3.3V/5V of logic are required. We included an opto coupler to isolate the microcontroller relay. With this setup, the microcontroller no longer physically connects to the relay; instead, it just activates the relay using the LED light of the opto coupler IC. By using this method, you can protect your microcontroller from a high VAC/VDC power.

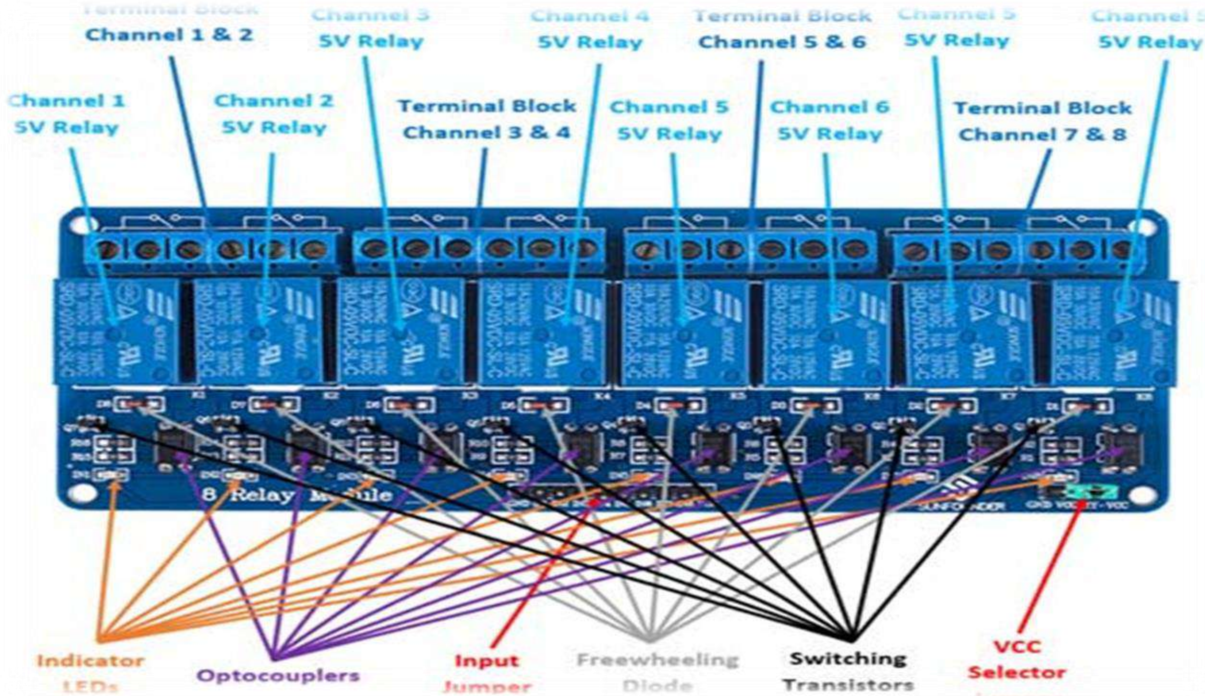

Figure 1 Relay module

3.2.1 Eight-Channel Relay Module Pinout

Pin Number	Pin Name	Description
1	GND	Ground reference for the module
2	IN1	1st relay active input
3	IN2	2st relay active input
4	IN3	3st relay active input
5	IN4	4st relay active input

6	IN5	5st relay active input
7	IN6	6st relay active input
8	IN7	7st relay active input
9	IN8	8st relay active input
10	V_{CC}	Relay module power supply
11	GND	Module ground reference
12	V_{CC}	Selection jumper power supply
13	RY-V_{CC}	Alternate power pin for the relay module

3.2.2 Components Present on Eight-Channel Relay Module

The following components are present on Relay module

5V relay, terminal blocks, male headers, transistors, opt couplers, diodes, and LEDs.

3.2.3 Specifications

- Supply voltage – 3.41V to 5.89V
- Trigger current – 5.01 mA
- Current when relay is active - ~70mA (single), ~600mA (for all eight)
- Relay maximum contact voltage – 250VAC, 30VDC
- Relay maximum current – 10.0A

3.3 ARDUINO MEGA:

Based on a straightforward I/O board and a development environment that supports the Processing/Wiring programming language, the Arduino Mega open-source physical computing platform. With Arduino, you can make interactive objects that stand alone or connect them to

computer software (e.g. Flash, Processing, Max MSP). You can get the open-source IDE for free (currently for Mac OS X, Windows, and Linux).
The ATmega2560 serves as the foundation for the Arduino Mega microcontroller board. It has 54 digital input/output pins, including 14 pins for PWM outputs, 16 analogue inputs, 4 hardware serial ports (UARTs), a 16 MHz crystal oscillator, a USB connector, a power jack, an ICSP header, and a reset button. Everything needed to support the microcontroller is included; all you need to do to utilise it is plug in.

3.3.1 Features:

- ATmega2560 microcontroller
- Input voltage – 7.5-12V
- 54 Digital I/O Pins (14 PWM outputs)
- 16 Analog Inputs
- 256k Flash Memory

3.4 Ultrasonic Sensor:

One of the most popular distance-measuring ultrasonic sensors, the HC-SR04 works fantastically with Arduino. One of the most popular distance-measuring ultrasonic sensors, the HC-SR04 works fantastically with Arduino.

3.4.1 Pin Configuration:

This module consists of 4 pins- Vic (5V), Trig, Echo, GND. Trig (trigger) is used to send out an ultrasonic high level pulse for at least 10µs and the Echo pin then automatically detects the returning pulse.

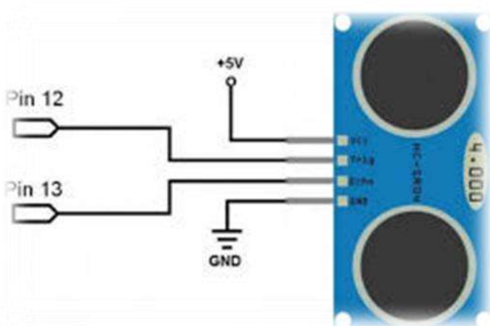

Figure 2 Ultrasonic Sensors (pin configuration)

3.4.2 Measuring Distance:

The time it takes for a sound wave to travel from the speaker to the target and back to the sensor is measured. The total distance travelled by the ultrasonic wave is then determined by multiplying this time by the speed of sound in order to account for the fact that the wave was emitted, struck the item, and then returned to the sensor, travelling twice the distance to the object. Distance is calculated as (wavelength / sound speed).

3.4.3 Possible Application Areas

Any robot that needs to know the distances to things in front of it can utilize this sensor. The Magician Robot Controller Board, Mini Driver Robot Controller, or Spider Robot Controller can all use this sensor. For a wider field of vision and object detection, this sensor can also be attached to a Pan Tilt Kit.

Figure 3 Ultrasonic Sensor

3.5 Mounting Bracket for Ultra Sonic Sensor:

This mounting bracket was created for a particular series of ultrasonic sensors. The ultrasonic sensors are held in place by them. The screw bolts will go through the holes to secure the sensors in place...

Figure 4 Mounting bracket

3.5 LM2596 buck converter

This Module Power Supply is a switching regulator with good line and load regulation that steps down a 3-A load that can be driven by an LM2596 Buck. These come in fixed output voltage options of 3.3 V, 5 V, and 12 V as well as an adjustable output version Smaller filter components are achievable than with switching regulators with lower switching frequencies thanks to the LM2596 Stepdown module's 150 KHz switching frequency.

3.6.1 Some Features of LM2596 Buck converter

O ripple: 30.5 mA maximum
L regression: ± 0.55%
VoRegulation: ± 0.55%
dsp: 5.5% 205uS
Input v: 4.8-34V
Output v: 1.2 -25.5
Output current: Rated current is 2A, maximum 3A (Additional heat sink is required)
Conversion Efficiency: Up to 92% (output voltage higher, the higher the efficiency)
Rectifier: Non-Synchronous Rectification
Module Properties: Non-isolated step-down module (buck)
Short Circuit Protection: Current limiting, since the recovery
Operating Temperature: Industrial grade (-40 to +85) (output power 10W or less)

Figure 5 LM2596 step-down

The Arduino Mega, other mainboards, and basic modules are all compatible with this buck converter power module with the high-precision potentiometer. It has excellent efficiency and can drive loads up to 3A. A heat sink must be installed when the output current reaches 2.5A (or the output power is larger than 10W).
This device is internally adjusted to decrease the number of external components and simplify the power supply architecture.
Since the LM2596 converter is a switch-mode power supply, its efficiency is substantially higher at higher input voltages than that of conventional three-terminal linear regulators.
Because the LM2596 switches at 150 kHz, fewer filter components are possible than with switching regulators that operate at lower frequencies.

3.7 Limited switch:

A limit switch is an electromechanical device that reacts to the physical pressure that an object applies on it. Limit switches is capable to determine if an object is present or not.

The working switches that we have are as follows.

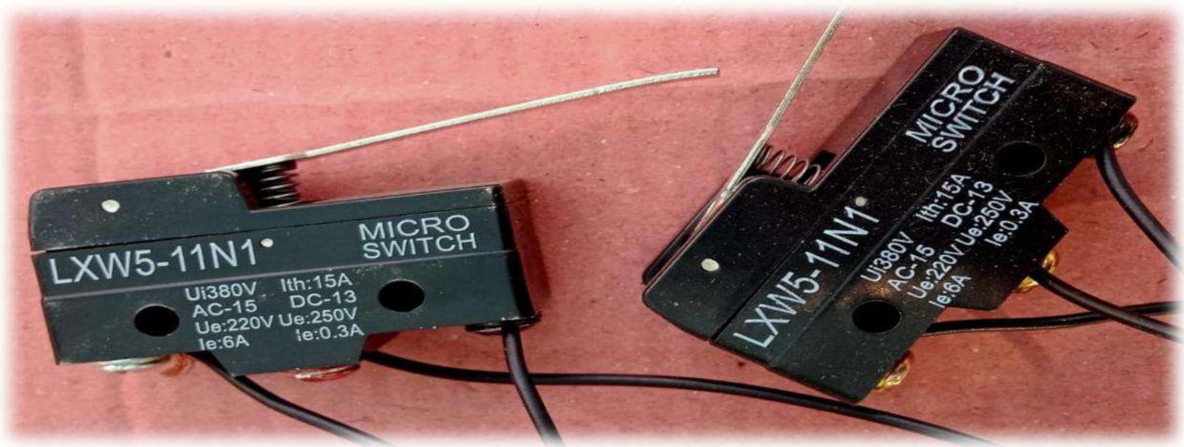

Figure 6 Limited switch

3.8 43A BTS7960 Motor Driver Features

Input voltage: is 6V to 27V
Maximum allowable current is 43 A
PWM capability is up to 25 kHz
Two PWM output pins are for speed control in direct and reverse directions
Two EN output pins to control motors
Two IS input pins to protect against high current and heat

The BTS7960 is a full-bridge high current motor driver module.

The Key features are as follows:

This module use the PWM technology to operate DC motors. These modules change the input voltage from a fixed value to a variable value for the motor. By changing the voltage of the DC motor, the speed may be controlled. PWMs mostly operate at a fixed frequency, and their frequency can be changed by altering the length of time the pulse is HIGH (Duty Cycle).

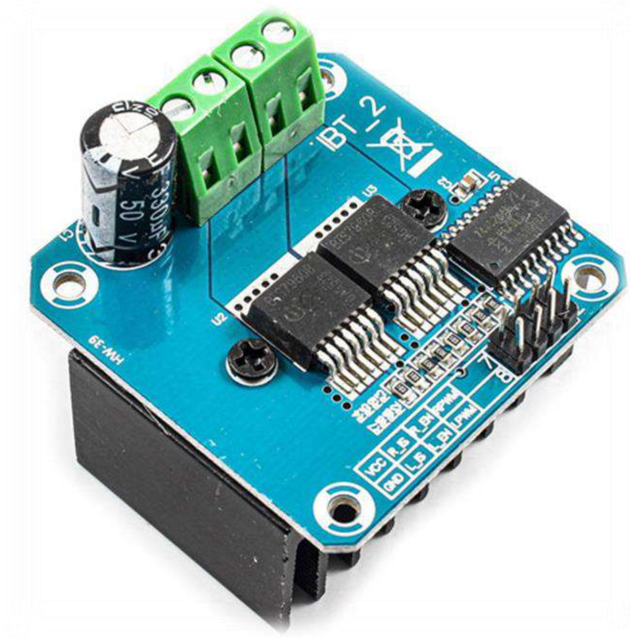

Figure 7 BTS7960 Motor driver

3.8.1 BTS7960 Motor Driver Pinout

This module consists of 12 pins:

Microcontroller pins (Low current):

• **VCC**: Module power supply – 5V
• **GND**: Ground
• **IS-R:** the Input signal for detecting straight high current
• **IS-L:** the Input signal for detecting inverse high current
• **EN-R:** the Output Signal for controlling straight motor direction
• **EN-L:** the Output Signal for controlling inverse motor direction
• **WM-R:** PWM Signal for controlling Straight rotation of the motor
• **PWM-L:** PWM Signal for controlling the Inverse rotation of the motor

Motor pins (High current):

• **M+:** positive wire of the motor
• **M-:** negative wire of the motor
• **B+:** positive battery terminal
• **B-:** negative battery terminal

You can see the pinout of this module in the image below.

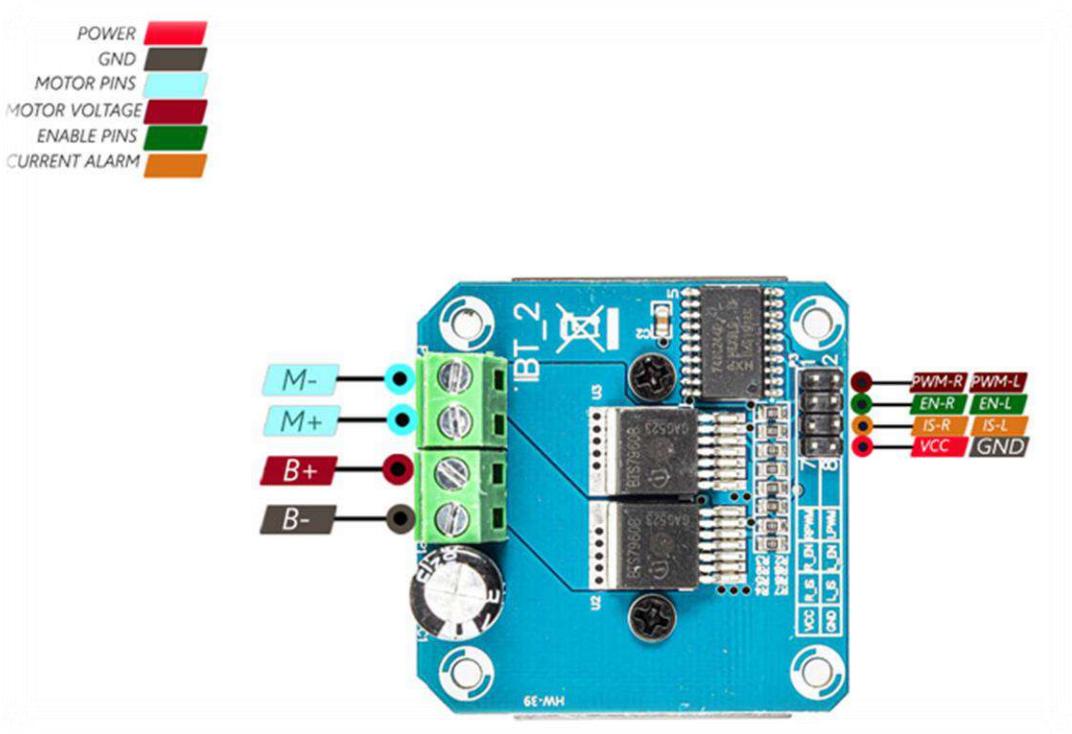

Figure 8 BTS 7960 motor driver circuit diagram

3.9 Potentiometer

A potentiometer is the variable resister having a wide range of wiper through which current flow can be controlled by moving wiper in clockwise and anti-clock wise directions.

Following are the typical potentiometers.

We are using this potentiometer as a gear in the car.

More the positive value more will be the forward speed, lower the value less than zero less will the acceleration.

Figure 9 potentiometer

Figure 10 wiper of potentiometer

3.9.1 Working Principle of Potentiometer

The fundamental principle of the potentiometer is that the voltage drop across any section of the wire will be directly proportional to the length of the wire, it has uniform cross section area that's why it has uniform current flow in the whole path.

3.10 Stepper Motor:

Stepper motor is a DC motor that move in discrete step. It has various coils that are structured into groups. The motor will rotate by continuous energizing each phase, one at a time.

You can change speed and/or location with extreme precision using computer-controlled stepping. Stepper motors are the preferred motor for numerous precision motion control applications as a result.

They are available in the wide range of sizes, designs, and electrical properties.

Figure 11 stepper motors

3.11 Steering motor:

A steering motor is the 12v DC motor which assists the driver to rotate steering easily.

It is used to automate the steering. This motor works on the 12 volt DC battery supply.

Methodology

3.11 Designed car:

Figure 12 designed car

3.12 Designed circuit for RC based autonomous real car

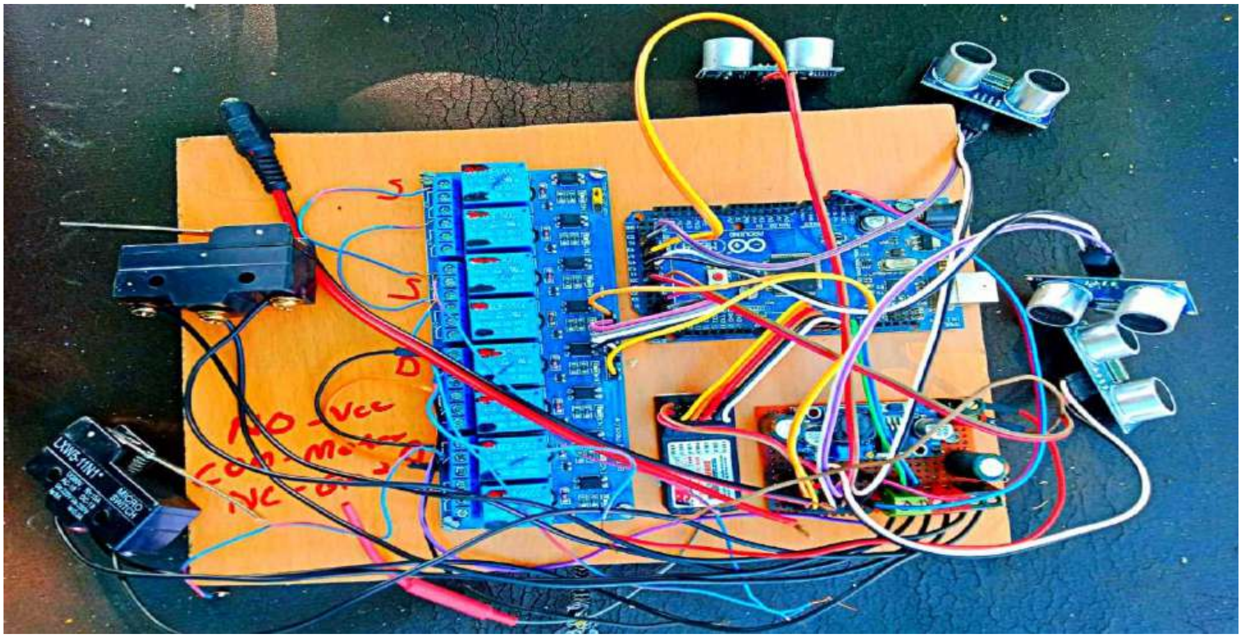

Figure 13 RC Based designed circuit

3.13 Designed Circuit for manual driving:

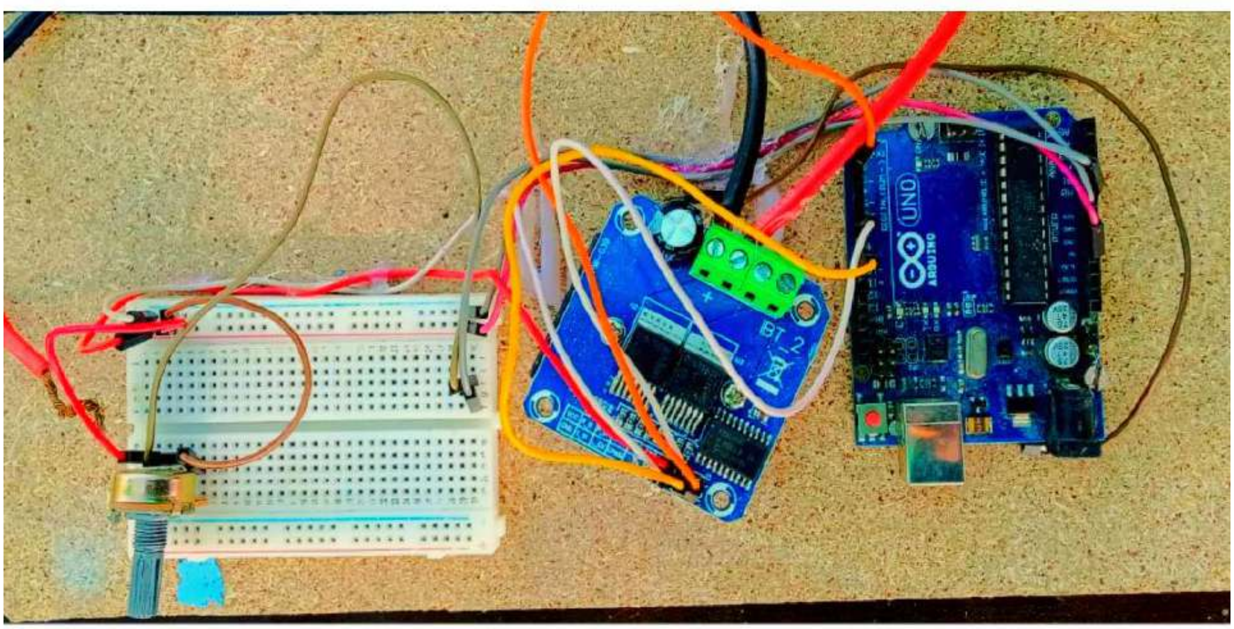

Figure 14 Manual based designed car

3.14 Hardware implementations:

The above figures show the hardware implementation. The car operates in two conditions

A) Manual drive circuit

B) RC based drive circuit

3.14.1 Manual Drive circuit

In this mode the car can be drive by the driver and it is fully functional and works on the solar charging like an Electric vehicle as per the requirements of SDGs.

3.14.1.1 Interfacing of BTS7960 Motor Driver Module with Arduino Uno

1st step: Circuit

The below cicuit shows the manual drive wiring diagram.

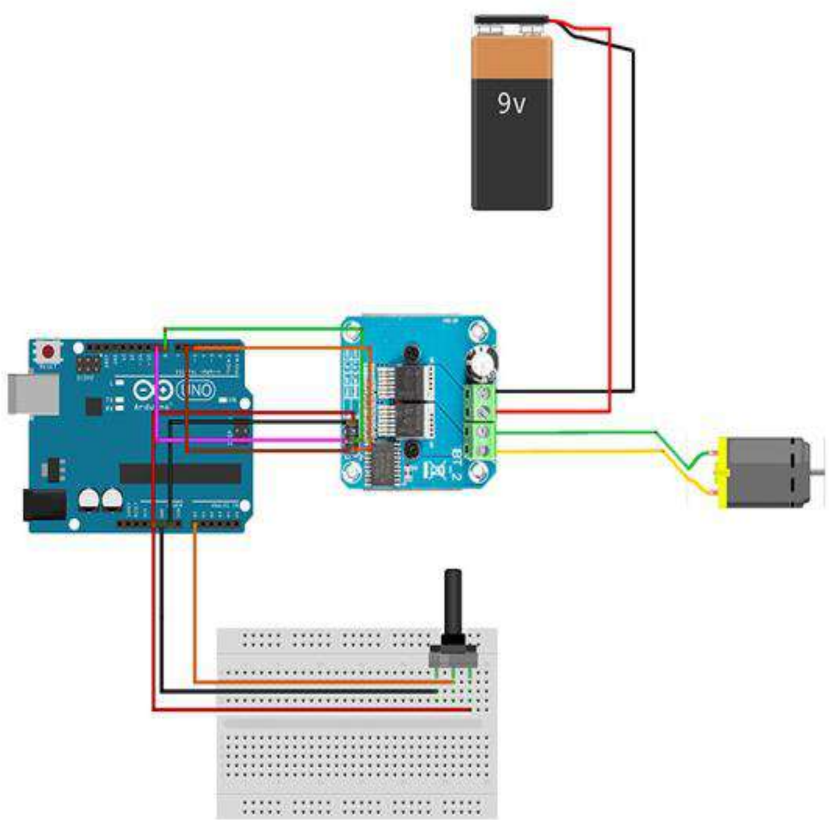

Figure 15 Manual circuit diagram

2^{nd} step: Code

3.14.1.2 Code upload to the Arduino Uno

By this code, the motor can be rotate in one of two directions—forward or backward—by fully rotating the potentiometer. The motor rotates forward when value is greater than 512 otherwise for less than 512 it will move reverse direction. We turned the EN pins to High and used PWM pins to operate the motor.

3.15 RC Based Drive circuit

In this mode we can control the car by Remote Control (RC). For this purpose, we are using the camera to know about the front of the car and drive it.

3.15.1 Flowchart of the RC based Drive Car:

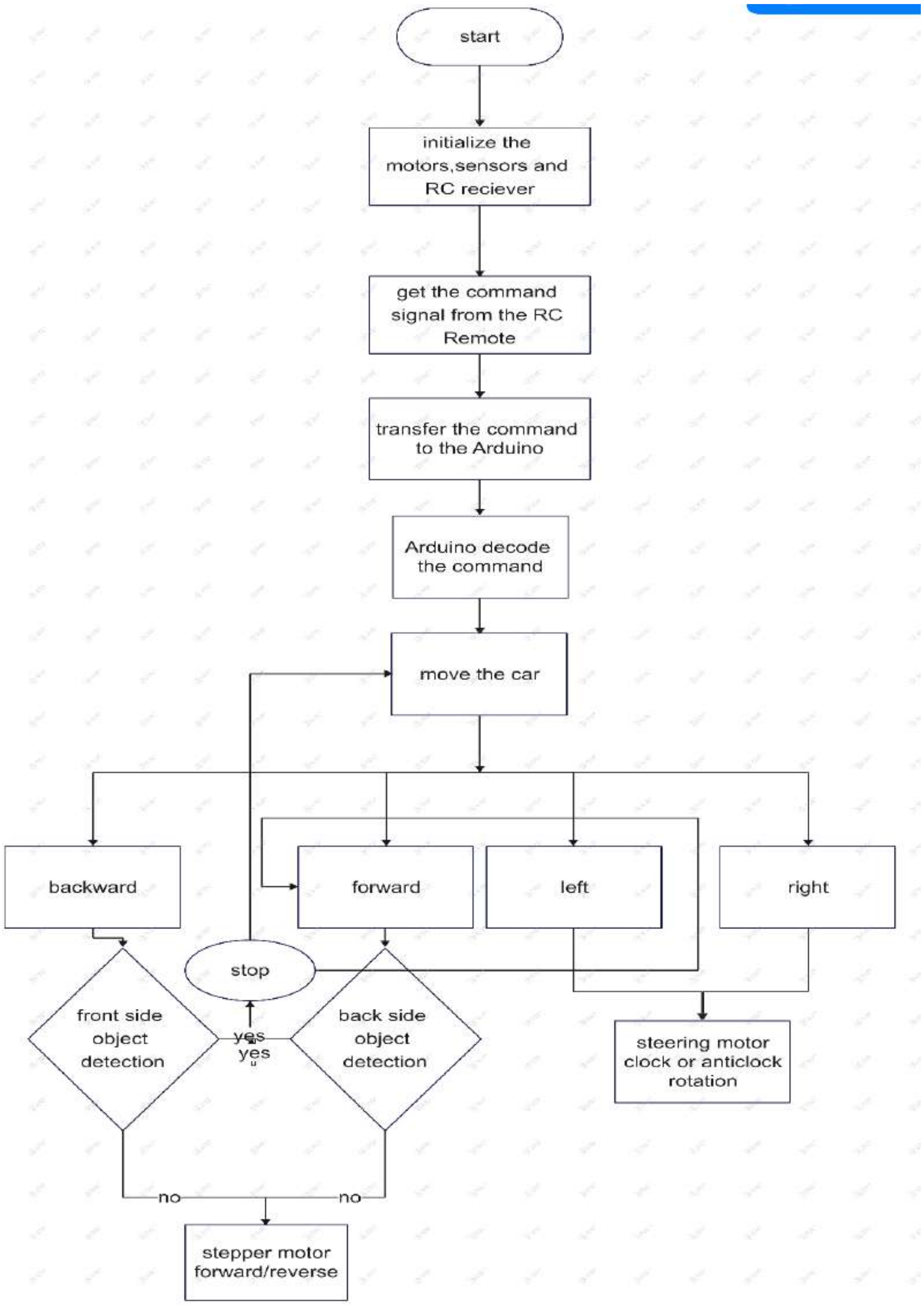

Figure 16 RC circuit proposed methodology

3.16 Communication/ Remote controller (RC)/Arduino Mega:

In the RC-based mode, communication is based on the Arduino Mega, a set of limited switches, the movement (forward, backward, left, and right) of a remote-control car, and object detection throw sensors.

Through remote control, the vehicle can be operated, and when an item is spotted, the vehicle can stop or drive in order to prevent a collision and arrive at the intended location.

3.16.1 Interfacing of components with Arduino Mega:

These below components interface with Arduino Mega:

A) Interfacing of Ultrasonic Sensors with Arduino Mega:

The use of ultrasonic sensors for interface Ultrasonic sensors on the HC-SR04 can assist us in avoiding obstacles that stand in the way of reaching our intended location. They are attached to several pins, including GND and VCC of the Arduino Mega when they are interfaced with the board. The GND and 5 volt pins of the Arduino Mega are connected to the ultrasonic sensors, and the pins for their echo and triggering are attached to the programmable explained pins of the Arduino. When they are well-programmed, they carry out their intended function, for example, avoiding impediments and instructing the vehicle to turn in a direction where there are no obstacles. Ultrasonic sensors also operate within a defined range.

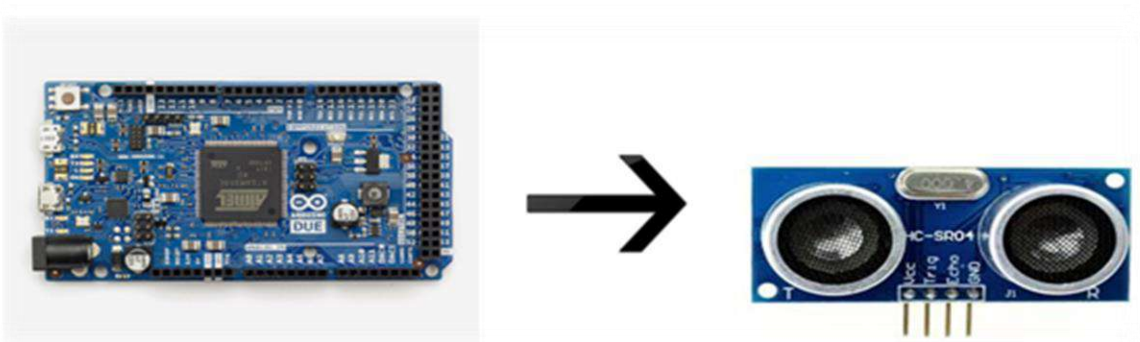

Figure 17 interfacing sensor with Arduino Mega

Interfacing Arduino Mega with ultrasonic sensor

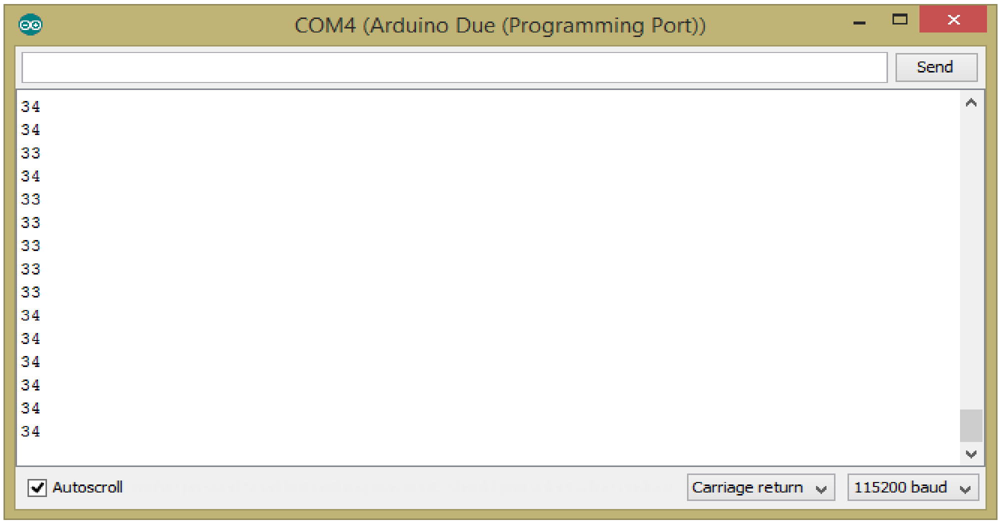

Figure 18 Ultrasonic sensor output

B) Interfacing (RC) Remote control with Arduino Mega:

3.17 Interfacing steps:

This process have three steps:

1st Step: Resources

Figure 19 fly sky RC remote controller

Figure 20 interfacing components

Following materials are required:

1. Arduino Mega
2. RC receiver
3. RC Transmitter
4. Stepper and steering motors

2nd step: Wiring

On the receiver, at the top, we must connect a wire from pin 7 to ch3 (and later, if we want to add other channels, we just need to connect more pins). Connect the Arduino's positive (middle) pin to 5 volts, and then connect GND to GND. Connect pins 8 and 9 to the stepper motor and steering motor, then connect GND to GND and VCC to 3.3 volts. That concludes the wiring.

3rd step: Coding

Your code is to control the motors or make it that the stepper and steering motor are more precise on where they move and also operate the sensors to detect the objects while forward or backward movements.

C) Interfacing of 8-Channel relay module wit Arduino mega:

Two motors are under our control: one is a stepper motor for backward and forward motion, and the other is a steering motor for left and right steering control.

We are employing an 8-channel relay module for this all-switching purpose, and the four alternate relays are the first, third, fifth, and seventh.

Therefore, we suggest using the 8 channel relay module's following pins for relay module interface:

3.18 Power pins:

- (DC+) this should be connected to the 5 volt power battery supply.
- (DC-) this pin should be connected to the ground of the power battery supply and also to the Arduino Mega.

Signal pins:

- IN1: This pin control the relay 1 by receiving the control signal from the Arduino Mega.
- IN3: This pin control the relay 3 by receiving the control signal from the Arduino Mega.
- IN5: This pin control the relay 5 by receiving the control signal from the Arduino Mega.
- IN7: This pin control the relay 7 by receiving the control signal from the Arduino Mega.

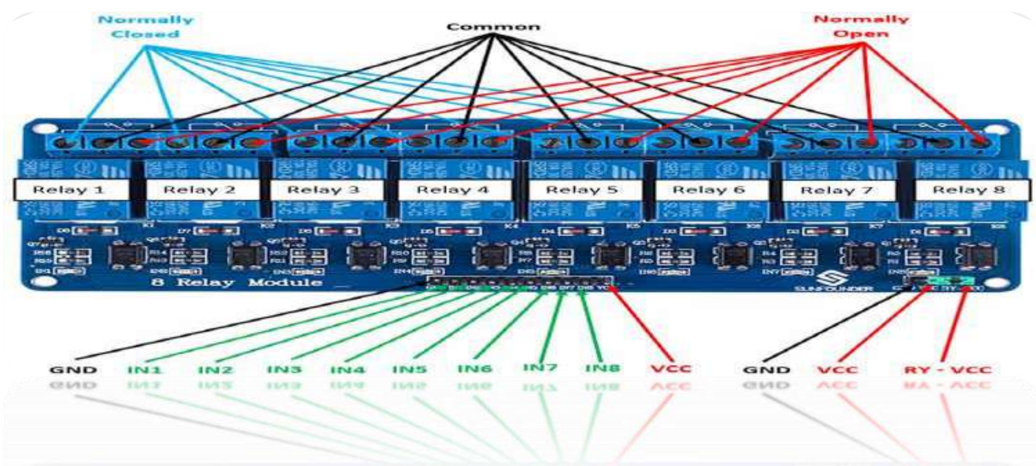

Figure 21 8 Channel relay Module pins diagram

Output Pins:

- NC1, NO1, COM1: This pin control the relay 1 having high voltage device.
- NC3, NO3, COM3: This pin control the relay 3 having high voltage device.
- NC5, NO5, COM5: This pin control the relay 5 having high voltage device.

- NC7, NO7, COM7: This pin control the relay 7 having high voltage device.

It consists of four jumpers to select b/w the high trigger and low trigger for each relay individually.

Power Wiring:

Module consumes more power than the 5 volt from the Arduino, so we have to add more 5 volt power that's why we just have:

• An Arduino Mega power supply with a 5V output.

• A step-up buck converter which supplies the 5v output.

To control the devices from 8 channel relay module, it will use the high power resource battery.

Chapter 4

Results and analysis

By the use of new high tech technologies such as RC (remote control) based systems we can control any system according to our requirements. This project is more cost effective to the other techniques. The autonomous electric car can also be controlled through RC controller. By connecting different sensors to the system it will sense the data and according to the analyzed data the RC control will perform accordingly.

The developed project in this thesis will control the speed of car and the other parameters of the car, through which a normal people can drive this car easily on the remote control or manually as well. This car will not require any fuel or petrol consumption. This is the most beneficial part of this project it will only use renewable resources like solar power to run the car and the car will control through RC.

The controlling of car through RC is a cost-effective way to implement the system. The controlling of RC-based autonomous electric real car includes the speed control of the car, the paddle control, and steering control. When a driver run this car automatically on RC then the car will sense the parameters and according to them, it will automatically drive.

4.1 With RC based Circuit:

4.1.1 RC Based AUTONOMOUS ELECTRIC REAL CAR RESULTS

a) **When a forward condition is applied on (RC) Remote controller:** Both tires moves to forward direction.

Figure 22 front side movement

The car is moving in forward direction

b) **When the reverse condition is applied on (RC) Remote controller:** Both tires move towards backward direction.

Figure 23 Backward movement

The car is moving backward direction

c) **When the right condition is applied on (RC)Remote controller:**

Figure 24 right side steering turn

Car steering turns to right side.

d) **When the left condition is applied on (RC)Remote controller:**

Figure 25 left side steering turning

Car steering turns to left side.

Chapter 5

Conclusion and future work

5.1 Conclusion

As we know that the electric car is a new invention of technology by using renewable resources, through which no any fuel consumption will utilized and it will benefit to the environment of the society as well. This autonomous electric car can be designed through various techniques such as by using AI, and other algorithms, but Al though these algorithms implement in high cost, that is not affordable by everyone so that we designed and developed a RV based autonomous electric real car that is based on the RC and it automatically controls the car by sensing the parameters of the car and control it through RC controller.

This car is also manual base if the driver wants to drive it manually or automatically it depends upon the driver's needs and requirements.

5.2 Future work

As we know new techniques such as AI, IOT, and other technologies can also be implemented to improve the performance of the car. This RC-based autonomous electric real car can modify by using more renewable resources which produce more power while even solar energy doesn't work. If the car parameters control should be done automatically by using different algorithms which will sense the data and perform the function automatically.

REFERENCES

[1] Schwarting, W., Alonso-Mora, J., & Rus, D. (2018). Planning and decision-making for autonomous vehicles. *Annual Review of Control, Robotics, and Autonomous Systems*, *1*, 187-210.

[2] Yeong, D. J., Velasco-Hernandez, G., Barry, J., & Walsh, J. (2021). Sensor and sensor fusion technology in autonomous vehicles: A review. *Sensors*, *21*(6), 2140.

[3] Paul, S., Biswas, S., AtreyoSengupta, B. B., & Basu, S. (2019). Arduino based, Bluetooth controlled RC car. *International Journal of Computer Science & Communication (ISSN: 0973-7391)*, *11*(1).

[4] Claes, D., Fossel, J., Broecker, B., Hennes, D., & Tuyls, K. (2013, September). Development of an Autonomous RC-car. In *International Conference on Intelligent Robotics and Applications* (pp. 108-120). Springer, Berlin, Heidelberg.

[5] Riley, H. B., & Celenk, M. (2017, August). IR sensing embedded system development for prototype mobile platform for autonomous convoy. In *2017 IEEE 2nd International Conference on Signal and Image Processing (ICSIP)* (pp. 441-445). IEEE.

[6] Jing, Y., Zhang, L., Arce, I., & Farajidavar, A. (2014, May). AndroRC: An Android remote control car unit for search missions. In *IEEE Long Island Systems, Applications and Technology (LISAT) Conference 2014* (pp. 1-5). IEEE.

[7] Hamzah, M. S. (n.d.). *Development of single-board computer-based self-driving car model using CNN-controlled RC Car*. IEEE Xplore. Retrieved October 24, 2022, from https://ieeexplore.ieee.org/document/9751873

[8]Schnieders, D., Bhattacharjee, S., & Kabara, K. D. (1970, January 1). *[PDF] Autonomous Drifting RC car with Reinforcement Learning: Semantic scholar*. [PDF] AUTONOMOUS DRIFTING RC CAR WITH REINFORCEMENT LEARNING | Semantic Scholar. Retrieved October 24, 2022, from

[9] Claes, D., Fossel, J., Broecker, B., Hennes, D., & Tuyls, K. (2013, September). analysis of an Autonomous RC-car. In *International Conference on Intelligent Robotics and Applications* (pp. 108-120). Springer, Berlin. .[ACCESSED 20 OCT 2022]

[10] Schwarting, W., Alonso-Mora, J., & Rus, D. (2016). Planning and decision-making for autonomous vehicles. *Annual Review of Control, and Autonomous Systems*, *1*, 187-210.