OAV

by Yogesh Yogesh

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OBSTACLE AVOIDING VEHICLE

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report "**OBSTACLE AVOIDING VEHICLE**" is the bonafide work of "**Soham Chakravorty, Sneha Kumari, Bobba Lavanya, Pammi Saini, Ankita Maitra**" who carried out the project work under my/our supervision.

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INTERNAL EXAMINER	**EXTERNAL EXAMINER**

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LIST OF STANDARDS

Standard	Publishing Agency	About the standard	Page No
IEEE 1859	**IEEE**	This standard covers the physical and electromechanical requirements for piezoelectric single crystal materials intended for fabrication into single plates, multilayer plate devices, and composites with other passive materials for use in medical, industrial, and sensors.	**38**
IEEE 1451	**IEEE**	They have some major factors that are regularly checked in the development of IEEE 1451 standard-based applications, such as reliability, maintenance, accuracy, easy to use, cost, test facility, .	**38**
IEEE 802.11	**IEEE**	Using this, devices can connect to existing Wi-Fi infrastructures directly and access the Internet with shorter communication delays and lower system cost.	**39**

ABSTRACT

Obstacle Avoiding Vehicle serves the purpose of dealing with modern day traffic issues. OAV is designed and developed to detect obstacles, to avoid obstacles and to alarm driver about upcoming obstacle which overall results in reducing accidents. More importantly it is backed by reliable and dependable support. The project 'Obstacle Avoiding Vehicle' is based on the Arduino Programming. This project uses C++ in Arduino programming which is an Object-Oriented Programming. It also uses WIFI module to connect driver with sensor functioning to give data about nearest obstacle and alarming functions. Obstacle Avoiding System is built according to Indian road conditions. All the required modules and features have been particularly built to fit in to the basic requirements of Indian roads. It is customizable and can be modified as per the needs and requirements of driver as well as further condition of roads. It also supports AUTO feature which automatically handles vehicle and avoid obstacle and it works according to need of driver. Prolonged study of the functionalities of the sensor and methods to avoid obstacle has given it a wonderful shape both technically and usability wise. It covers all the basic requirement that a driver needs right from Obstacle detection, Alarming, Obstacle Avoidance, Driver safety, Pedestrians safety, displaying range of nearest obstacle coming, etc.,

Chapter 1.

Introduction

1.1. Identification of Client / Need / Relevant Contemporary Issue

- We collected data related to road accidents across the entire country and observed the main causes which relate to accidents.
- We did research regarding this to prevent this kind of accident from happening with the help of this project.
- We also gathered information regarding this by checking other sources to make this more useful and helpful to users.

1.2. Identification of Problem

- Distracted Driving: Distraction while driving could be minor but it can cause fatal accidents. The brain is only capable of processing one thing at a time. The major distraction nowadays is using mobile phones while driving. The act of talking on the phone occupies a major portion of the brain and some part of the brain handles driving skills. This becomes one of the reasons for crashes. Driver might not be attentive if uses mobile while driving.
- Driving Under Influence of Alcohol & Drugs: People generally tend to celebrate any occasion by abusing substances, but when mixed with driving it turns celebration into misfortune. Alcohol reduces concentration, hampers vision due to dizziness & also delays response time. It leads to blurred vision and people will not be in their right mind if drank excessive alcohol. These factors while driving pose a danger to others as well as cause major accidents.

- Falling Asleep Behind the Wheel: We lead busy, stressful lives, and fatigue is one of the major factors which leads to falling asleep behind the wheel. A sleepy driver has difficulty paying attention to the road and has slower reaction or response times. Just within seconds, if the driver nods off then it leads to major accidents. Even the people who are driving carefully will have to face consequences for one's mistake.
- Climatic Conditions: Extreme weather conditions can affect your ability to drive safely as it would lead to loss of visibility, clogging of water on the roadway etc., One of the most dangerous weather conditions is fog. According to a survey conducted on Road accidents, approximately 21% of motor vehicle crashes each year are due to adverse climatic conditions. This leads to dangerous accidents.
- Speeding: Most accidents occur due to over speeding. An increase in speed multiplies the risk of accidents. Faster vehicles are more prone to accidents. A vehicle moving at a higher speed will have a greater impact during the crash and skids a long distance due to the laws of motion. No matter how well rated a car is in terms of NCAP, exceeding the speed above a certain limit will definitely result in fatal accidents.
- Avoiding Traffic Rules: It is a common sight at road intersections that vehicles cross without caring for light and avoiding safety gears like seatbelts and helmets. The other main rule that many people might not follow is to use indications.
- Inappropriate planning: Improper planning of infrastructure leads to accidents. In India, the roads are mostly not maintained properly and rules are also broken easily. Without proper implementation of actions, controlling accidents is very difficult.

- Malfunctioning Equipment: Vehicles are made up of multiple parts. These components are not always at their maximum capabilities and are vulnerable to faults. Lack of maintenance can also lead to equipment malfunctions like battery malfunctions or brake failures etc.

1.3. Identification of tasks:

- Proper detection of obstacle: An obstacle is detected with the help of Ultrasonic Sensor (HC-SR04) and Infrared Sensor (IR36). These sensors can measure the distance between two cars and nearby obstacles directly and the driver is alerted by beeps or LCD display.
- Platform Design: To control this entire system, the user needs to register their car with the necessary details. This website stores all details related to the vehicle. There are several other options like choosing the mode of driving (driver-based manual mode or auto), etc.
- User Friendly: It offers great design and prioritizes security as members can log on to this page with specific credentials. It is made up of GUI. It uses language easily understandable by users and takes queries from users to provide help.
- Auto Mode: Sometimes the driver might not respond to instructions given by the system, which may lead to accidents. To overcome this, there is an automatic mode which is an example of a driverless car. When a driver does not respond to the warnings, or, stop & change direction despite the indication of an obstacle, it automatically applies brakes & comes to a halt or steer away from the obstacle.
- Hardware design: Hardware design plays an important role in this project. It is designed in such a way that the model is aerodynamic, which would

reduce air drag, take less space and it's lightweight to move, which would apply less pressure on the motors ultimately obtaining a higher range.

- Remote connectivity: The remote connectivity is one of the important features that helps the hardware connect with the app and get controlled either manually within WiFi range by the user or be able to move in auto mode without user interaction.

1.4. Gantt chart

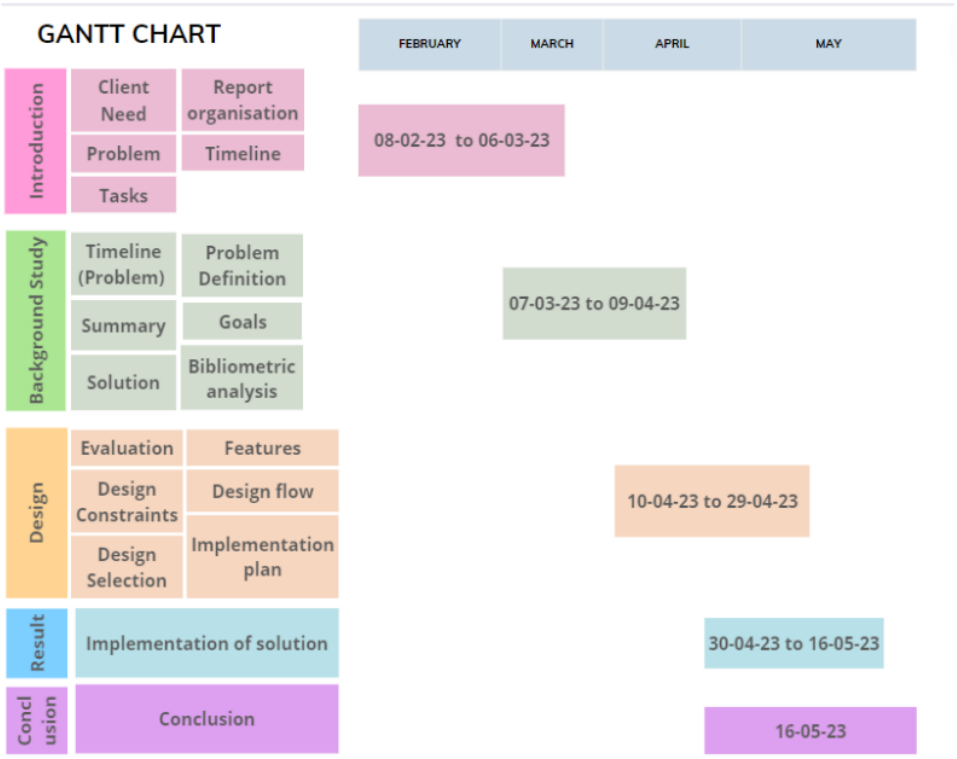


Fig 1: Gantt chart

1.5. Organisation of report:

1. Introduction: It gives the basic view of the project and identifies the problem

2. Literature view/ Background Study: It deals mainly with finding a solution for the above-identified problem by analysing the previous done models and try to identify the
3. Design Flow Process: In this, we work on the design of the website after selecting the design by comparing each of its pros and cons.
4. Result, Analysis and Validation: In this, we implement the solution for that problem after identifying the solution from above analysis.
5. Conclusion: In this, we complete the entire project and describe the future scope of the project and discuss the limitations.

Chapter 2.

Literature Review

2.1 Timeline of reported problem:

Reported Problem:

Cars could be automated to reduce the road accidents to a great extent, if it's calibrated properly. It would increase the mileage of the vehicles. It was invented in early 1970s. However, it started implementing on a massive scale since 2002.

Major car brands with Level 2 features include Audi, BMW, Mercedes-Benz, Tesla, Volvo, Citroën, Ford, Hyundai, Kia, Mazda, Nissan and Peugeot. Full Level 2 features are included with Full Self-Driving from Tesla, Pilot Assist from Volvo, Open Pilot from Comma.ai and ProPILOT Assist from Nissan.

Level 3 features are included in Drive Pilot from Mercedes-Benz.

Statistics:

In Europe, in Q2 2018, 3% of sold passenger cars had level 2 autonomy driving features. In Europe, in Q2 2019, 325,000 passenger cars are sold with level 2 autonomy driving features, that is 8% of all new cars sold.

According to a 2021 research report from Canalys, approximately 33 percent of new vehicles sold in the United States, Europe, Japan, and China had ADAS features. The firm also predicted that fifty percent of all automobiles on the road by the year 2030 would be ADAS-enabled

On June 29, 2021, the National Highway Traffic Safety Administration (NHTSA), the branch of the United States Department of Transportation

responsible for federal motor vehicle regulations, issued Standing General Order 2021-01 (SGO 2021-01), which required manufacturers of ADAS (Levels 1 or 2) and ADS (Levels 3 through 5) to promptly report crashes that occurred when driver-assistance or automation systems were in use. SGO 2021-01 subsequently was amended on August 5, 2021.[58] Under the amended SGO 2021-01, a crash involving an ADS or Level 2 ADAS is reportable to the NHTSA if it meets the following criteria: 13–15

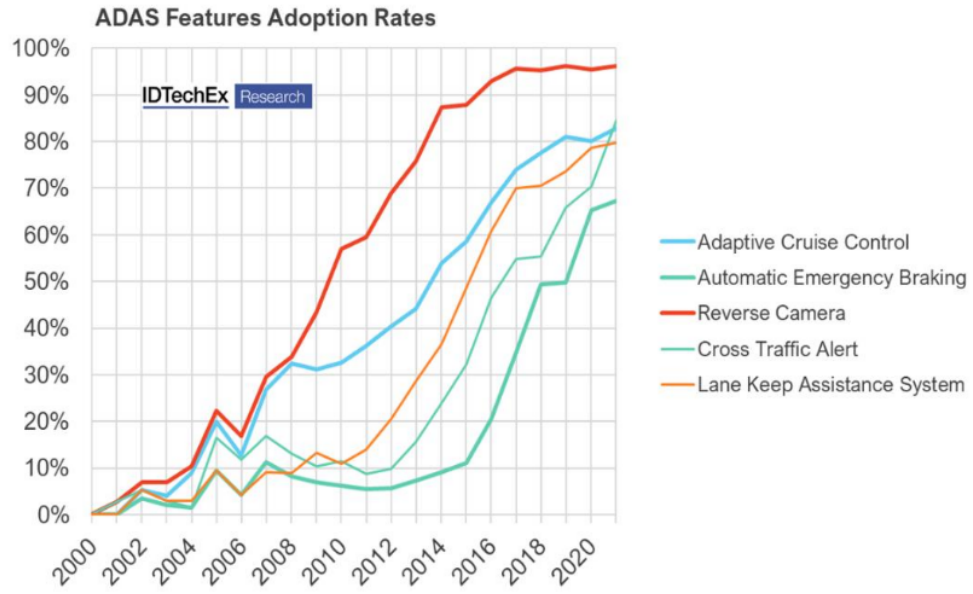


Fig 2: ADAS Features Adoption Rates

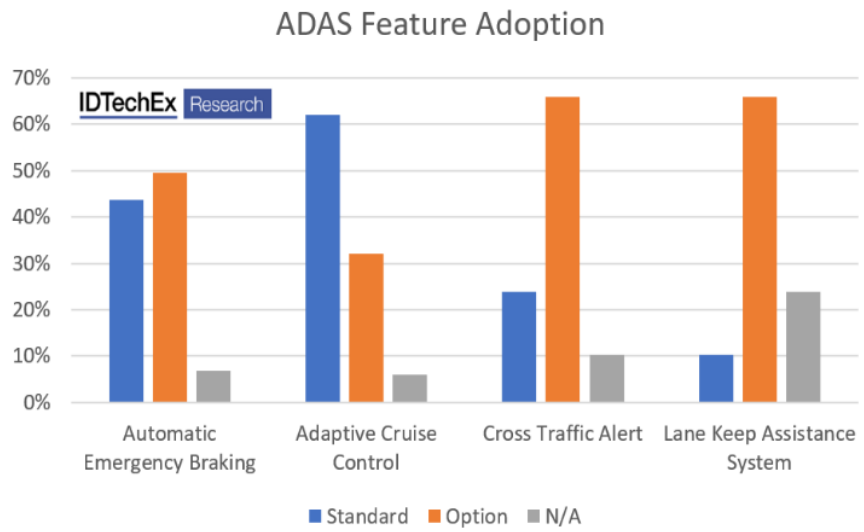


Fig 3: ADAS Feature Adoption

2.2 Existing solutions

There are some solutions currently which are suitable

- **LiDAR**: 'LiDAR' stands for light detection and ranging. In this, light(laser) is sent from source(transmitter) and reflected from objects in the scene. It uses a scan mirror, or multiple laser beams to scan the object space. It has minimum human dependency and can be used during day as well as night.

  25 Although LiDAR is cheap when used in huge applications, it can be expensive when applied in smaller areas

- **ADAS**: 'ADAS' stands for Advanced Driving Assistance Systems. This helps to prevent accidents by reducing the number of car accidents These include lane departure warning, Traffic sign recognition, etc. Ranging from 0 to 5, ADAS levels are given. In which level 0 contains no driving assistance it's completely manual, Level 1 comes with a little driving assistance to driver. Level 2 comes with partial driving assistance which benefits the driver to a

greater extent as compared to the ADAS Level 1 system. Level 3 comes with conditional automation; it facilitates the driver with automation but still human override is still required. In Level 4, it depicts high automation under which vehicle under specific circumstances performs it's own operations on its own however, human override is still an option. In Level 5, The vehicle performs all its actions own its own & zero attention from user side is required.

In India, this feature is available from Level 0 to Level 2. This provides basic assistance, such as basic steering, acceleration, and braking when required but a human is required to be in driver's seat to take over at any time.

2.3 Bibliometric analysis:

S.no	Name of Authors	Name of Research Paper	Year	Brief Description
1	Mugahed Ghaleb	Design of an obstacle avoiding car based on Arduino microcontroller	2018	This paper proposes a coordinated steering and braking obstacle avoidance control strategy based on a safety distance model.
2	Bharat Lohani & Suddhasheel Ghosh	Airborne LiDAR Technology: A Review of Data Collection and Processing Systems	2017	The paper discusses various types of LiDAR sensors and their working. This is followed by information on data format and data quality assessment procedures, existing data classification techniques, etc.,

3	Emily Rosenthal (New York University)	When an Autonomous Vehicle on Autopilot Kills Someone, Who Is Responsible?	2022	What obligation does an advanced tech company such as Tesla - have in informing drivers, whether directly or through advertising and marketing messages, that they are liable for all damages, regardless of whether the car is on autopilot?

2.4 Review Summary:

Accounting all the data from the research papers, various cases and scenarios are observed and taken into account. The various factors which require the modern-day use of autonomous vehicles, its drawbacks, & case-studies based on those scenarios.

The first research paper, states the possible ways in which an autonomous vehicle is built through the latest use of technologies and used to eliminate the means of manual errors. It uses various methods and technologies to prevent the man-made errors and automate the systems at its peak such that errors like dozing off to sleep while driving, tailgating, etc., can be avoided with the means of technological advanced mechanisms.

The second research paper enlightens us with the method by which we can detect an obstacle which possess threat to the vehicle and simply avoiding it by the means of automation. LiDAR is basically a data collection and processing system which helps us to process the data received from surroundings and eventually act accordingly.

The last research paper that we analysed is a paper published by New York University. When an accident occurs, a major controversy occurred, as many insurance companies denied to pay the insured amount as it was an automated vehicle considering there's no mode of manual override and machine failure is not insured within its clause.

2.5 Problem Definition:

The main problem faced by people these days are road accidents, which are increasing day by day. These are mainly caused due to the problems identified from the research papers, and stating a few of those:

- **Technical Malfunctions**: Since machines are meant to automate the tasks which were to be performed by human, but improper maintenance may lead to major malfunctions which may lead to hazardous events.
- **Approaching Obstacles**: When an automated vehicle travels from a source to destination, if an obstacle approaches from side faces, avoiding it can be troublesome as speeding up may cause accident, and slowing down may cause the vehicle to get rear ended.
- **Lane Changes**: If an obstacle is detected and hence the vehicle changes the lane suddenly, this may cause the rear vehicle to crash into it. If any vehicle is changing its lane without indicator, then it wait until it passes by.
- **Road Conditions**: While cruising, a vehicle may not detect or consider wet roads and icy roads as a hazard.
- **Driver Monitoring**: Driver monitoring needs to be implemented such that in worst case scenarios, the driver can override the automated system and take control over it.
- **Autonomous System Implementation**: Automated systems being implemented in the vehicles which run on IC (Internal Combustion) engines can be a bit of a challenge as the acceleration and fuel injection into the valves are directly proportional.

- **Assessment Space of Collision**: The data needs to be processed up to much accurate place as multiple obstacle may appear at a time and accordingly the probable space of collision needs to be analysed properly.

2.6 Goals/Objectives:

Goal: To reduce road accidents and provide a safe environment for driving.

Objectives:

- To reduce technical malfunctions by debugging the set of code which automates the vehicle at its peak.
- Lane change issues can be resolved by detecting the rear approaching vehicles up to a certain distance with an angle of approach of up to 270deg and acting upon it accordingly.

Autonomous system can be implemented quite easily in EVCC as compared to vehicles with IC engines as it's quite difficult to handle the engine – to – fuel injection ratio as well as the power and torque output can be handled using power delivery

Chapter 3.

Design Flow/Process

3.1. Evaluation & Selection of Specifications/Features

Obstacle Avoiding Vehicles are designed in order to serve the purpose of dealing with modern day traffic issues. While driving a car, multiple situations occur which lead to distraction of the driver or losing of the conscience, which can lead to tragic events. Other than these events, multiple assisting features are provided to the user which leads to aid the ease of driving. While there are multiple features already provided as per the needs of the customer, yet there are vast features which are yet to be explored or worked on. Here are some of the features that have been identified in the literature as important for Obstacle Avoiding Vehicle:

1. Obstacle Detection & Avoidance: The device should be able to detect the obstacle around it in all directions and implement proper measures to avoid the obstacle to proceed with safe driving.
2. Alarming Driver: After detecting the obstacle through sensors, the driver might not be attentive in some cases. So the buzzer is used in this situation to inform the driver of the problem ahead of time so that it will not be late to take any measures.
3. Reaction on incoming traffic: The sensors on the device should be able to foresee the vehicle ahead to proceed forward or while changing its directions.
4. Remote Connectivity: This Obstacle avoiding vehicle is connected with the web through WiFi card to make it easy for users to understand the concept in a much easier and effective manner.
5. Obstacle Approximation: By being able to find out the distance between the obstacle and vehicle helps us in avoiding them easily.

6. Speed modulation: The speed of the device should be able to be controlled by the driver by ensuring proper working of dc motors and its connection with the module.
7. Reliable Power Source: This device consists of a rechargeable battery so that we do not need to change batteries repeatedly. This saves us time and energy and cost.
8. Assistance to driver: It helps the driver by giving proper instructions when an obstacle is detected and there is a need to avoid it, while changing lanes, etc.,
9. GPS Location: This is connected with GPS API so that the driver need not to worry about going to unfamiliar places and it also guides drivers with better ways by detecting traffic on that way.

Apart from all the above features provided to the user, several other features can also be considered to increase the overall awareness and safety. The opinions are subjective as per the needs and demands of the customer and hence new features can still be introduced or improvised as per their needs.

3.2. Design Constraints

When considering the obstacles and other issues faced during transportation, there are several important issues to consider:

Regulations: There may be regulations governing the use of radars, sensors & other equipment. These regulations may vary by country or region, and compliance with them will be important for manufacturers and drivers.

Economic: There may be costs associated with the installation and maintenance of electronic equipment such as Radars & Sensors which are pretty expensive and costly to maintain.

Environmental: Obstacle avoiding vehicles may use components such as Infrared Emitters, Ultrasonic resonators, which pose an environmental impact.

Manufacturers should consider the potential environmental effects of their products and work to minimize their impact.

Health: Relying completely on the assistance mechanism may lead to catastrophic results as there may be errors within the mechanism which may lead to accidents or pose a threat of death.

Manufacturability: The design and manufacturing of obstacle avoiding vehicle must consider issues such as reliability, durability, and ease of use as they are subject to wear & tear over time.

Safety: Obstacle avoiding vehicles must be designed and tested to ensure that they do not cause additional safety risks to others due to hardware or software failure.

Professional and ethical: Professionals involved in the design, manufacture, and installation of obstacle avoiding systems must adhere to ethical standards, such as maintaining user privacy and preventing discrimination.

Social and political issues: The use of obstacle avoiding vehicle can raise social and political issues, such as concerns about individual privacy and civil liberties. Manufacturers and policymakers must consider these issues and work to address them in a responsible manner.

Cost: The cost of obstacle avoiding vehicle systems must be considered, both in terms of the initial cost of installation and ongoing maintenance costs. Cost considerations may impact the affordability and accessibility of these systems for individuals and organizations. Price is subject to hike with the demand and supply.

3.3. Analysis of Features and finalization subject to constraints

The features of this vehicle can be broadly classified into two categories, those related to obstacle detection and those related to obstacle avoidance.

Some of the features related to obstacle detection may include:

1. Proximity Detection: The sensors can be used to detect the distance of the obstruction of path ahead and proper measures are taken to avoid accidents.
2. Approaching Obstacle: Any sorts of incoming traffic when overlooked can be a means of accident, however detection of it may help us to avoid it at earliest.
3. Alarming The Driver: Driver might not be able to notice the obstacle in some cases. Piezo Buzzer plays a prominent role in alerting the driver and helps in avoiding the later consequences.
4. Obstacle Distance: Despite detection of obstacles, we cannot estimate the exact distance between the obstacle and our vehicle, or there might be multiple obstacles on our way. With this feature we will be able to tell the obstacle distance and follow the path in a better way.

Some of the features related to obstacle avoidance may include:

1. Changing of lanes: Changing of lanes without proper signals, leads to accidents. This feature helps in avoiding it by alarming the driver if changing lanes without turning any signal indicators and also informs if there are any other vehicles near in that process.
2. Speed Modulation: The proper speed should be maintained while avoiding the obstacle, changing of lanes and while moving in reverse and forward direction. The speed should vary according to the situation.

Once the features of the obstacle avoiding vehicle have been determined, it is important to finalize the design subject to various constraints. Some of these constraints may include:

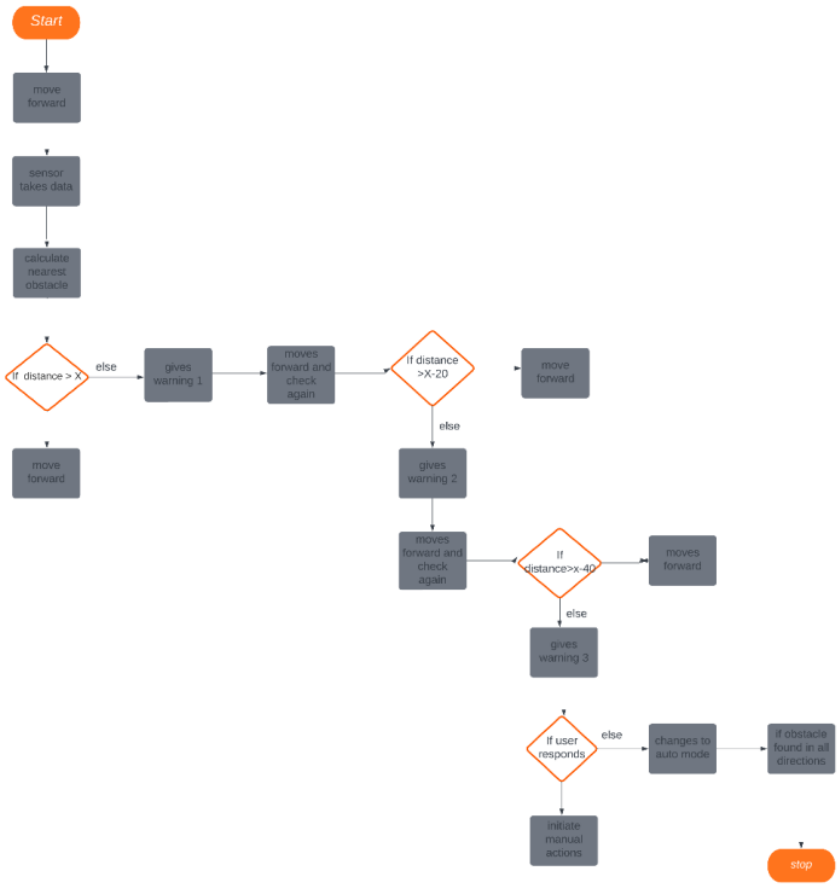
1. Cost: The device should be affordable and cost-effective so that it can be widely adopted by the public and law enforcement agencies.
2. Power consumption: We use a rechargeable battery, so that it can be charged and be reused again. It saves from purchasing multiple batteries.

3. Durability: The device should be durable so that it can last for a long time without any hardware issues and be able to move irrespective of weather conditions.

4. Data storage: The detected values of obstacles should be stored properly for better calculation of the nearest obstacle.

In summary, the obstacle avoiding vehicles is designed to reduce accidents, mostly caused due to man made mistakes. By being able to detect and avoid the obstacles with the help of sensors we can achieve this. In the meanwhile, it can also assist drivers in many ways like by guiding with directions and so on.

Design Flow



In this process, the sensor first it detects if there is any obstacle ahead. If any obstacle is detected in one direction, then it checks on the other directions. The same process is repeated until it finds no obstacle and then when the path is clear the vehicle moves accordingly.

The driver is notified of obstacle ahead. If the driver is incapacitated, the control is taken by the vehicle itself & actions are executed accordingly.

This flow diagram represents a simple scenario, and the implementation of Obstacle Avoiding Vehicle additional details and considerations.

3.5 Design selection

The above design or Data Flow is taken into consideration as it has a feedback mechanism as well as a simple approach to execute the whole process. The designs are efficiently made so that the decision process takes minimum time & hence actions are taken fastest to avoid any accident or collision since in current road scenarios, even fraction of a second matters. The above design is selected because of its efficiency in performing it's task. It helps to achieve its goal by detecting and avoiding obstacles by detecting them as soon as they are found. The ultra sonic sensors have huge range in detecting the obstacle. This feature helps in avoiding as soon as it can because detecting the obstacle with less distance between obstacle and vehicle may lead to accidents or it makes it difficult to avoid it.

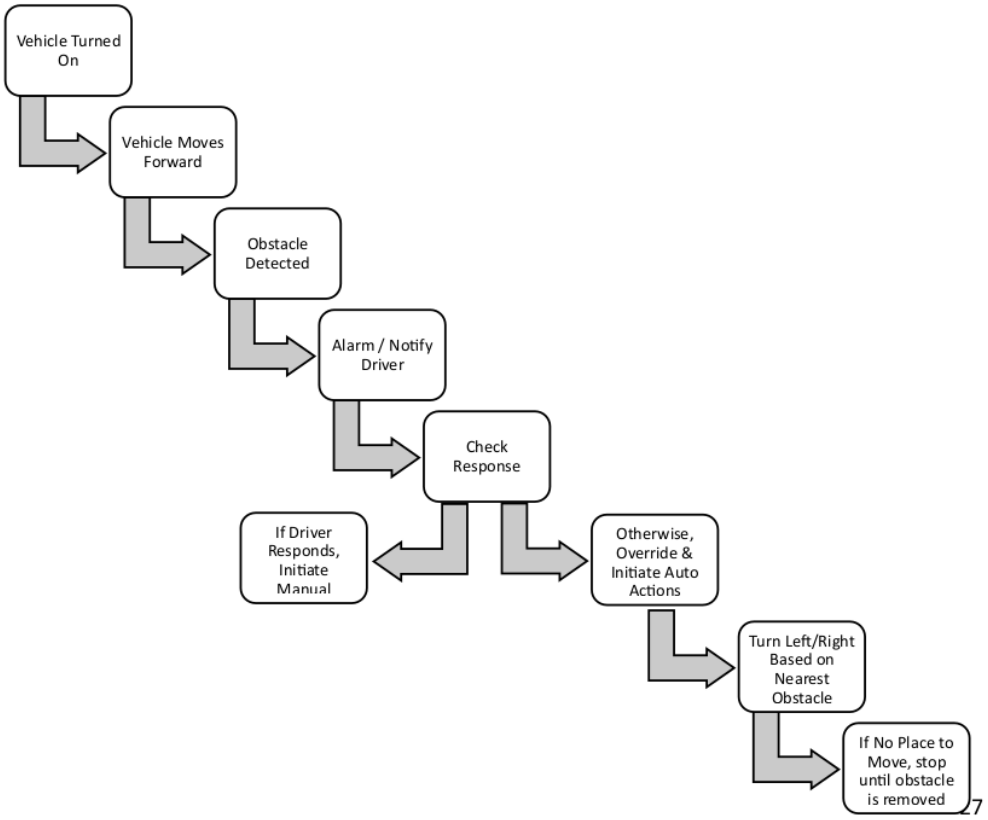
3.6. Implementation plan/methodology

A detailed algorithm for the working of an Obstacle Avoiding Vehicle:

1. Start
2. Turn ON Power Supply
3. Vehicle moves in forward direction
4. Step 3 is repeated until obstacle is detected

5. Calculate nearest obstacle distance
6. Once obstacle is detected, it alarms or notifies driver
    - At distance < X, Alarm 1 rings at a certain Pitch
    - At distance <X-20 units, Alarm 2 rings at a certain pitch
    - At distance <X-40 units, Alarm 3 rings at a certain pitch
7. Check for response
8. If response occurs from user end, initiate manual actions
9. Otherwise, override & initiate auto actions
10. Turn Left/Right based on nearest distance of the surrounding obstacles
11. Repeat Step 10 until obstruction clears
12. If there's no possible way to move, wait until obstruction clears
13. End

Overall, this flow chart highlights the key steps involved in the working of a Obstacle Avoiding Vehicle, which involves checking for the nearest obstacles and any approaching obstacles, alerting the driver and overriding manual controls to avoid collision if required.



Chapter 4.

Result Analysis and Validation

Analysis:

After analysing the above-mentioned designs. We selected the design based on its efficiency to work. In this firstly, the robot is started then it moves forward. Then the sensors placed on robot starts accounting the distance value, which is the distance between obstacle from it. There are six sensors placed on the robot. There are three Ultrasonic Sensors are placed on front side of the robot and three IR-36 sensors are placed on backside. These sensors each calculate the distance from the model to any obstacle sensed in its direction. Each valued is stored and then the distance is compared and according to the condition mentioned in programming, the movement of robot is done. If the obstacle is in the range of the mentioned code, then it either tries to avoid or entirely stops depending upon situation.

There are many cases for its movement.

CASE 1:

If obstacle is found in front of the vehicle (prototype). Then the Ultra sonic sensors placed sense it and it either moves left or right after checking if there are any obstacles in the path or it can also move in reverse direction if there are obstacles all over the front side. Then after some movement towards backside then it follows the same method until the destination is reached.

CASE 2:

If the obstacle is found at backside of vehicle, then as usual, the robot moves forward after avoiding the obstacles ahead.

CASE 3:

If there are obstacles in both directions. The sensors check if there is any obstacle, if found in all directions then it tries to move in reverse direction and even then, there is any obstacle sensed by IR-36 then the robot has no choice but to stop.

When the vehicle starts moving then it first takes the data values through sensor. After sensing the obstacle then it avoids it and provides a safe way and helps in avoiding accidents. There are several elements used in making this prototype like Arduino Uno, Dc Motors, Motor Module, Ultrasonic Sensors, Infrasonic Sensors, etc.

Considering the elements we used, we should get to know about the elements itself. The various electrical & non electrical components used are:

- DC Geared Motors: In order to move the vehicle operated by batteries, DC Geared Motors are used. It works from a range of 3-12V power supply. It has an RPM of almost 200rpm. The wheels attached to it has a profile of 65x26 mm. There are 4 DC motors attached to the model. This makes the car a 4 Wheel Driven Vehicle (4WD). This helps the vehicle to cross any irregular path with an ease as the power is channelled to all the 4 wheels. Unlike front wheel driven cars or rear wheel driven cars. This also makes the power distribution equal to all wheels as a result the load distribution is uniform,
- Motor Module: The DC Motors are connected to Motor driver module L298N. Motor drivers act as interface between motors and the Arduino. In order to control a DC Motor, i.e., it's speed and spinning direction, this module is very effective in these terms.

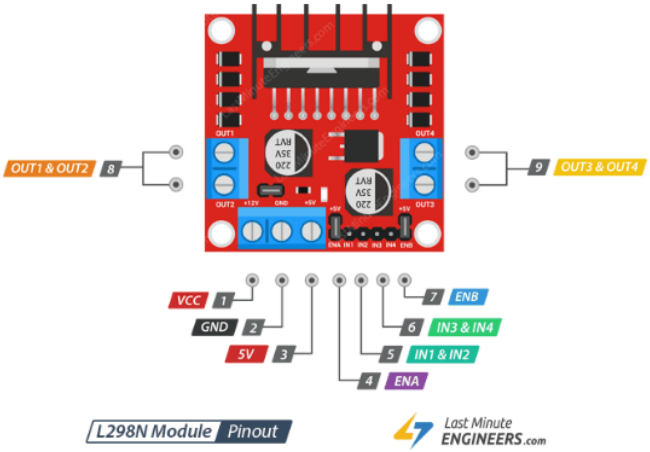
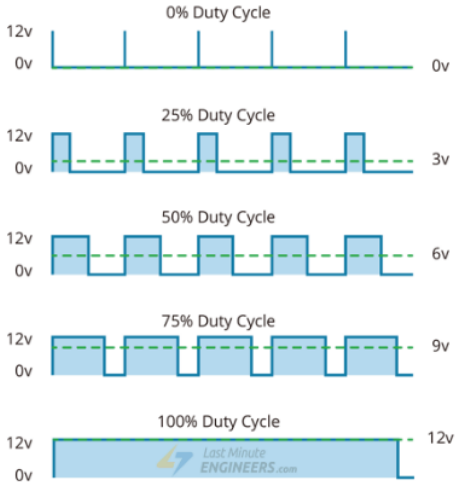


Fig: L298N Motor Module

The speed & direction of the DC Motors is done through combining two techniques, firstly the PWM which is used to control the speed & the H-Bridge which is used to control the spinning direction. The speed of the DC Motors can be controlled by changing the input voltages to the DC Motors.

The most common technique to facilitate this task is PWM which stands for Pulse Width Modulation. It is a technique in which the speed is controlled by sending a series of average value of the input voltages in the form of ON-OFF pulses. The average voltage is directly proportional to the width of the pulses also known as Duty Cycle.



Since, it's directly proportional, the higher the average voltage the higher speed of the motor is observed & vice versa.

Similarly, H-Bridge is used to control the spinning direction of the DC Motor. It's made up of four switches arranged in a H-Shape which has the motor in the middle or the center.

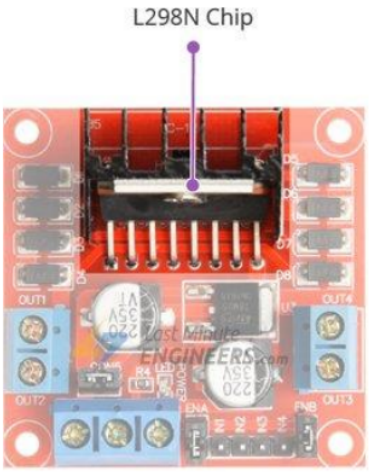


Fig: L298N Chip

Closing two specific switches at a time, reverses the polarity of the voltage applied to the motor. This causes the change in the spinning direction of the motor. Apart from these techniques, let's talk about the onboard components. It has a big black chip with a heat sink within it. This is known as the L298N Chip. The name of the driver module is derived from this chip. It has two standard H Bridges capable of driving a pair of DC Motors.

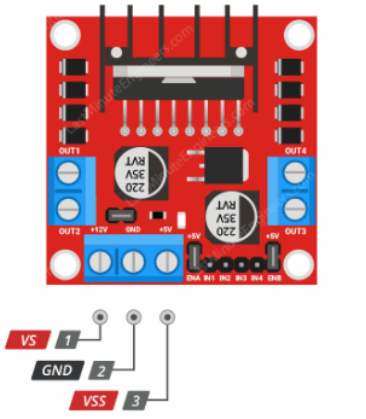


Fig: Power Pins

It has 11 Pins on it, to communicate with the Arduino or the motors, etc., It has three power pins, i.e., VCC, GND & 5V, out of which it has 2 input power pins which is VC & 5V pin. VCC pin powers the IC's internal H-Bridge which drives the motor module. However, the VCC pin is used to power the logic circuit situated within the L298N IC. GND is the common ground pin.

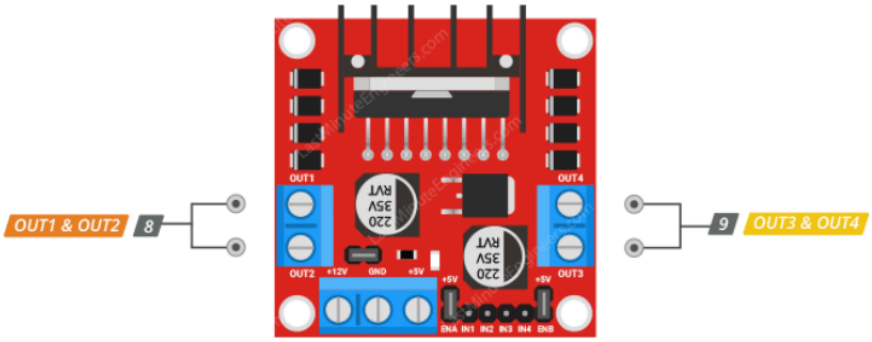


Fig: Output Pins

There are 4 Output Pins in the motor driver module. OUT1 & OUT2 are used to control the motors of one side while the OUT3 & OUT4 is used to control the motors of the other side. These terminals are made up of 3.5mm pitch screw terminals on the either side of the board.

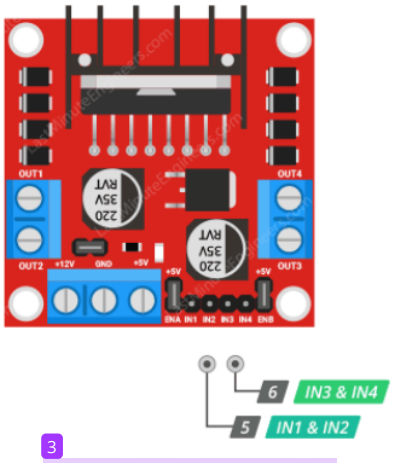


Fig: Direction Control Pins

The direction control pins which are located on the board rotates the motor in either forward or backward direction. Basically, these pins actually control the

four switches of the L298N chip. There are four pins designated on the board responsible for the direction of spinning of the motor. The four pins are IN1, IN2, IN3 & IN4 located on the opposite side of the L298N chip. The spinning of the motors is controlled by applying the logic of HIGH & LOW to these inputs. The speed control pins which facilitates the PWM function is given by the ENA & ENB pins which are located adjacent to the direction control pins on the either side respectively.

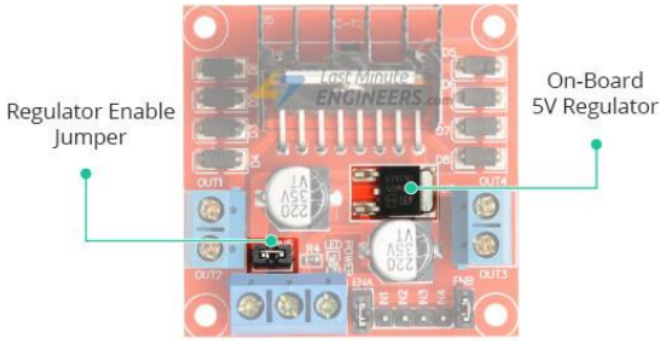
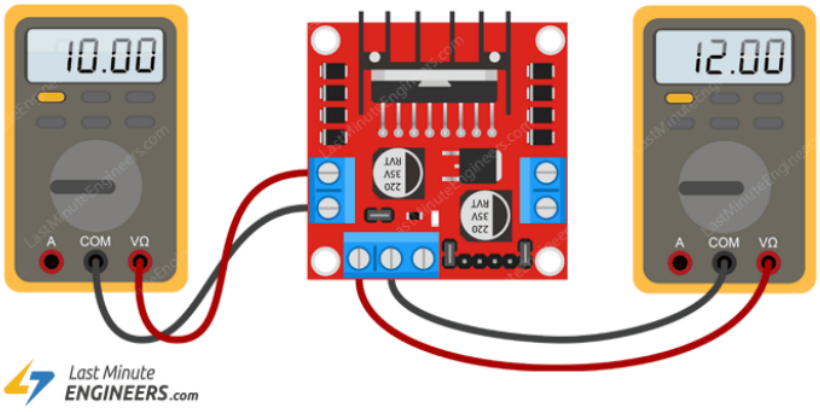


Fig: 5V Regulator & Regulator Enable Jumper

Apart from the mentioned pins, there are various onboard components such as 5V Regulator as well as the Regulator Enable Jumper. However, there is a voltage drop across the power pins & the output pins due to the fact of internal switching transistors.



Whenever, 12V is passed through the power pins, the power received on the output pins is approximately 10V as there is a voltage drop of 2V across them.

The direction pins & speed pins are connected to the digital pins of the Arduino & the speed pins are connected to the pins of the Arduino which support PWM. The 12V supply from battery is connected to VCC, the GND from Battery is connected to the GND pin of motor module as well as the Arduino Sensor Shield. The 5V supply is connected from the motor module power pin to the Sensor Shield 5V supply.

- Arduino: Arduino is used in this project. Arduino Uno is a microcontroller board based on the ATmega328P. It is single chip Microcontroller of the Atmel family. The processor code inside of it is of 8-bit. It combines Memory (SRAM, Analog to Digital Convertor, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.

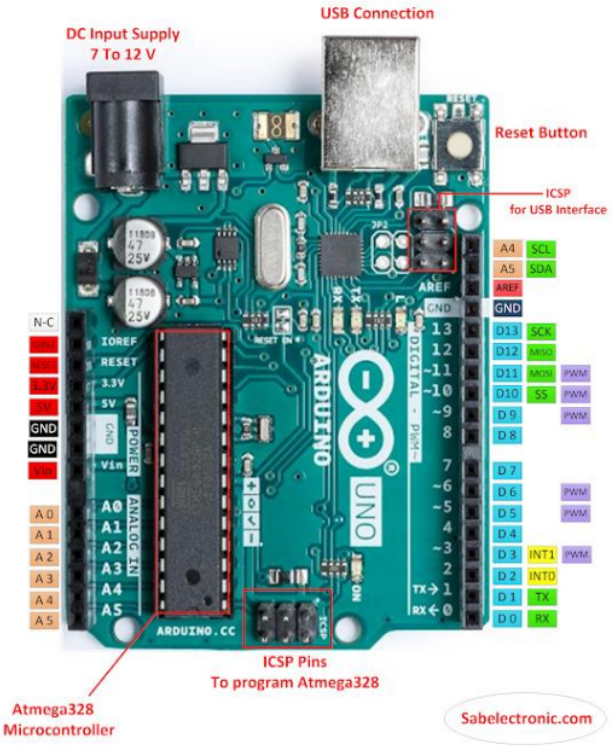


Fig: Arduino UNO

It is easy to use compared to other boards, such as Arduino mega board, etc. It connects the hardware with the help of Arduino programming. The code is

uploading into Arduino with the help of USB A to B cable. It then allows the hardware to follow the instructions set in the code. It has 14 digital input/output pins. In which six pins can be used as PWM outputs which are pin 11, 10, 9, 6, 5 and 3. We need to use the analogWrite() to set the duty cycle of PWM pulse. The frequency can also vary for some PWM pins present on the board. The frequency on pin 3 and 11 is 980Hz, while other PWM pins have 490Hz of frequency. It also consists of a 16MHz ceramic resonator, a power Jack and reset button. It works simply by connecting it to computer with a USB cable. It can be powered by a USB cable or connector that accepts voltages between 7 and 20 volts. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms. It also contains Power LED Indicator. In this the ON status shows us that the power is activated. When the power is off, the LED will not light up. The digital pins have the value HIGH or LOW. The pins which are numbered from D0 to D13 are digital pins. Reset button is used to add a reset button to the connection. There is voltage regulator which converts the input voltage to 5V. There are ground pins which act as a pin with zero voltage. Analog pins are the pins which are numbered from A0 to A5. The function of Analog pins is to read the analog sensor used in the connection. It can also act as GPIO (General Purpose Input Output) pins.

- Arduino Sensor Shield: Arduino Boards comes with the standard header layout. It is used to connect sensors with the Arduino board without soldering. This board is connected with Arduino Board using jumper wires. Using Arduino board separately we only find a very few of 5V and GND connection for every Arduino signal pin. Arduino sensor shield has 20 digital input/output pins and 6 Analog pins in which 6 pins are PWM. This comes into use mainly when we find shortage of pins in Arduino Uno.
- Breadboard: Breadboard is a solderless construction base used for developing an electronic circuit and wiring for projects with microcontroller boards like

Arduino. It consists of plastic block holding a matrix of electrical sockets of a size suitable for gripping thin connecting wires or the pins of transistors and Integrated Circuits (IC's).

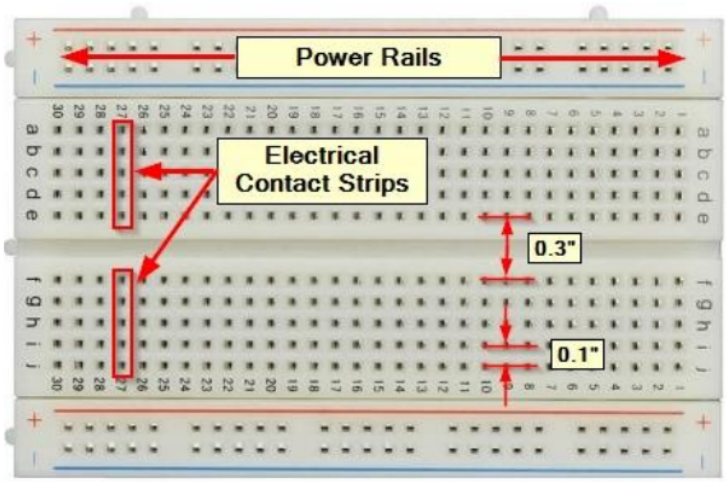


Fig: Breadboard Top

Breadboard consists of two areas called strips. The bus and the terminal strip. Bus strips are mainly used for power supply connections whereas, Terminal strips are used for electrical components. In Terminal strip each strip consists of 5 pinholes, indicating that you only can connect up to 5 components in one particular session.

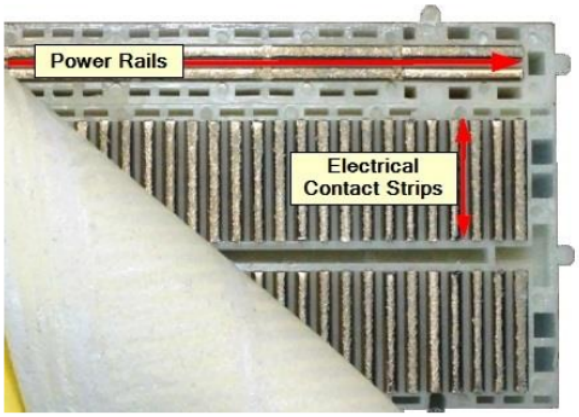


Fig: Breadboard Back

It has adjustable voltage. We can either connect it with 3.3V or 5V. We can power the breadboard directly through power supply adapter. It is mainly used when we need to connect from longer distance by jumping its connection.

- Ultrasonic Sensors (HC – SR04): Ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into electrical signal.

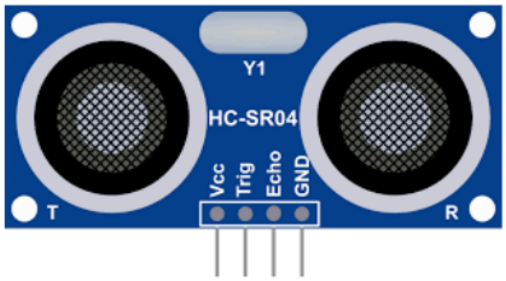


Fig: Ultrasonic Sensor (HC-SR04)

Ultrasonic sensors have two main components the transmitter (which emits the sound using piezoelectric crystals) and receiver (which encounters the sound after it has travelled to and from the target). Ultrasonic ranging module HC-SR04 provides 2cm- 400 cm non-contact measurement function. This ultrasonic sensor consists of four pins namely GND, ECHO, TRIG and VCC. The GND (Ground) pin connects with the ground pin in Arduino. While the VCC pin connects with the 3.3V. The ECHO pin is input pin which receives data whereas, trigger pin transmits the signal. Both ECHO and TRIG pins are connected to Analog pins in the Arduino. This helps in providing the data in values which further helps us detecting obstacle and avoiding it in this project. There are three Ultra sonic sensors used in this project on the front side of the robot, which detects the obstacle in the frontside. The main features of these sensors are it provides input voltage of 5V and the ultrasonic frequency is 40KHz. Since these ultrasonic sensors work using sound waves, detecting obstacles is not affected by as many factors and makes it more reliable to use over other sensors.

- Infrasonic Sensors (IR-36): Infrasonic sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests.

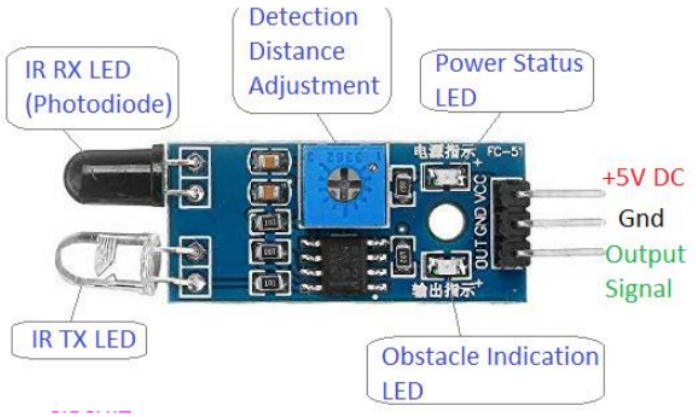


Fig: IR Infrared Obstacle Avoidance Sensor Module

In a defined angle range, the sensor elements detect the heat radiation that changes over time and space due to movement of the people. The wavelength of this sensor ranges from 780nm to 50 micrometres. These are mostly used due to its cost effectiveness when compared to other sensors. There are three IR_36 sensors used in this project in the backside of the robot. Each sensor consists of three pins GND, Data and VCC. The ground is connected to ground of the Arduino board and VCC is connected to 5V whereas the data pin is connected to the Analog pin in the Arduino Uno. These sensors are good for detection between 100cm to 500 cm. The long range makes them a good alternative to other sensors.

- Piezo Buzzer: Piezo Buzzer is a type of electronic device that's used to produce a tone, alarm or sound. It's lightweight with simple construction, and it's typically a low-cost product. In this project this is used to alert the driver when the vehicle is moving in manual mode and obstacle is detected by the sensors. This piezo buzzer produces sound based on reverse of piezoelectric effect.

- WiFi Card (ESP8266 01): The ESP 01 ESP8266 Serial WIFI Wireless Transceiver Module is a self-contained SOC with integrated TCP/IP proptocol stack that can give any microcontroller access to your WiFi network.

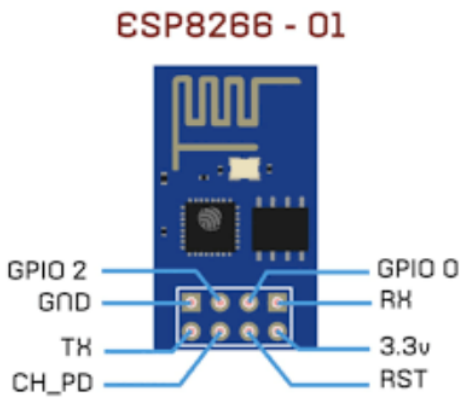


Fig: ESP8266 - 01

This is embedded with 32-bit microcontroller (MCU), which features extra low power consumption and 16-bit RSIC.

- LED: It's a semiconductor device which emits light when current flows through it.
- Piezo Buzzer: It's a speaker which uses the piezoelectric effect for generating sound. Initially, voltage is applied to the piezoelectric material and the motion makes audible using diaphragms and resonators. It operates well in 1-5KHz.
- Battery: Two 6V batteries are used to power the whole supply of the motors, motor module, Arduino, etc.,

Chapter 5.

Conclusion and Future Work

Through this project we can conclude that it plays a prominent role in avoiding accidents. It helps in identifying the obstacle in time. When the vehicle is on, the sensors are turned on and they start taking data. It then starts moving forward. If any obstacle is detected by any of the six sensors placed on robot, then it first gives warning to user. Despite multiple warnings, if driver pays no attention, then it is automatically set into auto mode and moves accordingly. If the user responds to any of the warning and take action as suggested then it can avoid accidents. It can reduce many accidents and also helps us in not violating traffic rules.

In auto mode the vehicle moves without user efforts. This also helps in rectifying manmade mistakes and saves them from the latter consequences. When the obstacle is detected by one of the sensors then it alarms the driver according to the distance and pitch set in coding based on the conditions. Then it again moves either right or left and follows same process. Then after moving in certain direction, if distance is less than the certain distance according to other condition then it again alarms driver with another pitch. This process is again repeated until the third alarm is given to user and then the auto mode is activated in failure of driver's response. If all directions are surrounded by obstacles, then it has no option but to stop.

Limitations:

1.The maintenance might be costlier if the prototype is being implemented.

2. The batteries are rechargeable. It might be an issue if the battery is turned off.

3. If the WiFi gets disconnected and the vehicle isn't on auto mode, then control cannot be established.

Future work

In future, we can develop a model based on this prototype using the features mentioned above and try to add new features by taking feedback from users after using this current version and this helps us in achieving our goal.

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- https://www.youtube.com/watch?v=KpI9l8xa0MU
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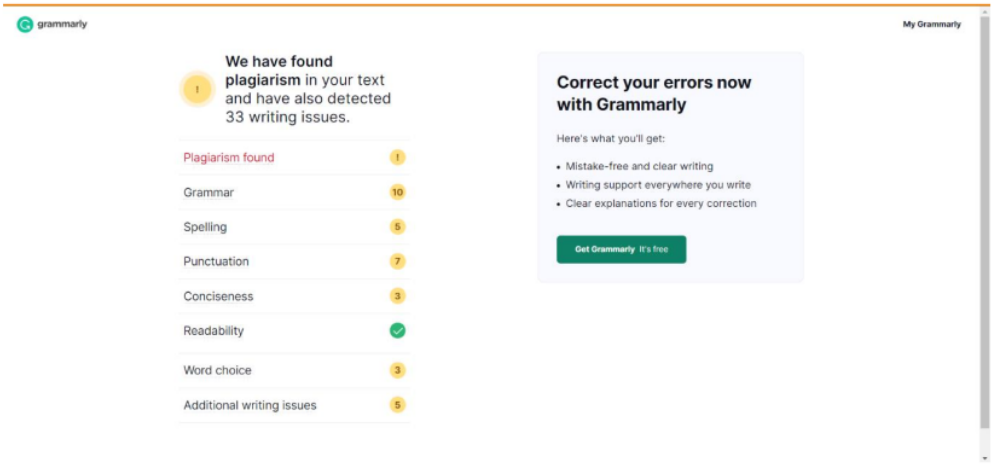
APPENDIX

- **Plagiarism Report**



USER MANUAL

It is implemented using Remote XY software. It acts as a bridge between the Arduino and WiFi module. The conditions are checked and according to condition, it switches between the auto mode and the manual mode.

Manual Mode: Firstly, the vehicle starts in Manual Mode. User has to turn on both the motors and then the vehicle starts. For Indication while moving while either right or left side, the user has to turn on the left or right light. In this user control vehicle by themselves. Speed Modulation, alarming function and Blinking of the indicator is done according to the user requirements. If the vehicle detects an obstacle, it Automatically moves in reverse direction and stop. It is also provided with an Auto button, through which we can convert the vehicle into moving from Manual to Auto mode. After sensing the obstacle, the distance between the robot and vehicle is displayed on the screen, which helps the driver to drive in an effective manner.

Auto Mode: In this mode, Vehicle moves on its own without any user control. It detects an obstacle, gives an alarm and after three warnings, it moves in another direction and checks if there is any other obstacle. This process is repeated until and unless the vehicle finds no obstacle. If the Vehicle is surrounded by obstacles in all directions and there is no way for the vehicle to move, then it stops. In this mode, if the robot finds an obstacle in one of its directions, then the indicator of the other side (either right or left) is turned on Automatically without any user efforts and the vehicle moves in the appropriate direction after avoiding the obstacle successfully. When the obstacle is detected by the sensor then Alarm also rings on its own in three certain intervals depending upon the distance. The distance of the upcoming obstacle is displayed on the screen and the user can see it.

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