Chapter 1

INTRODUCTION

Vehicle accident has become very acute now a day. When investigated, it has been found that many of the accidents happen due to drivers' failure to stop the car at the right time. In some cases, it is the pedestrians who cannot cross a road at the right time. Researchers have found that nearly 35% people die from accident of which 98% die due to fatal road accidents. Many vehicle industries have introduced artificial intelligence system in the vehicles to reduce such accidents. But, this system is complicated and cost requirement is high. As a result, mass people still remain in the risk of accidents. This limitation has drawn the concentration of this research. This research describes how a cheap intelligent system design can be implemented to avoid sudden accidents. The design includes such system that the vehicle speed automatically reduces whenever there is a possible threat of accident. Automatic speed control and accident avoidance vehicle is designed for driver. When the driver is unable to take any measure and the car is more near to the obstacle. By considering this factor in the designed system Pre-crash sensing ultrasonic sensor is used to senses the obstacle both at the back and front of the car and gives the signal to the microcontroller (Arduino). Based on the received signal from the ultrasonic sensor the system works into two ranges. At first range if an obstacle enters in the specified range (either in front or back of the car) the system actuates the alerting system. At the second stage if the obstacle is more near to the car in front side and if the driver does not give a response the system itself automatically break the pedal of the car to avoid collision both at low speeds, typical of urban driving, and at higher speeds typical of rural roads and highways. To do this project we follow the following methodology. First, we study different literatures related to accident avoidance vehicle system and select required materials. After that we design overall control circuit for the selected materials based on their specification and develop the microcontroller program. Finally, by interfacing the software components and hardware components we implement microcontroller (Arduino) based accident avoidance vehicle system

In recent years, with the advancement of sensor technology, there has been a growing interest in developing systems for automatic speed control and accident avoidance of vehicles using sensors. These systems aim to improve road safety and reduce the number of road accidents by utilizing various sensors to gather real-time data about the vehicle's surroundings and automatically adjusting its speed and trajectory to avoid potential collisions.

Road accidents are a major concern globally, causing significant loss of life and property. Human error, such as distracted driving, speeding, and failure to respond to changing road conditions, is a leading cause of road accidents. Automatic speed control and accident avoidance systems using sensors have the potential to significantly reduce the number of accidents by providing an additional layer of safety through real-time monitoring and control of the vehicle's movements.

These systems typically use a combination of sensors, such as cameras, radar, lidar, ultrasonic sensors, and GPS, to continuously collect data about the vehicle's surroundings, including other vehicles, pedestrians, obstacles, road conditions, and traffic signs. This data is then processed in real-time by an onboard computer to make decisions about the appropriate speed and trajectory adjustments needed to avoid potential collisions.

The automatic speed control and accident avoidance systems can be implemented in various types of vehicles, including passenger cars, commercial trucks, buses, and even autonomous vehicles. These systems can operate independently or be integrated with other advanced driver assistance systems (ADAS) and vehicle-to-vehicle (V2V) communication technologies to further enhance their capabilities.

The potential benefits of automatic speed control and accident avoidance systems using sensors are numerous. They can help reduce the number of road accidents, save lives, prevent injuries, and minimize property damage. Additionally, these systems can contribute to reducing traffic congestion and improving overall traffic flow by optimizing the speed and trajectory of vehicles in a coordinated manner.

1.1 Problem Statement

- **Road accidents:** Road accidents are a significant problem worldwide, causing loss of lives, injuries, and property damage.
- **Inefficient speed control:** Speeding is a common contributing factor to accidents, and many drivers fail to comply with speed limits or adapt their speed to changing road conditions.
- **Lack of accident-avoidance systems:** Many vehicles on the road lack advanced accident-avoidance systems that can proactively detect potential hazards and take actions to prevent accidents.
- **Limited utilization of sensor technology:** Although sensors, such as proximity sensors, radar sensors, and camera sensors, have advanced significantly in recent years, their full potential in preventing accidents and controlling vehicle speed is not yet fully utilized.

1.2 Objectives

- Enhance road safety: The primary objective of this topic is to improve road safety by developing a system that can automatically control the speed of a vehicle and avoid accidents using sensors.
- Reduce accidents and collisions: Another objective is to reduce the number of accidents and collisions on the road.
- Optimize vehicle speed: The system can also optimize the speed of the vehicle by adjusting it based on the road conditions, traffic flow, and other factors.
- Improve driving experience: The topic also aims to enhance the overall driving experience by providing convenience and comfort to the driver.

Chapter 2

LITERATURE REVIEW

Adnan M. Al-Smadi, Wasan Al-Ksasbeh, Mohammad Ababneh, Manar Al-Nsairat (IEEE, 2020). "Intelligent Automobile Collision Avoidance and Safety System" [1]. This paper proposes a design for detecting an imminent collision and works to prevent or reduce the strength of the imminent collision at the rear or front of the vehicle. The method presented here uses an ultrasonic sensor. Detects that the driver is approaching his vehicle and displays an alert to the driver. This system measures the distance between two vehicles moving in the same lane and in the same direction. If the trajectory of an object is directed at your vehicle and becomes dangerous, the system will deploy security measures to your vehicle.

Mahesh A. Rakhonde, ; **Prof. Dr. S. A. Khoje; Prof. R. D.Komati (IEEE, 2018)." Vehicle Collision Detection and Avoidance with Pollution Monitoring System Using IoT"** [2]. This document is based on improvements to the intelligent vehicle system. This document implements various units that improve the vehicle system. The main goal is to detect accidents in real time and minimize medical support response times Tire pressure is measured to avoid accidents and accident detection is implemented using MCU nodes MQ7 is used to monitor pollution. The proposed system helps reduce vehicle accidents, and monitoring pollution helps to know the state of the environment.

P. Ramya, R.K. Kavin, R. Rathish, M. Sathees Kumar, R. Karthi Kumar (IJESC, 2020)." Accident Avoidance and Prevention System" [3]. The purpose of the project is to provide a technical approach to detect and monitor driver fatigue levels to avoid accidents early. Is to do. The purpose is to detect if the driver is drunk. This locks the vehicle's ignition system. This system controls the direction of the vehicle when the limit distance is exceeded and avoids accidents, we also send information to relevant authorities or owners in the event of an accident caused by the use of the GSM module. From observations, we can conclude that there are three main causes of road accidents sleep, overtaking, and drinking, which are related to the driver. One of the main reasons for drunk driving is that not all police officers can check every car to determine if a person is drinking Therefore, there is a need for an effective system for screening drunk drivers with alcohol detectors. By connecting the Raspberry Pi and the ultrasonic sensor, it is possible to detect the forward movement of the vehicle and control the vehicle at a very high speed, or turn left and right according to the vehicle in another lane to control the direction of the vehicle.

Aditi Padayar, Dipali Jadhav, Priti Pashte, Shweta Lagade, Prof. S. K. Srivastava (JETIR, FEB 2020). "Microcontroller -based Accident Prevention System Using IOT" [4]. The main goal of this project is to develop a system for determining alcohol content. The driver's air exhales and automatically turns off the car when the alcohol concentration exceeds the limit. This project uses the 8051 family (89552) microcontrollers MQ3 is used as an alcohol sensor in this project, which aims in alcohol content detection in human breathing the alcohol sensor outputs analog data that cannot be analyzed by the 8051 micro-controllers. The data received from the alcohol sensor is converted to digital format by a digital converter (analog-to-digital converter). The data is then stored in the microcontroller and compared to the threshold. If the value exceeds the set limit, the program controller will take appropriate action to control the ignition system. Here, an electromechanical relay was used to control the ignition system. In this project, by controlling the ignition system, it is possible to prevent accidents caused by drunk driving and driving

Mubashir Murshed, Md Sanaullah Chowdhury (2019) ICATIS." IoT-based Car Accident Prevention and Detection System with Smart Brake Control" [5]. Car Accident is considered one of the most devastating phenomena. There are many reasons for a traffic accident, but most accidents are caused by the driver's carelessness and uncontrolled speed. There also seems to be a problem in getting to the scene of the accident in time due to lack of awareness. As a solution, the advent of Internet of Things (IoT) technology can reduce the number of accidents This article describes an intelligent system that alerts and controls the speed of the vehicle and notifies people accordingly in the event of an accident. The system uses distance sensors to constantly monitor the distance between the vehicle and obstacles in front of it. It controls speed and warns the driver to slow down when the critical distance is reached Whenever a dangerous accident occurs, an email notification with vehicle details will be sent to the responsible person.

Rachia Shettar, [6] Rachita Shettar, Sandeep Dabhade, Basavaraj Viraktamath, Amit Dalal, Varsha B Vannur (IJERT, 2015). "Design and Development of Accident Prevention

and Control Systems"[6]. This paper describes three basic circuits for accident prevention and control measures. To do. One is the accelerometer circuit used to detect drowsiness, and the other is the alcohol sensor circuit used to detect and control the vehicle due to alcohol consumption When an angle-step accelerometer detects and captures tilting motion, an alarm mechanism controlled by a relay can prevent accidents due to drowsiness Similarly, when the alcohol level is read by a higher than the normal sensor, the relay turns off the vehicle's ignition process. In addition to detecting this brake failure, continuity is also checked if the vehicle owner has not been warned to prevent a brake failure accident.

Chapter 3

METHODOLOGY

3.1 WORKING PRINCIPLE:

The automatic speed control and accident - avoidance robotic vehicle uses ultrasonic sensors for its movements. An Arduino family is used to achieve the desired operation. The motors are connected through motor driver IC to Arduino board. The ultrasonic sensor is attached in front of the robot car.

Whenever the robot car is going on the desired path the ultrasonic sensor transmits the ultrasonic waves continuously from its sensor head. Whenever an obstacle comes a head of it the ultrasonic waves are reflected back from an object and that information is passed to the Arduino. The Arduino controls the motors left, right, back, front, based on ultrasonic signals. In order to control the speed of each motor pulse width modulation is used (PWM).

3.2 BLOCK DIAGRAM:

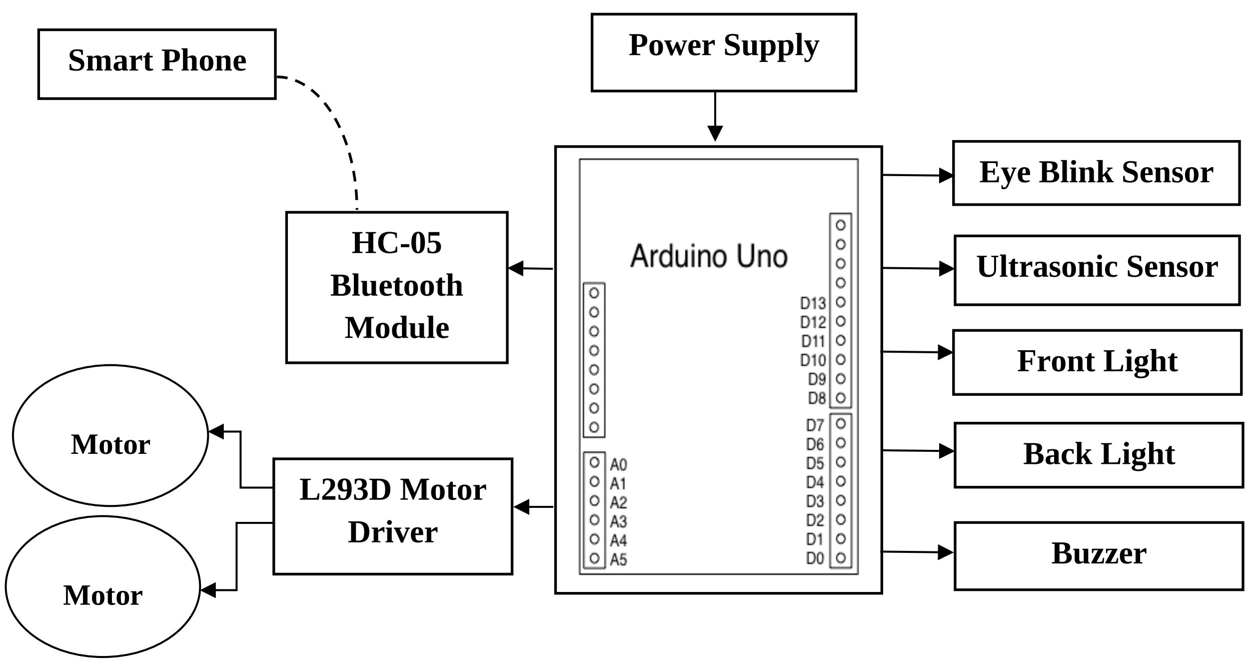

Figure 3.2.1: Block Diagram

The Arduino microcontroller based accident avoidance vehicle system consists of input part, process part and output part. The combination of the three parts is important to ensure the system operate automatically. The input part consists of two ultrasonic sensors and power supply. Microcontroller (Arduino) is used to process data. While, buzzer, LED and DC servo motor are used in the output part. In the input part, the ultrasonic sensor will measure the distance between the car and any obstacle in front of or at the back of the car continuously, then, the values of the measurement are sending to the microcontroller.

Collision Avoidance System deals with two basic object detection modes. The first one is alarm range and the other one is automatic braking system. The system, which is provided with obstacle sensing device, gets the obstacle warning a head of the host vehicle, and also the distance that object has been detected. After the data received by the control module from sensing device, it decides whether the object is in alarm range or in braking range according to the data fed already in to the control module as per control algorithm. Simply, as the object found within the alarm range (30) cm controller actuates first green LED light for alerting the driver. If the driver doesn't take any measurement the alarm sound is followed. Otherwise if the object found closer than alarm range braking range (below 29cm) controller actuates LED, alarm and braking respectively.

3.3 FLOW CHART

We have designed our system flow chart based on the following algorithm.

- First the ultrasonic sensor senses whether the obstacle is there or not
- If there is an obstacle the sensor send signal to the Arduino microcontroller
- The microcontroller received the coming signal then check the level of the incoming
- signal depending on the distance of the obstacle location relative to the vehicle
- If the obstacle on alarm position it actuates the alarm to alert the driver
- If the obstacle near to the vehicle in front of vehicle automatically decrease speed of vehicle
- Finally, If the obstacle more near to the vehicle the Arduino microcontroller actuates both alarm and vehicle to stop

FLOW CHART:

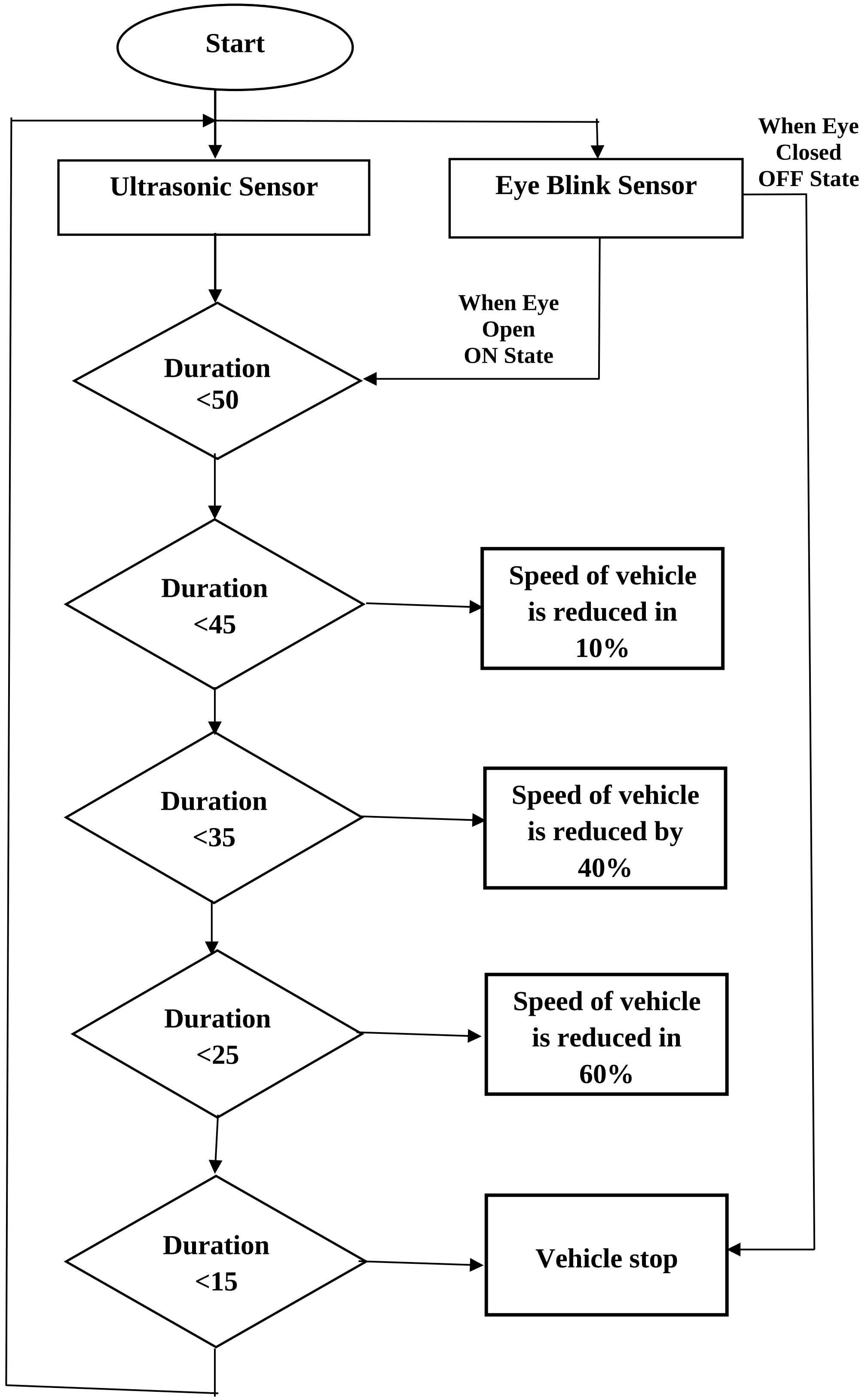

Figure 3.3: Flow Chart

Chapter 4

HARDWARE AND SOFTWARE TOOLS REQUIREMENTS

4.1 HARDWARE TOOLS REQUIREMENTS:

4.1.1 ARDUINO UNO:

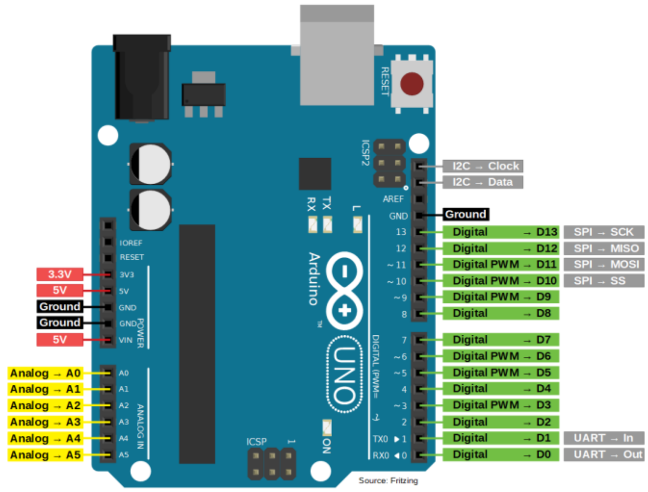

Figure 4.1.1: Arduino UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano.

4.1.1.1 POWER

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

- **VIN:** The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V:** This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.
- **3V3:** A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND:** Ground pins.

4.1.1.2 MEMORY

The ATmega328 has 32 KB (with 0.5 KB used for the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

4.1.1.3 INPUT OUTPUT

Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode (), digital Write (), and digital Read () functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

- **Serial: 0 (RX) and 1 (TX):** Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
- **External Interrupts: 2 and 3:** These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.
- **PWM: 3, 5, 6, 9, 10, and 11:** Provide 8-bit PWM output with the analogWrite() function.

- **SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK).** These pins support SPI communication using the SPI library.
- **LED 13:** There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference() function. Additionally, some pins have specialized functionality:

4.1.2 DC MOTOR:

Motors convert electrical energy into mechanical energy. A DC motor is an electric motor that runs on direct current (DC) electricity.

Figure 4.1.2: DC Motor

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

Direct current (DC) motors are widely used to generate motion in a variety of products. Permanent magnet DC (direct current) motors are enjoying increasing popularity in applications requiring compact size, high torque, high efficiency, and low power consumption.

In a brushed DC motor, the brushes make mechanical contact with a set of electrical contacts provided on a commutator secured to an armature, forming an electrical circuit between the DC electrical source and coil windings on the armature. As the armature rotates on an axis, the stationary brushes come into contact with different sections of the rotating commutator.

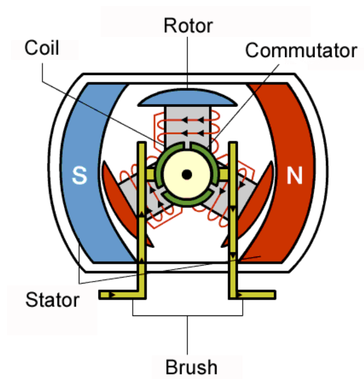

Figure 4.1.2.1: Internal Architecture of DC Motor

Permanent magnet DC motors utilize two or more brushes contacting a commutator which provides the direct current flow to the windings of the rotor, which in turn provide the desired magnetic repulsion/attraction with the permanent magnets located around the periphery of the motor.

The brushes are conventionally located in brush boxes and utilize a U-shaped spring which biases the brush into contact with the commutator. Permanent magnet brushless dc motors are widely used in a variety of applications due to their simplicity of design, high efficiency, and low noise. These motors operate by electronic commutation of stator windings rather than the conventional mechanical commutation accomplished by the pressing engagement of brushes against a rotating commutator.

A brushless DC motor basically consists of a shaft, a rotor assembly equipped with one or more permanent magnets arranged on the shaft, and a stator assembly which incorporates a stator component and phase windings. Rotating magnetic fields are formed by the currents applied to the coils.

The rotator is formed of at least one permanent magnet surrounded by the stator, wherein the rotator rotates within the stator. Two bearings are mounted at an axial distance to each other on the shaft to support the rotor assembly and stator assembly relative to each other. To achieve electronic commutation, brushless dc motor designs usually include an electronic controller for controlling the excitation of the stator windings.

4.1.3 EYE BLINK SENSOR:

Figure 4.1.3: Eye Blink Sensor

Eye Blink Sensor is a relatively simple sensor used to detect eye blinks. It uses a simple infrared sensor to detect if the person's eye is closed and the corresponding data received can further be processed by any logic as required for the application. The eye blink system comes with an IR sensor mounted on glasses which the user can wear like regular glasses, shown in the picture above.

The infrared sensor is mounted on the glasses and positioned in a way so that it lines up with the user's eye. The infrared then gives an output HIGH signal when the sensor detects a blink, that is the uses closes their eyes. The infrared sensor also has an onboard indicator LED to alert the user of the same.

The onboard infrared sensor comes with three pins

- VCC – 5V input
- OUT – output based on blink detection
- GND – ground connection VCC and GND can be connected to the system and blink detection will be signaled using the onboard LED.

In case further logics are required to keep track of the duration of the blink, number of times blinked, etc. a microcontroller can easily be paired up with a system and an appropriate code can be written on the controller to record the above.

For cases such as the above, an OUT pin is given where the logic state can either be HIGH or LOW based on the blink state. The OUT pin can directly connected to any digital input pin of any microcontroller.

4.1.4 ULTRASONIC SENSOR:

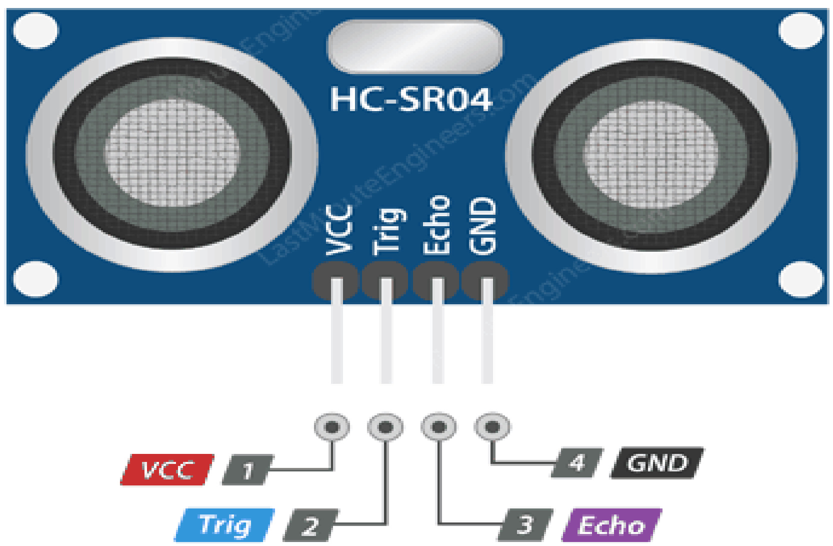

Figure 4.1.4: Ultrasonic Sensor

An 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 an electrical signal. Ultrasonic waves travel faster than the speed of audible sound. Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

Ultrasonic sensors can detect the movement of targets and measure the distance to them in many automated factories and process plants. Sensors can have an on or off digital output for detecting the movement of objects, or an analog output proportional to distance.

PRINCIPLE OF ULTRASONIC SENSOR

The principle of ultrasonic rangefinders is to measure the time it takes the signal sent by a transmitter and propagated back to the receiver. As the name implies ultrasonic sensor operates on ultrasonic frequencies. Frequencies beyond our hearing range are known as ultrasonic frequencies. Those frequencies are above 20k Hertz.

They are the all-rounders of sensor technology and can be used in any industrial application. There are several types of objects that can be detected, including solids, liquids, granules, and powders. They reliably detect transparent or glossy objects, as well as objects whose colors change.

Specifications:

- Supply voltage +5 V;
- Consumption in silent mode 2 mA;
- Consumption at work of 15 mA;
- Measurement range - 2 to 400 cm;
- Effective measuring angle 15°;
- The dimensions are 45×20×15 mm.

4.1.5 BUZZER:

Figure 4.1.5: Buzzer

An audio signaling device like a beeper or buzzer main function of this is to convert the signal from audio to sound. It is provided through DC voltage and used in timers, alarm devices, etc. Based on the various design it can generate different sound.

4.1.6 L293D MOTOR DRIVER:

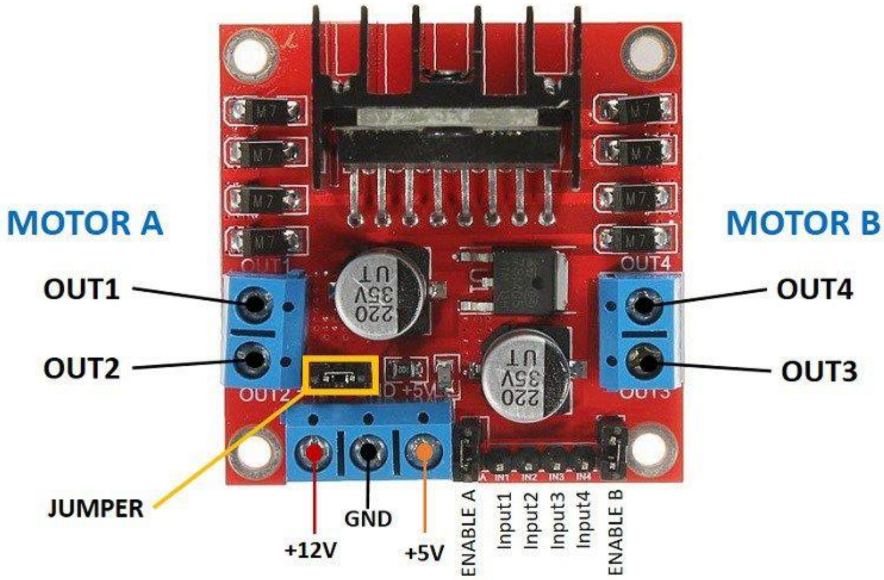

Fig 4.1.6: L293D Motor Driver

A motor driver IC is an integrated circuit chip that controls motors in autonomous robots and embedded circuits. L293D and ULN2003 are the most commonly used motor Driver IC that is used in simple robots and RC cars. A motor driver is unquestionably something that causes the motor to move in accordance with the given instructions or inputs (high and low). It listens to the low voltage from the controller/processor and controls an actual motor that needs high input voltage A motor driver IC, in simple terms, controls the direction of the motor based on the commands or instructions received from the controller. Many motor drivers follow different topologies, in this article, we will focus on the popular H-bridge topology which is used in the L293D motor driver IC.

Even the simplest robot requires a motor to rotate a wheel or performs particular action. Since motors require more current than the microcontroller pin can typically generate, you need some type of a switch that can accept a small current, amplify it and generate a larger current, which further drives a motor. This entire process is done by what is known as a Motor driver. With L293D Motor Driver IC, that task is made simple and has helped in a number of applications with relative ease.

L293D H-bridge driver is the most commonly used driver for Bidirectional motor driving applications. This L293D IC allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. Because it has two H-Bridge Circuit inside. The L293D can drive small and quiet big motors as well. There are various ways of making an H-bridge motor control circuit such as using transistors, relays, and using L293D/L298. Before going into detail, first we will see what is H-Bridge circuit.

4.1.7 HC-05 BLUETOOTH MODULE:

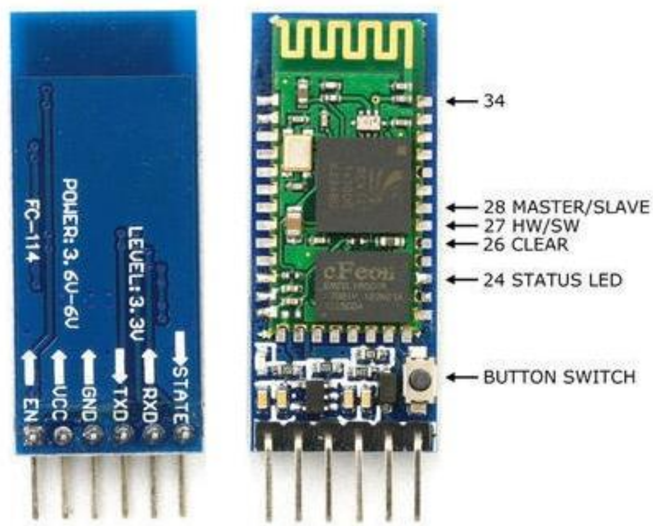

Figure 4.1.7: HC-05 Bluetooth Module

It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard, and many more consumer applications.

- It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions.
- It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air.
- It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART).

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration.

Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth. It has 6 pins,

1. **Key/EN:** It is used to bring Bluetooth module in AT commands mode. If Key/EN pin is set to high, then this module will work in command mode. Otherwise by default it is in data mode. The default baud rate of HC-05 in command mode is 38400bps and 9600 in data mode.

HC-05 module has two modes,

- **Data mode:** Exchange of data between devices.
- **Command mode:** It uses AT commands which are used to change setting of HC-05. To send these commands to module serial (USART) port is used.

2. **VCC:** Connect 5 V or 3.3 V to this Pin.
3. **GND:** Ground Pin of module.
4. **TXD:** Transmit Serial data (wirelessly received data by Bluetooth module transmitted out serially on TXD pin)
5. **RXD:** Receive data serially (received data will be transmitted wirelessly by Bluetooth module).
6. **State:** It tells whether module is connected or not.

Specification of HC-05 Bluetooth Module:

- Bluetooth version: 2.0 + EDR (Enhanced Data Rate)
- Frequency: 2.4 GHz ISM band
- Modulation: GFSK (Gaussian Frequency Shift Keying)
- Transmit power: Class 2 (up to 4 dBm)
- Sensitivity: -80 dBm typical
- Range: approximately 10 meters (or 33 feet) in open air
- Profiles supported: SPP (Serial Port Profile), HID (Human Interface Device) and others
- Operating voltage: 3.3V to 5V DC
- Operating current: less than 50mA
- Standby current: less than 2.5mA
- Sleep current: less than 1mA

- Interface: UART (Universal Asynchronous Receiver/Transmitter)
- Baud rates: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, and 460800
- Operating temperature: -20°C to 75°C (-4°F to 167°F)

4.1.8 LED:

Figure 4.1.8: LED

The lighting emitting diode is a p-n junction diode. It is a specially doped diode and made up of special type of semiconductors. When the light emits in the forward biased then it is called a light emitting diode.

A light-emitting diode (LED) is a semiconductor device that emits light when an electric current flows through it. When current passes through an LED, the electrons recombine with holes emitting light in the process. LEDs allow the current to flow in the forward direction and blocks the current in the reverse direction.

Light-emitting diodes are heavily doped p-n junctions. Based on the semiconductor material used and the amount of doping, an LED will emit colored light at a particular spectral wavelength when forward biased. As shown in the figure, an LED is encapsulated with a transparent cover so that emitted light can come out.

4.2 Software Required:

- Arduino IDE
- Bluetooth RC Controller

4.2.1 ARDUINO IDE SOFTWARE

Figure 4.2.1: Arduino IDE

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

The key features are:

- Arduino boards are able to read analog or digital input signals from different sensors and turn it into an output such as activating a motor, turning LED on/off, connect to the cloud and many other actions.
- You can control your board functions by sending a set of instructions to the microcontroller on the board via Arduino IDE (referred to as uploading software).
- Unlike most previous programmable circuit boards, Arduino does not need an extra piece of hardware (called a programmer) in order to load a new code onto the board. You can simply use a USB cable.
- Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.

- Finally, Arduino provides a standard form factor that breaks the functions of the microcontroller into a more accessible package.

- **Step 1:** Install the Arduino Software (IDE)
- **Step 2:** Get an Uno R3 and USB cable
- **Step 3:** Connect the board

The Arduino Integrated Development Environment (IDE) is a software platform that is used to write, compile, and upload code to Arduino microcontroller boards. It provides a user-friendly interface for programming Arduino boards and offers a range of tools for code development, debugging, and uploading firmware. Here is an overview of the Arduino IDE software:

Installation: The Arduino IDE can be downloaded from the official Arduino website (https://www.arduino.cc/en/software) and installed on a compatible operating system, such as Windows, macOS, or Linux.

Library Manager: The Arduino IDE includes a Library Manager that allows you to easily search, install, and manage third-party libraries, which are pre-written code that can be used to extend the functionality of your Arduino projects.

Board Manager: The Arduino IDE includes a Board Manager that allows you to select and configure the specific Arduino board you are using for your project. It provides a wide range of options for different Arduino boards, including official Arduino boards and third-party boards.

Serial Monitor: The Arduino IDE includes a Serial Monitor tool that allows you to communicate with the Arduino board over a serial connection. It provides a text-based interface for sending and receiving data between the Arduino board and your computer, which can be useful for debugging and monitoring the behavior of your Arduino projects.

Upload: The Arduino IDE allows you to compile and upload your code to the Arduino board using a USB connection. The upload process involves compiling the code into firmware that can be executed by the Arduino board, and then uploading the firmware to the board's microcontroller memory.

4.2.2 BLUETOOTH RC CONTROLLER

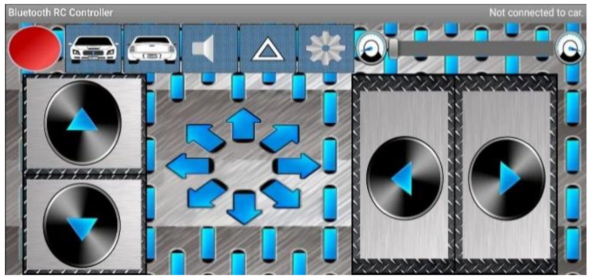

Figure 4.2.2: Bluetooth RC Controller

Bluetooth RC Car is an education app developed by Andi.Co. The APK has been available since August 2012.

Commands/characters sent to the car:

- Forward -> F
- Back -> B
- Left -> L
- Right -> R
- Forward Left -> G
- Forward Right -> I
- Back Left -> H
- Back Right -> J
- Stop -> S
- Front Lights On -> W (upper case)
- Front Lights Off -> w (lower case)
- Back Lights On -> U (upper case)
- Back Lights Off -> u (lower case)
- Horn On -> V (upper case)
- Horn Off-> v (lower case)
- Extra On -> X (upper case)
- Extra Off -> x (lower case)
- Speed 0-> 0 (zero)
- Speed 10 -> 1
- Speed 20 -> 2
- Speed 30 -> 3
- Speed 40 -> 4
- Speed 50 -> 5
- Speed 60 -> 6
- Speed 70 -> 7
- Speed 80 -> 8
- Speed 90->9

Chapter 5

RESULTS & DISCUSSION

The project “Automatic Speed Control and Accident Avoidance of vehicles using Sensors.” has been successfully designed and tested. When ultrasonic sensor reading above 50cm in real system it indicates that there is no any type obstacle near to the car and the speed of car is controlled with driver. When the reading of the ultrasonic sensor is read between 50cm and 45cm in the first step the obstacle on the way of the car but the distance is far and speed is decrease slowly. So, the driver has enough distance to take measure and automatically speed of vehicle is reduced according to the reading of ultrasonic sensor. When the ultrasonic sensor reads from 45cm to 15cm in the next step still the speed of vehicle is reduced. Again, as the ultrasonic sensor reads below 15cm vehicle is automatic stop. This implies that the obstacle become closer to the vehicle and the driver does not have enough time to take measure.

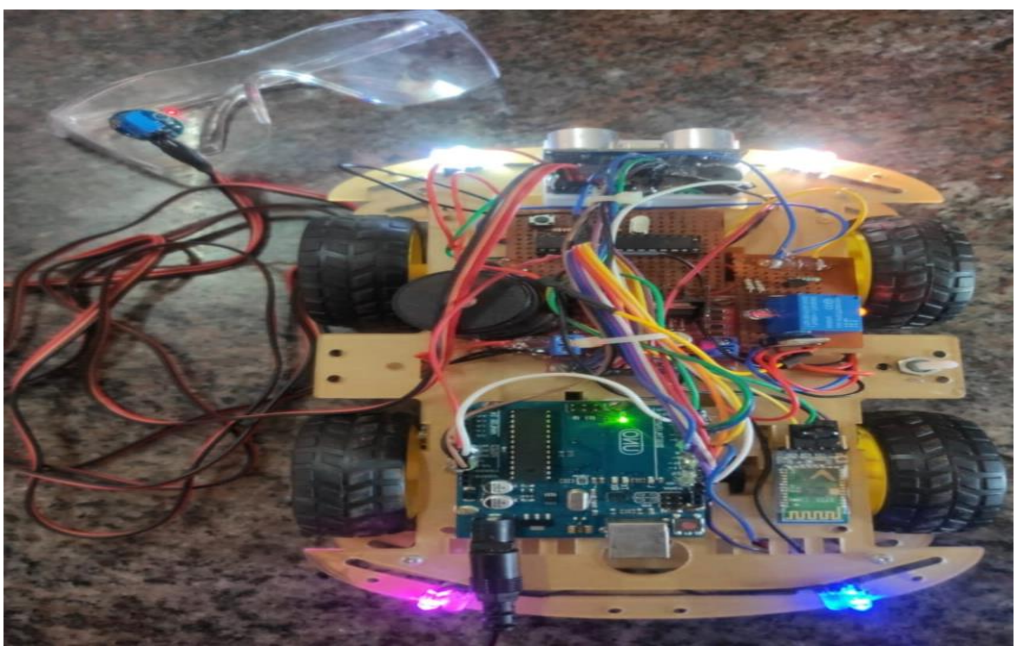

Figure 5.1: Final Result

Chapter 6

ADVANTAGES, DISADVANTAGES AND APPLICATIONS

6.1 ADVANTAGES:

- Speed can be automatically control.
- This system useful when the driver is drunk or sleepy.
- Low maintenance cost.
- Human safety.
- **Increased Safety:** One of the primary advantages of automatic speed control and accident avoidance systems is enhanced safety. These systems use sensors to monitor the vehicle's surroundings, including road conditions, other vehicles, pedestrians, and obstacles. They can detect potential collisions and take preventive measures, such as automatically applying the brakes or adjusting the vehicle's speed to avoid accidents.
- **Accident Reduction:** Automatic speed control and accident avoidance systems can help reduce the number of accidents on the road. By constantly monitoring the vehicle's environment and taking appropriate actions to avoid potential collisions, these systems can help prevent accidents caused by human error, such as distracted driving or speeding.
- **Enhanced Traffic Flow:** Automatic speed control systems can help improve traffic flow by maintaining safe distances between vehicles and avoiding sudden acceleration or deceleration. This can reduce traffic congestion and create a smoother and safer driving experience for everyone on the road.
- **Emergency Response:** Some automatic speed control and accident avoidance systems are equipped with emergency response features, such as automatically alerting emergency services in the event of a collision. This can help reduce response times and increase the chances of survival for those involved in an accident.
- **Enhanced Driver Comfort:** Automatic speed control systems can also contribute to enhanced driver comfort. By maintaining a constant speed and reducing the need for frequent speed adjustments, drivers can experience reduced fatigue during long drives, resulting in a more comfortable driving experience.

6.2 DISADVANTAGES

- This system can be operating certain distance only.
- **Reliance on Sensors:** Automatic speed control and accident avoidance systems heavily rely on sensors to detect the vehicle's surroundings, road conditions, and other objects. However, sensors can sometimes be affected by external factors such as weather conditions, dirt, or interference, which may impact their accuracy and reliability. False readings or sensor failures could potentially lead to incorrect actions or even system malfunctions.
- **Limitations of Sensor Technology:** Sensors used in automatic speed control and accident avoidance systems have their limitations. For example, some sensors may have limited range or accuracy, which could affect the system's ability to detect objects or obstacles accurately in certain conditions. Additionally, some sensors may not be effective in detecting certain types of objects, such as transparent or non-metallic objects, which could pose a limitation in the system's ability to avoid collisions with such objects.
- **Complexity and Maintenance:** Automatic speed control and accident avoidance systems can be complex and require regular maintenance. The integration of multiple sensors, controllers, and actuators may increase the complexity of the system, which could pose challenges in terms of system setup, calibration, and troubleshooting. Regular maintenance, including sensor calibration, software updates, and system checks, may be required to ensure proper functionality and reliability of the system.
- **Cost:** Implementing automatic speed control and accident avoidance systems using sensors may require significant investment in terms of sensor hardware, processing units, and software development. This could potentially increase the overall cost of the vehicle or retrofitting existing vehicles with such systems, which may be a limitation for budget-conscious consumers or fleet operators.
- **Privacy and Data Security:** Some automatic speed control and accident avoidance systems may collect and process data, such as vehicle speed, location, and sensor readings, which could raise concerns about privacy and data security. Ensuring proper data protection measures, such as encryption and secure storage, may be necessary to prevent unauthorized access or data breaches.

6.3 APPLICATION:

- **Collision Avoidance:** The system can use sensors such as radar, or cameras to detect objects or obstacles in the vehicle's path and automatically adjust the speed or apply brakes to avoid a collision. This can be particularly helpful in situations where the driver may not have enough time to react, such as sudden obstacles or unexpected road conditions.
- **Adaptive Cruise Control (ACC):** The system can use sensors to monitor the distance to the vehicle ahead and adjust the speed of the vehicle accordingly to maintain a safe following distance. This can enhance driving safety by preventing tailgating and reducing the risk of rear-end collisions.
- **Speed Limit Compliance:** The system can use GPS or road sign recognition sensors to detect speed limits and automatically adjust the vehicle's speed to comply with the legal speed limits. This can help prevent speeding and reduce the risk of accidents due to driving at unsafe speeds.
- **Lane Departure Warning and Correction:** The system can use sensors to monitor the vehicle's position within the lane and provide warnings or corrective actions if the vehicle drifts out of the lane unintentionally. This can help prevent lane departure accidents caused by driver distraction or drowsiness.
- **Intersection Collision Avoidance:** The system can use sensors to detect cross-traffic or approaching vehicles at intersections and provide warnings or automatically apply brakes to prevent collisions. This can be particularly useful in situations where visibility may be limited, such as at busy intersections or during adverse weather conditions.
- **Emergency Brake Assist:** The system can use sensors to detect potential collision situations and automatically apply brakes with increased force to assist the driver in emergency situations where quick braking is required.
- **Driver Assistance:** The system can provide real-time feedback to the driver on safe driving practices, such as maintaining a safe following distance, avoiding sudden lane changes, or speeding, to encourage safer driving behavior and reduce the risk of accidents.

CONCLUSION

Automatic speed control and accident avoidance systems using sensors have the potential to greatly improve driving safety by leveraging sensor technologies to detect obstacles, road conditions, and other vehicles in real-time, and automatically adjust the vehicle's speed or take preventive actions to avoid accidents. These systems can offer several advantages, including reducing the risk of collisions, preventing speeding, improving driver awareness, and enhancing overall road safety.

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