AUTOMATIC SPEED CONTROL IN SCHOOL AND COLLEGE ZONES

A PROJECT REPORT

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ABSTRACT

As far as automobiles are concerned, safety is very important to reduce the occurrence of accidents in speed restricted zones. It minimizes the loss of property and life. According to the recent surveys, in the past few years, an accident near the school zones, hospital zones and sharp turnings have increased tremendously, because of their hurry to get the targeted place soon. Therefore controlling vehicle speed has been a crucial issue to be considered. This paper aims to give a practical, compact and simple design to develop an automatic vehicle speed control system, which has to be quickly get implemented in school, college, hospital, sharp turning zones to reduce the number of accidents. This paper paves way for controlling the speed of the vehicles within certain limit in restricted zones without interruption of the drivers. An RFID is used for this purpose. The RFID reader is attached along with the vehicle and the RFID Tag with these Zones. The tags are placed at the beginning and the end of the regions for which the speed should be reduced. This automated speed controlling system is built using the microcontroller-based platform of the Arduino Uno board. Here the Oncethis technique was implemented the accidents will be reduced on a larger rate, and alsoreduce the nuisance by some drivers.

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LIST OF SYMBOLS, ABBREVIATIONS

IOT	Internet Of Things
RFID	Radio Frequency and Identification
DC	Direct Current
LCD	Liquid Crystal Display
CNN	Convolutional Neural Network
MCU	Micro-Controller Unit

CHAPTER 1
INTRODUCTION

1. INTRODUCTION

1.1 OVERVIEW

Road traffic safety refers to strategies and measures for reducing the danger of aperson using the road being killed or genuinely harmed. Efforts to enhance road security have been under way for a long time and majorly affected the road safety record. A notable reduction in danger practices, for example, alcohol-impaired driving or non-wearing of safety belts authenticates this. At that point likewise such a large number of road related accidents still reason to many victims and their families consistently.

The World Health Organization (WHO) extends that by 2030, the most widely recognized reason behind loss of life will be damage produced by road accidents. New vehicles over the world, will be outfitted with cutting edge wellbeing systems to help the driver to make the correct move, and if necessary, to control the vehicle in basic circumstances. This migration process, which is the strongest trend in traffic safety, will be market driven and will spreadquickly around the world.

These measurements give a total thought regarding theseriousness of the issue and consequently the need of time to actualize the systemto stay away from such accidents. In this manner the proposed system will help us to diminish the danger of accidents. The highlights that are proposed in this work are: collision notification that gives notification about accident to the victim's relative, Red light traffic control makes sure vehicle doesn't break signal,Speed control alters speed in different zones and prevent vehicle from entering no entry zones, Horn control prevents no honking in horn prohibited zone and Alcohol detection detects drunk driving.

The issue of over-speeding has been a major concern for many years, leading to a significant number of road accidents and fatalities. Private zones such as university campuses, industrial areas, and residential neighborhoods have also faced challenges in managing vehicle speeds within their premises. The need for a reliable and effective solution to regulate vehicle speeds in these private zones has become more pressing than ever. This project proposes the implementation of an automatic speed control system that utilizes modern technologies to maintain vehicle speeds within safe limits

1.2 PROBLEM DEFINITION

Private zones such as university campuses, industrial areas, and residential neighborhoods have been facing challenges in managing vehicle speeds within their premises. Over-speeding in these private zones has been a major cause of accidents and fatalities. Despite the installation of speed limit signs, some drivers still exceed the set limits, putting the safety of pedestrians and other road users at risk. Traditional methods of controlling speed in private zones, such as the use of speed bumps and humps, have proven to be ineffective in regulating vehicle speeds. These methods have also been associated with increased vehicle maintenance costs and discomfort for passengers.

CHAPTER 2
LITERATURE SURVEY

2. LITERATURE SURVEY

2.1 Embedded Vehicle Speed Control and Over-Speed Violation AlertUsing IoT

**Author Name : ** Ashok Reddy K, Saakshi Patel

Year of Publish 2019

In today's world, road and transport has become an integral part of every human being. The present transport system has minimized the distance, but on the other hand it has increased the life peril. The main idea is to develop aroad safety measure. This paper proposes a novel system where it is able to automatically control the speed of the vehicle by detecting the speed signs labels from speed sign boards, which are laid on the road side and take necessary steps to take it to the knowledge of the driver by sending a cautionnotification. When the driver does not speed down even after the sign of caution, details of the vehicle are notified to the authorities (traffic officials)and the speed of the car is reduced to threshold speed limit as on the speed label. A real time image processing identifies speed sign label, “ARDUINO UNO” is used to send that data to cloud and GPRS module to send location of the vehicle. The sent data is analyzed by PHP in the cloud and necessary steps are executed according to the results of the analysis.

2.2 : Predictive Speed Control for Automated Vehicles in Urban Areausing Speed Zones

**Author Name : ** Peter Szilassy, Balazs Nemeth and Peter Gaspar

Year of Publish 2020

The paper proposes a predictive control for speed trajectory design and tracking in urban area. In the method the urban area is divided into speed zones, in which the reference speed for the automated vehicle is determined by the type of the road. In the paper a Model Predictive Control (MPC) based strategy is provided, which contains various constraints, e.g. on keeping safe distance from the surrounding vehicles or on the achievable acceleration of the vehicle. The result of the optimization is an acceleration profile for the automated vehicle, with which the safe distance from the vehicles in the urbanarea can be guaranteed. The effectiveness of the design method is illustratedthrough VISSIM simulation examples

2.3 : Real Time Automatic Speed Control Unit for Vehicles

Author Name **:** S Arun Prakash, Aravind Mohan R, Rahul M Warrier, R ArunKrishna, Sooraj Bhaskar A, Aswathy K Nair

Year of Publish 2018

Most of the prevailing system to control vehicle speed has a fixed speed control mechanism, which is not sufficient in places of high alert. The objective of this paper is to reduce the speed of the vehicle automatically in comparison with the maximum permissible speed limit of particular location.The Real Time Automatic Speed Control Unit we proposed is highly driver friendly and the mechanical systems do not lose their functional integrity. The controlling part incorporated in this system fully avoids any kind of human intervention, and integrating both mechanical and electronic systems. In this prototype, the zonal position and the associated maximum speed limit is collected using mobile GPS. The algorithm incorporated continuously monitors and compares the speed raised by manual acceleration and the maximum permissible speed of the particular location. Based on this, the speed of the motor is brought down to the speed limit assigned to that particular zone. The hardware complexity of the prototype presented in this paper is less since the speed of the vehicle motor is measured using an IR sensor and controlled electronically through PWM technique. LabView simulation software is used for developing virtual model of the system that enables embedding the prototype model directly on the vehicle. For testing, the prototype modeling was developed on Arduino board.

2.4 : Automatic Vehicle Speed Control System

Author Name **:** Shubhangi Sanjay Bhargave, Monika Vijay Jadhav, Aditi Sunil Patil

Year of Publish 2018

Automatic Vehicle Speed Control System is designed to control the speed of the vehicle in specific zones to avoid the accidents in the low speed areas. In this system the low speed zone is considered to be the 100 meter earlier to the traffic signal. The case study and implementation is based on the light vehicle speed control, when the vehicle is running with full speed and gets entered into the low speed zone the speed of it will be automatically reduced to the allowed speed in low speed zone. The microcontroller will interface with the sensors to detect the speed of vehicle and based on this input the controller will take appropriate action and generate a control signal for the vehicle control system which then will activate the mechanism of the Speed control in the vehicle and the speed of the vehicle is reduced to the required speed inthat zone.

2.5 : Simulation of automatic vehicle speed control by transponder- equipped infrastructure

Author Name : Dominique Gruyer, Sébastien Glaser, Benoit Vanholme, Bertrand Monnier.

Year of Publish : 2019

A huge amount of research has been done to improve the safety of road environments and reduce the risk of unsafe traffic areas. Initially this researchwas mainly focused on the perception surrounding a vehicle (local perceptionwith embedded sensors) and its potential reaction on hazardous situation. Since a few years, it has become clear that a local perception is not sufficient.Its extension is essential to minimize risk and maximize the security of the road traffic. To achieve such extension, additional works is required as well as implementation of a lot of devices often very expensive. Therefore, in earlydesign stage, it becomes necessary to have a simulation environment dedicated to prototyping and evaluating these extended and enriched drivingassistance systems. For such virtual platform it is mandatory to provide physic-driven road environments, virtual embedded sensors, embedded and virtual communicating devices and physic-base vehicle models. In this publication, we present the prototyping of a speed control application by using beacons put on the road side. The SiVIC simulation platform is used to generate the virtual world (the environment, sensors, beacons, and vehicle). The framework platform RTMaps is used for prototyping the automatic speed control algorithm. The seamless coupling of these platforms allows subsequently embedding the prototyped application directly on a real vehicle.

CHAPTER 3
SYSTEM ANALYSIS

3. SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

In existing system, there is no automatic speed control. Currently, private zones rely on traditional methods of controlling vehicle speeds such as the use of speed bumps, humps, and road markings. However, these methods have proven to be ineffective in regulating vehicle speeds, leading to over-speeding and accidents. The Zones are also not been indicated in the existing model and the lack of automatic zone recognition system. The use of speed bumps and humps has been associated with increased vehicle maintenance costs and discomfort for passengers. The discomfort experienced by passengers can lead to reduced ride comfort, increased fuel consumption, and increased wear and tear on vehicle suspension systems. In some private zones, speed limit signs have been installed to regulate vehicle speeds. However, these signs have proven to be ineffective in regulating vehicle speeds as some drivers still exceed the set limits.

3.2 Disadvantages of Existing System

The existing system of controlling vehicle speeds in private zones, such as the use of speed bumps, humps, and road markings, has several disadvantages. Some of these disadvantages are::

- Ineffective in Regulating Vehicle Speeds: The traditional methods of controlling vehicle speeds, such as speed bumps and humps, have proven to be ineffective in regulating vehicle speeds in private zones. Drivers tend to speed up after passing these obstructions, leading to over-speeding and accidents.
- Discomfort to Passengers: The use of speed bumps and humps can cause discomfort to passengers, leading to reduced ride comfort, increased fuel consumption, and increased wear and tear on vehicle suspension systems.
- Lack of Real-time Monitoring: The existing system lacks real-time monitoring of vehicle speeds in private zones. It is difficult to detect over-speeding and take appropriate action to prevent accidents.
- Reliance on Driver Compliance: The use of speed limit signs relies on driver compliance, which is not always guaranteed. Some drivers tend to ignore speed limit signs, leading to over-speeding and accidents.

3.3 PROPOSED SYSTEM

The proposed system for Automatic Vehicle Speed Control in Private Zones utilizes RFID technology to control vehicle speeds within safe limits. The system consists of two main components: an RFID reader and an RFID card. The RFID reader is installed at the entrance of the private zone and is responsible for reading the RFID card installed in the vehicle. The RFID card contains information about the vehicle and the speed limit of the private zone. When a vehicle enters the private zone, the RFID reader reads the information on the RFID card and verifies that the vehicle is authorized to enter the private zone. The RFID reader then communicates with the vehicle's speed control system and regulates the vehicle's speed based on the speed limit of the private zone. The system ensures that the vehicle remains within safe limits and prevents over-speeding, reducing the risk of accidents and fatalities in private zones.

The Components involved in this system are :-

- RFID Cards
- RFID Reader
- Adruino Microcontroller
- DC Motors
- Power Board , Buzzer Sound & Bluetooth device

Advantages of Proposed System

- Improved Safety: The system ensures that vehicles remain within safe limits, reducing the risk of accidents and fatalities caused by over-speeding in private zones.
- Real-time Monitoring: The system provides real-time monitoring of vehicle speeds in private zones, making it easier to detect over-speeding and take appropriate action to prevent accidents.
- Reduced Discomfort to Passengers: The system does not rely on the use of speed bumps and humps, reducing discomfort to passengers and minimizing wear and tear on vehicle suspension systems.
- Improved Efficiency: The system reduces the time and effort required to control vehicle speeds in private zones, improving the efficiency of the process.
- Cost-effective: The system is cost-effective compared to traditional methods of controlling vehicle speeds in private zones, such as the use of speed bumps and humps.

3.4 FEASIBILITY STUDY

The implementation of the proposed system is cost-effective compared to traditional methods of controlling vehicle speeds in private zones, such as the use of speed bumps and humps. The initial investment for the system is affordable, and the maintenance costs are minimal. The system has the potential to reduce vehicle maintenance costs and minimize the risk of accidents and fatalities, leading to cost savings in the long run. It has the potential to improve the safety and efficiency of private zones, making them more conducive for human activity. The system reduces the risk of accidents and fatalities caused by over-speeding, ensuring the safety of pedestrians and other road users. The system also reduces the discomfort experienced by passengers and minimizes wear and tear on vehicle suspension systems, making travel more comfortable and enjoyable. It uses RFID technology to control vehicle speeds in private zones, which is a proven and reliable technology. RFID readers and cards are readily available in the market, and the installation and maintenance of the system are relatively easy. The system can be integrated with existing speed control systems, making it easy to implement. So, this method is technical, economically as well as socially feasible.

3.5 SOFTWARE REQUIREMENTS

- Operating System : Windows 11 (64 bit)
- Software : Adruino
- Tools : C / C++, RFID Reader Software, Vehicle, Speed Control

3.6 HARDWARE REQUIREMENTS

- RFID Reader
- RFID Cards
- Control Unit
- Power Supply Unit
- Cables and Connectors
- Display Unit
- Mounting Hardware
- DC Motors
- Robotics Chasis and Wheels

3.7 TECHNOLOGIES USED

- RFID Technology
- Internet Of Things (IOT)
- Embedded Systems
- Wireless Communication

3.7.1 RFID TECHNOLOGY

RFID (Radio-Frequency Identification) technology is a wireless technology that uses radio waves to transmit data between a reader and a tag attached to an object, such as an RFID card installed in a vehicle. The tag contains a microchip and an antenna that enable it to communicate with the reader. RFID technology is widely used in various industries, including transportation, retail, and healthcare, for tracking and identifying objects. In the context of Automatic Vehicle Speed Control in Private Zones, RFID technology is used to detect the presence of RFID cards installed in vehicles and regulate their speed based on the speed limit of the private zone.

3.7.2 INTERNET OF THINGS (IOT)

IoT (Internet of Things) is a network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, and network connectivity. These devices are capable of exchanging data with other connected devices and systems, enabling them to interact and communicate with each other. IoT technology allows for the creation of smart and connected systems that can be remotely monitored, controlled, and optimized. In the context of Automatic Vehicle Speed Control in Private Zones, IoT technology can be used to remotely monitor and control the system from a central location, allowing for real-time monitoring and management of the system's performance.

3.7.3 EMBEDDED SYSTEMS

An embedded system is a computer system designed to perform specific tasks or functions within a larger system. It is a combination of hardware and software that is designed to perform a dedicated function. Embedded systems are used in various industries, including automotive, aerospace, medical, and consumer electronics. They are often used in applications where real-time response and high reliability are critical. In the context of Automatic Vehicle Speed Control in Private Zones, embedded systems are used to develop the control unit that processes information from the RFID reader and regulates the vehicle's speed. The control unit is designed to be reliable and operate in real-time to ensure that the system performs its intended function effectively.

3.7.4 WIRELESS COMMUNICATION

Wireless communication refers to the transfer of information between two or more devices without the use of physical wires or cables. Wireless communication technologies use radio waves, microwaves, infrared signals, or other wireless signals to transmit data. Some examples of wireless communication technologies include Bluetooth, Wi-Fi, NFC (Near Field Communication), and cellular networks. In the context of Automatic Vehicle Speed Control in Private Zones, wireless communication technologies may be used to communicate between the RFID reader and the control unit, enabling real-time processing and regulation of vehicle speed. Wireless communication may also be used to transmit data to a central monitoring system or to provide alerts and notifications to users.

CHAPTER 4
SYSTEM DESIGN

4. SYSTEM DESIGN

4.1 UML DIAGRAMS

A UML diagram is a diagram based on the UML (Unified Modelling Language) with the purpose of visually representing a system along with its main actors, roles, actions, artefacts or classes, in order to better understand, alter, maintain, or document information about the system. It is based on diagrammatic representations of software components.

Some UML diagrams are:

- Use case diagram
- Class diagram
- Activity diagram
- Collaboration Diagram
- Sequence Diagram

4.1.1 Use-Case Diagram

A Use case Diagram is used to present a graphical overview of the functionality provided by a system in terms of actors, their goals and any dependencies between those use cases.

Use case diagram consists of two parts:

Use case: A use case describes a sequence of actions that provided something of measurable value to an actor and is drawn as a horizontal ellipse.

Actor: An actor is a person, organization or external system that plays a role in one or more interaction with the system.

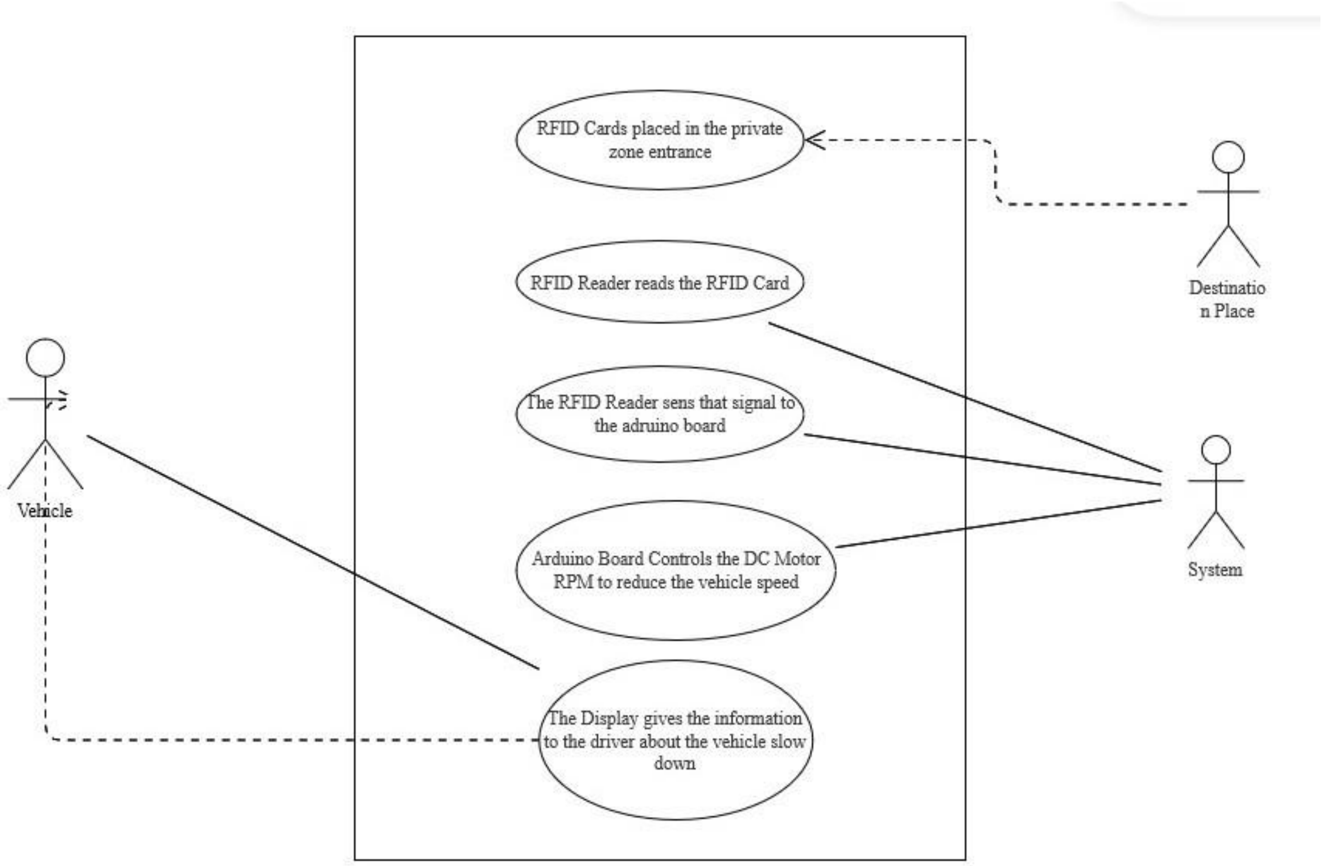


Fig 4.1.1 Use-Case Diagram

4.1.2 Activity Diagram

Activity diagram is a graphical representation of workflows of stepwise activities and actions with support for choice, iteration and concurrency. An activity diagram shows the overall flow of control.

The most important shape types:

- Rounded rectangles represent activities.
- Diamonds represent decisions.
- Bars represent the start or end of concurrent activities.
- A black circle represents the start of the workflow.
- An encircled circle represents the end of the workflow

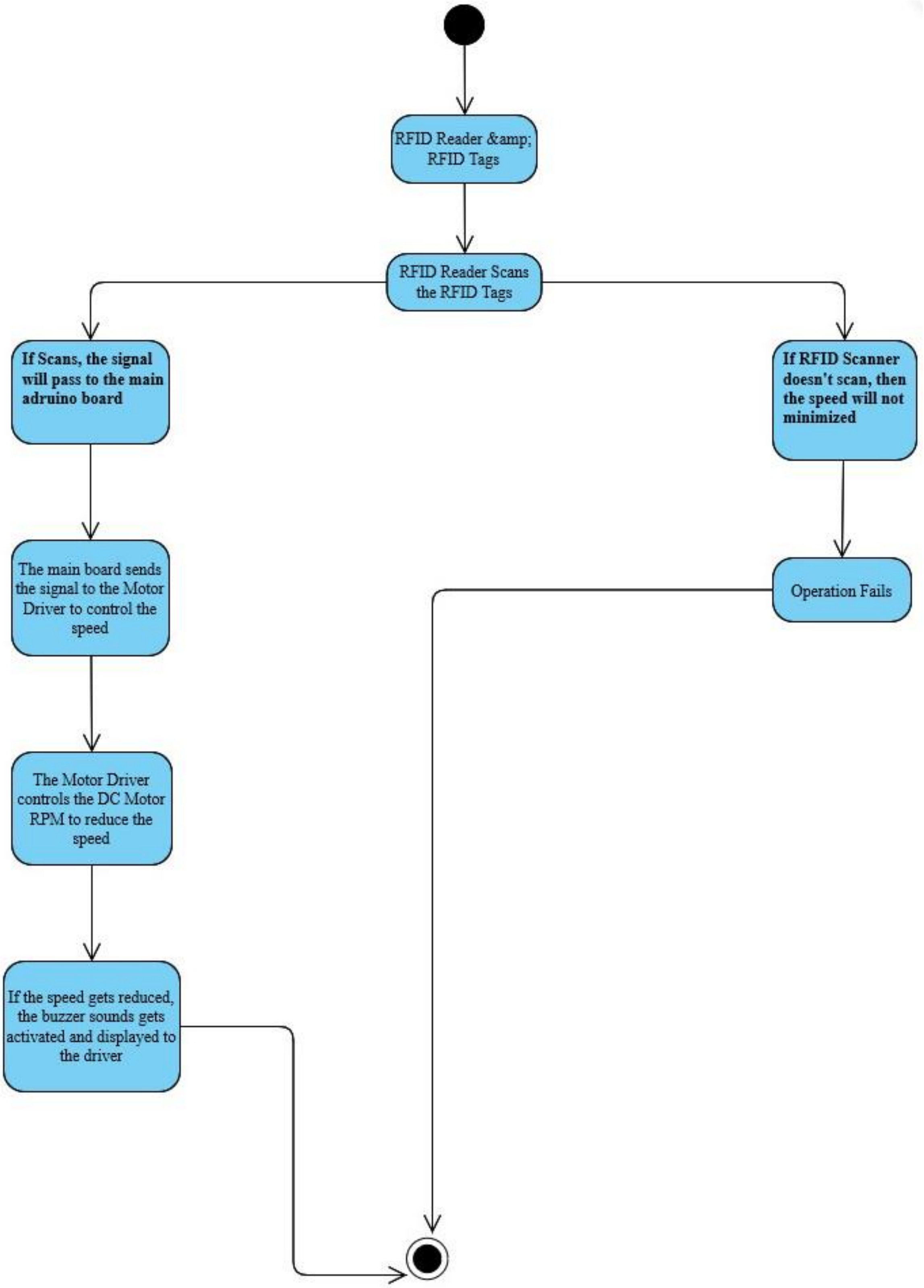


Fig 4.1.2 Activity Diagram

4.1.3 Class Diagram

A class diagram is a visual representation of class objects in a model system, categorized by class types. Each class type is represented as a rectangle with three compartments for the class name, attributes, and operations. Objects are represented as ovals that contain class names inside class name compartments.

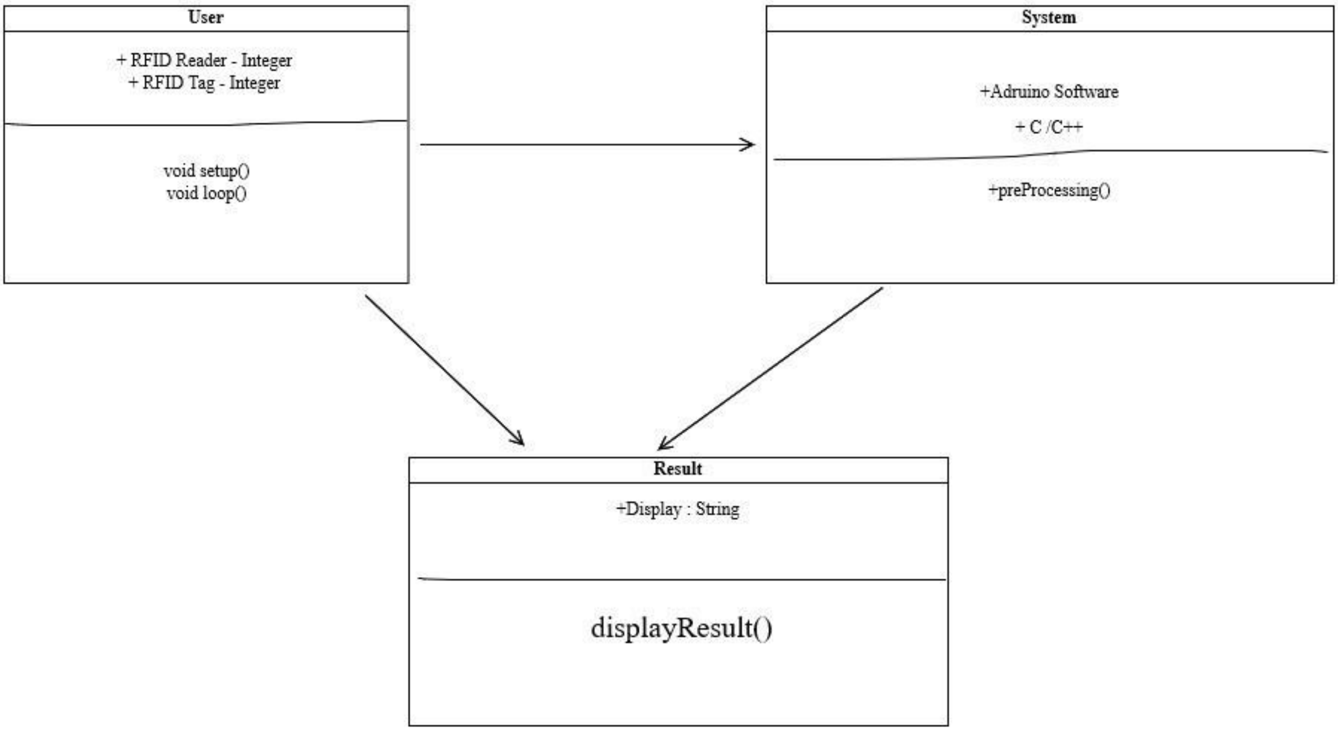


Fig 4.1.3 Class Diagram

4.1.4 Sequence Diagram

A sequence diagram shows the sequence of messages passed between objects. Sequence diagrams can also show the control structures between objects. For example, lifelines in a sequence diagram for a banking scenario can represent a customer, bank teller, or bank manager.

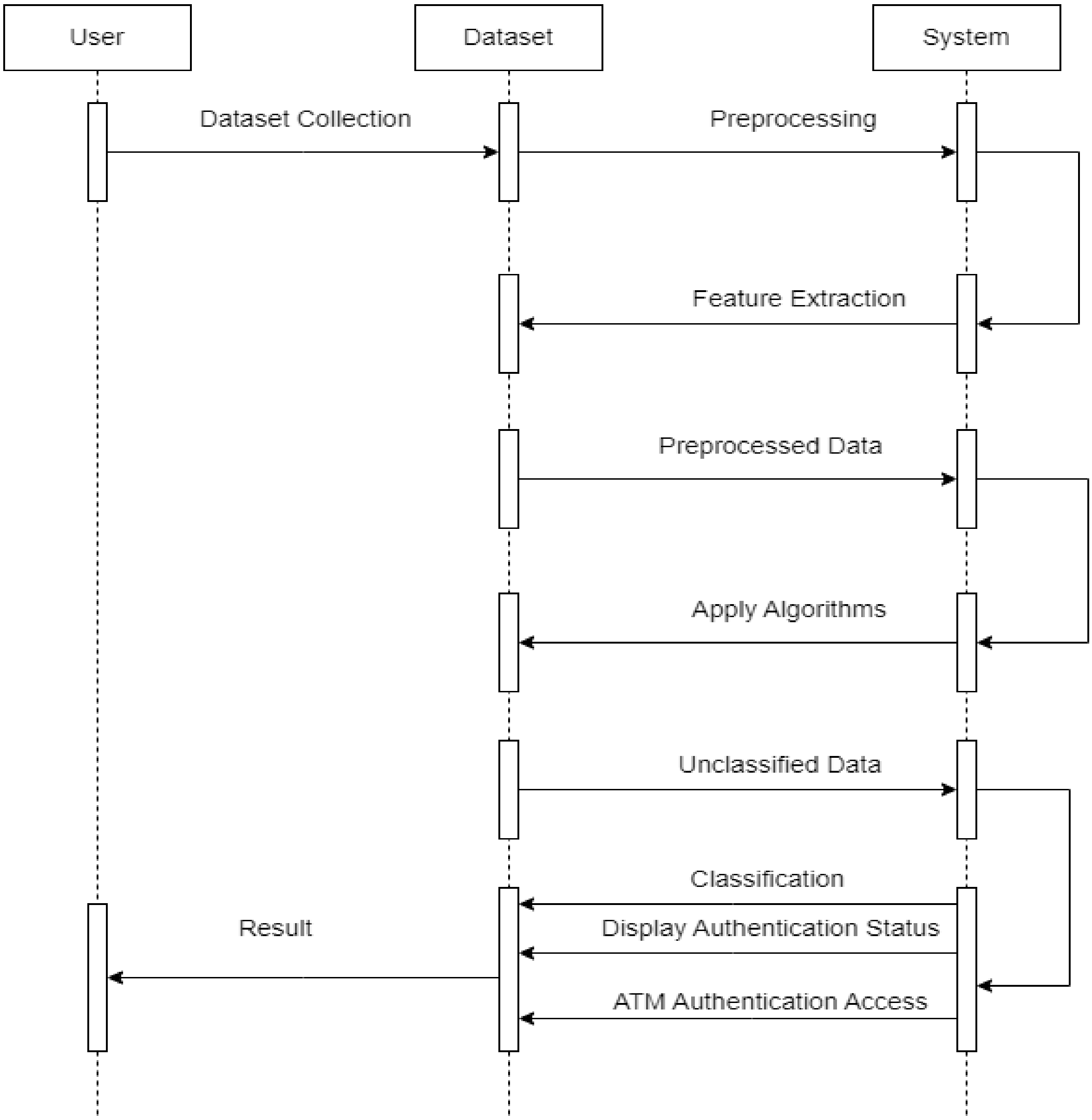


Fig 4.1.4 Sequence Diagram

4.1.5 State Chart Diagram

State chart diagram describes the flow of control from one state to another state. Statesare defined as a condition in which an object exists and it changes when some event is triggered. The most important purpose of State chart diagram is to model lifetime of an object from creation to termination.

State chart diagrams are also used for forward and reverse engineering of a system. However, the main purpose is to model the reactive system.

Following are the main purposes of using State chart diagrams

- To model the dynamic aspect of a system.
- To describe different states of an object during its life time.
- Define a state machine to model the states of an object.

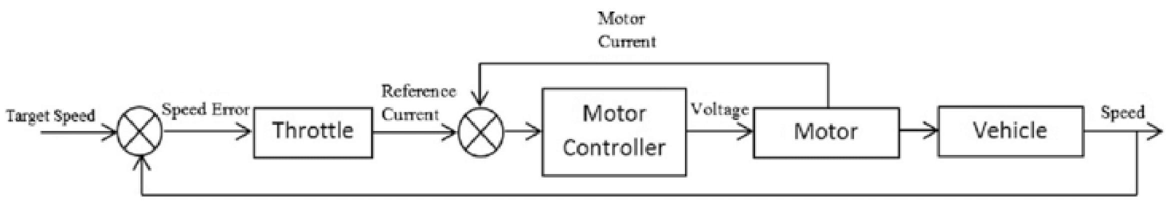


Fig 4.1.5 State Chart Diagram

4.1.6 Component Diagram

A component diagram is used to break down a large object-oriented system into the smaller components, so as to make them more manageable. It models the physical view of a system such as executables, files, libraries, etc. that resides within the node.It visualizes the relationships as well as the organization between the components present in the system. It helps in forming an executable system. A component is a single unit of the system, which is replaceable and executable. The implementation details of a component are hidden, and it necessitates an interface to execute a function. It is like a black box whose behaviour is explained by the provided and required interfaces.

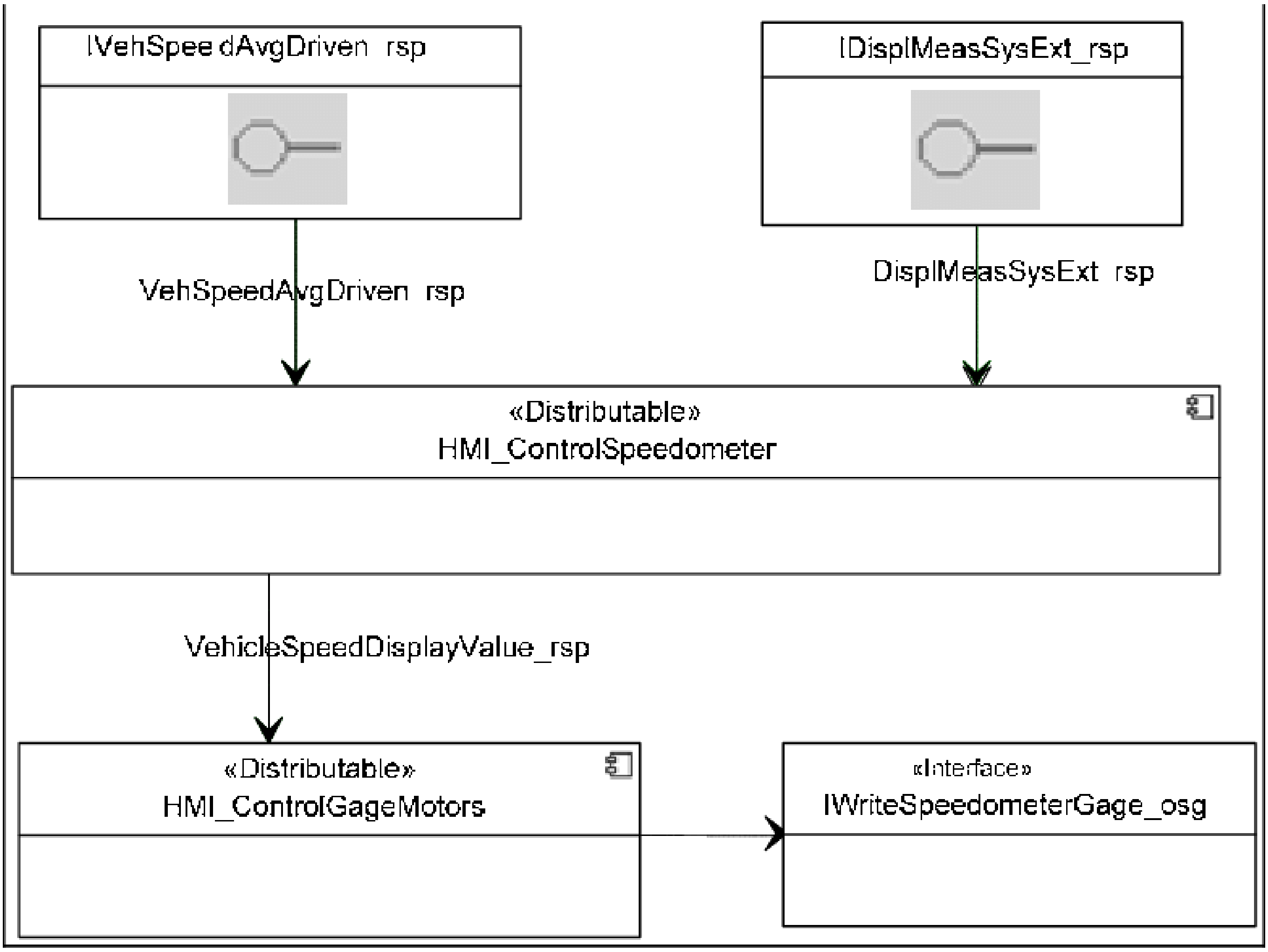


Fig 4.1.6 Component Diagram

4.1.7 Deployment Diagram

The deployment diagram visualizes the physical hardware on which the software will be deployed. It portrays the static deployment view of a system. It involves the nodes and their relationships. It ascertains how software is deployed on the hardware. It maps the software architecture created in design to the physical system architecture, where the software will be executed as a node. Since it involves many nodes, the relationship is shown by utilizing communication paths.

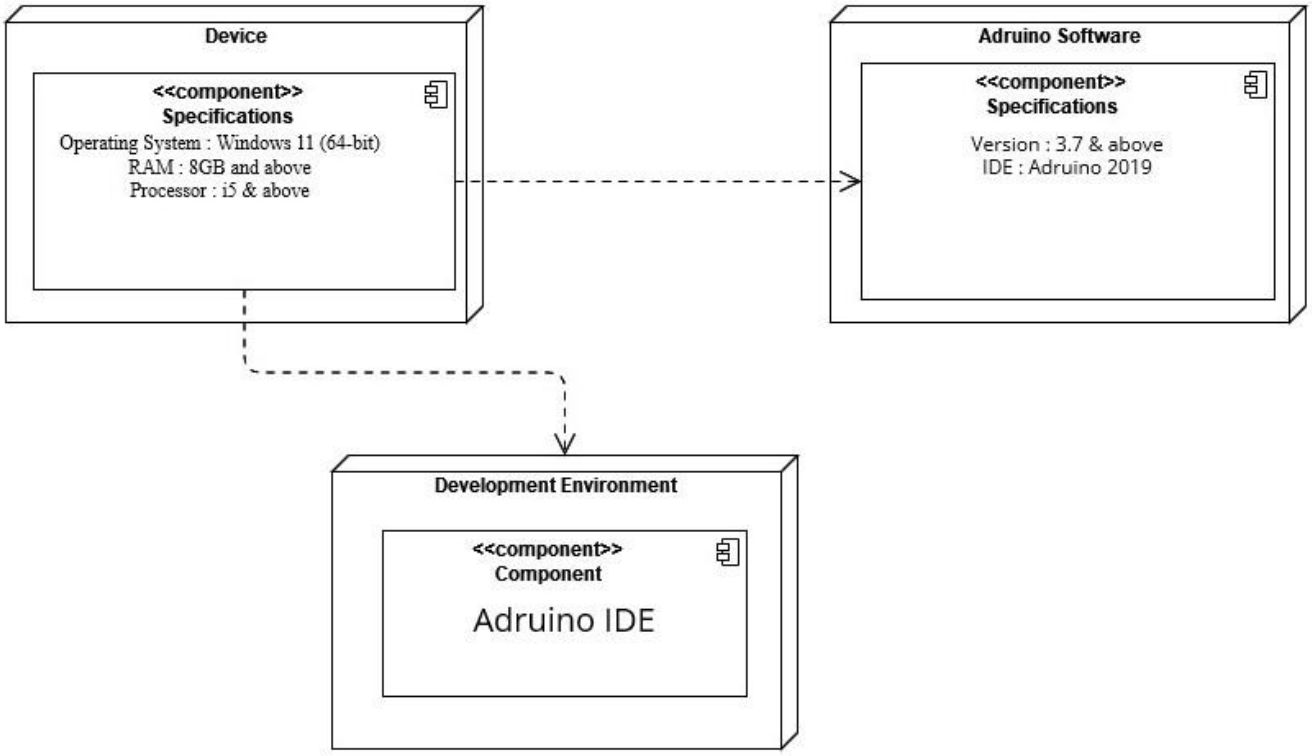


Fig 4.1.7 Deployment Diagram

CHAPTER 5
SYSTEM ARCHITECTURE

5. SYSTEM ARCHITECTURE

5.1 ARCHITECTURE DIAGRAM

An architecture diagram is a graphical representation of a set of concepts that are part of an architecture, including their principles, elements and components. It is also defined as a visual representation that maps out the physical implementation for components of a software system. It shows the general structure of the software system and the associations, limitations, and boundaries between each element. This diagram gives a top-level view of a software's structure. To elaborate, it generally includes various components that interact with each other and how the software interacts with external databases and servers. It's useful for explaining software to clients and stakeholders; and assessing the impact of adding new features or upgrading, replacing, or merging existing applications.

An architecture diagram typically consists of several key elements:

- Components: These are the building blocks of the system or application, such as servers, databases, APIs, and user interfaces.
- Relationships: These represent the connections and interactions between components, such as how data flows between servers and databases, or how users interact with the user interface.
- Layers: These represent the different levels or tiers of the system, such as the front-end, back-end, and database layers.
- Security and Access Controls: These represent the security measures put in place to protect the system from unauthorized access, data breaches or cyber-attacks.
- Deployment: This refers to the physical infrastructure on which the system or application is deployed, such as cloud-based servers or on-premises data centers.

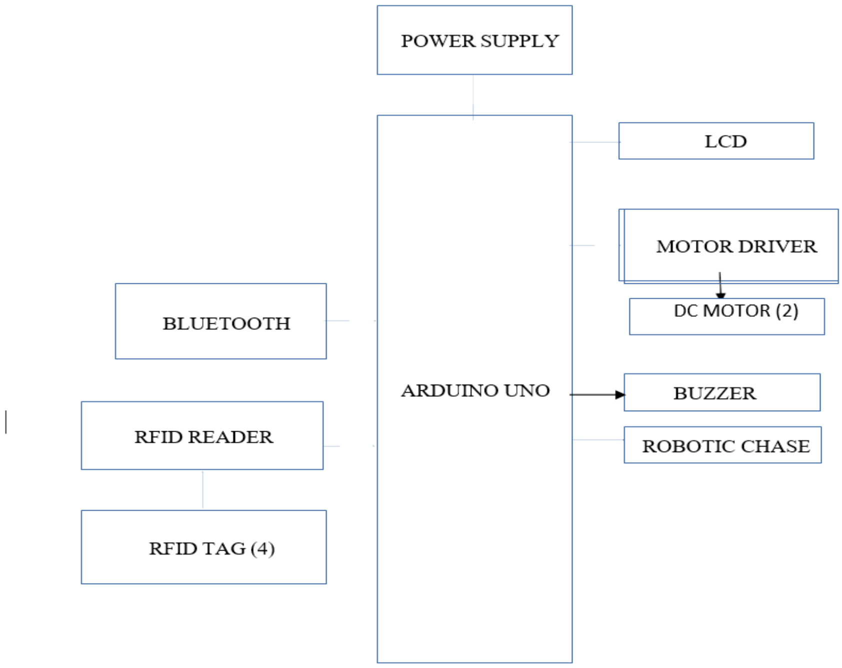


Fig 5.1 Architecture Diagram

In this proposed method, Arduino Uno microcontroller is used to interface with the sensors and to the communication devices. The LCD is used to update the latest information in the LCD. School zone and hospital zone are identified by RFID tags place between the zones. Motor driver is used to control the speed of the motor. If the vehicle reaches school zone and hospital zone the buzzer which represents the horn is disabled. Here we are using robotic chase for vehicle movement which is controlled by Bluetooth module.

- RFID Card: An RFID card is installed in the vehicle, which contains information about the vehicle and the driver.
- RFID Reader: An RFID reader is installed at the entry point of the private zone, which reads the information from the RFID card installed in the vehicle.
- Control Unit: The control unit is responsible for processing the data received from the RFID reader and determining the speed limit of the private zone.
- Speed Regulator: The speed regulator is responsible for regulating the speed of the vehicle based on the speed limit of the private zone. The speed regulator can control the fuel flow to the engine or apply the brakes to regulate the speed of the vehicle

- IoT Platform: The IoT platform is responsible for connecting the system components and providing real-time monitoring and control of the system. The IoT platform can also store data related to the performance of the system.

- User Interface: The user interface provides an interface for the system operator to monitor the performance of the system and make changes to the system settings if necessary.

5.2 ALGORITHMS

5.2.1 RFID CARD DETECTION ALGORITHM

RFID (Radio Frequency Identification) is a technology that uses radio waves to identify and track objects. RFID cards are used in a variety of applications, including access control systems, inventory management, and tracking of assets.

RFID card detection algorithms are used to detect the presence of an RFID card in the vicinity of an RFID reader. These algorithms are designed to process the signal received from the reader and determine whether a card is present, and if so, to read the information stored on the card.

There are several types of RFID card detection algorithms, including:

- Threshold Detection Algorithm: This algorithm involves setting a threshold value for the received signal strength, and detecting the presence of a card when the signal strength exceeds this threshold.
- Anti-Collision Detection Algorithm: This algorithm is used to detect multiple RFID cards in the vicinity of the reader. It involves using a collision avoidance mechanism to prevent multiple cards from transmitting their data simultaneously.
- Adaptive Threshold Detection Algorithm: This algorithm involves adjusting the threshold value dynamically based on the variation in the received signal strength over time. This allows for more accurate detection of the presence of a card, even in environments with varying levels of interference.

STEP 1 : Connect to the Power Board

Give the connection to the power board in order to function.

STEP 2 – Download the App

Download the “Adruino Bluetooth Controller” app from the playstore/Appstore

You can download the app using this link https://play.google.com/store/apps/details?id=com.broxcode.arduinobluetoothfree

STEP 3 – Connect to bluetooth

Open the app and connect it to the bluetooth

STEP 4 – Terminal

Open the terminal from the phone app and type the following character command to move the vehicle

- W – Vehicle to move forward
- X – Vehicle to move backward
- V – Stop the Vehicle

CHAPTER 6
SYSTEM IMPLEMENTATION

6. SYSTEM IMPLEMENTATION

6.1 MODULE DESIGN SPECIFICATION

The system is made up of four main parts:

- Design and Development
- Installation of RFID Reader and Cards
- Integration of IoT Platform
- Testing and Calibration
- Deployment

6.1.1 Design and Development

The system architecture is designed, which involves selecting the hardware components such as RFID readers, RFID cards, and IoT platform, and designing the software algorithms that will regulate the speed of vehicles in private zones. The software is developed, which involves writing the code for the algorithms and integrating the different components of the system. This includes developing the user interface, data management systems, and communication protocols.

6.1.2 Installation of RFID Readers and Cards

RFID readers are installed at the entry points of the private zone, and RFID cards are installed in the vehicles. The RFID readers and cards use radio frequency signals to communicate with each other and transmit data, such as the speed of the vehicle and the vehicle's identity. During installation, the RFID readers are strategically placed to ensure that they can detect the RFID cards in the vehicles as they enter and exit the private zone. The RFID cards are installed in the vehicles in a location that is easily accessible and visible to the RFID reader.

6.1.3 Integration of IOT Platform

IoT platforms allow for real-time monitoring and control of the system, enabling system operators to remotely monitor and manage the system. During integration, the IoT platform is connected to the system's hardware and software components, such as the RFID readers and cards, data management system, and communication protocols. This allows for real-time data collection, analysis, and management, providing system operators with a comprehensive overview of the system's performance.

6.1.4 Testing and Calibration

Testing and calibration of the Automatic Vehicle Speed Control system in private zones is a critical component of ensuring that the system is functioning correctly and effectively regulating the speed of vehicles within the private zone.

Testing involves evaluating the system's performance under different conditions, such as varying speeds and different types of vehicles, to ensure that the system accurately detects the RFID cards and regulates the speed of the vehicles. The testing also involves evaluating the system's communication protocols and data management capabilities.

Calibration involves adjusting the system's settings and parameters to ensure that it is functioning optimally. This may include adjusting the sensitivity of the RFID readers, adjusting the speed limits within the private zone, and configuring the communication protocols.

Once the testing and calibration are complete, the system is verified to ensure that it is functioning correctly and meeting the requirements of the system specifications. Any issues identified during testing and calibration are addressed and resolved before the system is deployed for operational use.

6.1.5 Deployment

The deployment process typically involves working closely with the private zone owner or operator to ensure that the system is installed and configured to meet their specific requirements. This may involve conducting a site survey to assess the private zone's layout and identify any potential obstacles or challenges.

Once the system is deployed, it undergoes rigorous testing and calibration to ensure that it is functioning correctly and effectively regulating the speed of vehicles within the private zone. System operators are trained on how to use and manage the system, including monitoring and analyzing the system's data and making adjustments as necessary.

After deployment, the system is monitored and maintained on an ongoing basis to ensure that it is functioning correctly and meeting the requirements of the private zone owner or operator. This may involve conducting routine maintenance and software updates, as well as responding to any issues or concerns that arise.

CHAPTER 7
SYSTEM TESTING

7. SYSTEM TESTING

7.1 WHITE BOX TESTING

The box testing approach of software testing consists of black box testing and white box testing. We are discussing here white box testing which also known as glass box is testing, structural testing, clear box testing, open box testing and transparent box testing. It tests internal coding and infrastructure of a software focus on checking of predefined inputs against expected and desired outputs. It is based on inner workings of an application and revolves around internal structure testing. In this type of testing programming skills are required to design test cases. The primary goal of white box testing is to focus on the flow of inputs and outputs through the software and strengthening the security of the software.

The term 'white box' is used because of the internal perspective of the system. The clear box or white box or transparent box name denote the ability to see through the software's outer shell into its inner workings.

Developers do white box testing. In this, the developer will test every line of the code of the program. The developers perform the White-box testing and then send the application or the software to the testing team, where they will perform the black box testing and verify the application along with the requirements and identify the bugs and sends it to the developer.

The developer fixes the bugs and does one round of white box testing and sends it to the testing team. Here, fixing the bugs implies that the bug is deleted, and the particular feature is working fine on the application.

The white box testing contains various tests, which are as follows:

- Path testing
- Loop testing
- Condition testing
- Testing based on the memory perspective
- Test performance of the program

7.2 BLACK BOX TESTING

Black box testing is a technique of software testing which examines the functionality of software without peering into its internal structure or coding. The primary source of black box testing is a specification of requirements that is stated by the customer.In this method, tester selects a function and gives input value to examine its functionality, and checks whether the function is giving expected output or not. If the function produces correct output, then it is passed in testing, otherwise failed. The test team reports the result to the development team and then tests the next function. After completing testing of all functions if there are severe problems, then it is given back to the development team for correction.

The test procedure of black box testing is a kind of process in which the tester has specific knowledge about the software's work, and it develops test cases to check the accuracy of the software's functionality.

It does not require programming knowledge of the software. All test cases are designed by considering the input and output of a particular function.A tester knows about the definite output of a particular input, but not about how the result is arising. There are various techniques used in black box testing for testing like decision table technique, boundary value analysis technique, state transition, All-pair testing, cause-effect graph technique, equivalence partitioning technique, error guessing technique, use case technique and user story technique.

7.3 TEST CASES

Test Report 01

Product **:** Hardware Functionalities

UseCase **:** Connecting cables

Test Case Id	**Test Case/Action to be Performed**	**Expected Result**	**Actual Result**	**Pass/Fail**
1	Plug the cord connection to the power board	Plugged	As Expected	Pass
2	Adruino with LCD Display should be powered on	Turned On	As Expected	Pass

Table 7.3.1 Test Case for Hardware Functionality.

Test Report 02

Product **:** Software Upload

Usecase **:** Upload the software code into the adruino board

Test Case Id	**Test Case/Action to be Performed**	**Expected Result**	**Actual Result**	**Pass/Fail**
1	Upload the appropriate code to the adruino board	Uploaded Successfully	As Expected	Pass

Table-7.3.2 Test Case for uploading the software to the adruino board

Test Report 03

Product **:** Individual Component Checking

Usecase **:** Check the individual component

Test Case Id	**Test Case/ Action to be Performed**	**Expecte dResult**	**Actua l Result**	**Pass/Fail**
1	Alarm test : Test the system's ability to trigger an alarm when a vehicle exceeds the speed limit within the private zone.	Tested Successfull y	As Expected	Pass
2	RFID reader test: Test the functionality of the RFID reader to ensure that it can accurately detect and read the RFID tags attached to the vehicles passing through the private zone.	Tested successfull y	As Expected	Pass
3	Speed regulation test: Test the system's ability to regulate the speed of the vehicles passing through the private zone based on the information received from the RFID reader.	Tested Successfull y	As Expected	Pass

Table-7.3.3 Test Case for checking the individual hardware components.

Test Report 04

Product : Checking the Scalabilty, Accuracy & User Interface

Usecase : Scalability, Accuracy & User Interface

Test Case Id	**Test Case/ Action to be Performed**	**Expected Result**	**Actual Result**	**Pass/Fail**
1	Accuracy test: Test the system's accuracy in detecting and regulating the speed of vehicles passing through the private zone.	Tested Succesfully	Tested Succesfully	Pass
2	Scalability test: Test the system's ability to handle large volumes of traffic and effectively regulate the speed of multiple vehicles passing through the private zone simultaneously.	Tested Succesfully	Tested Succesfully	Pass
3	User interface test: Test the user interface of the system to ensure that it is user-friendly and easy to navigate for system operators.	Tested Successfuly	Tested Successfully	Pass

Table-7.3.4 Test Case for system scalability

CHAPTER 8

CONCLUSION

&

FUTURE ENHANCEMENT

8. CONCLUSION AND FUTURE ENHANCEMENTS

8.1 CONCLUSION

In conclusion, the implementation of an Automatic Vehicle Speed Control system using RFID technology and IoT can be a promising solution to regulate the speed of vehicles in private zones. The proposed system aims to provide a safer and more efficient driving environment, reducing the risk of accidents and ensuring compliance with speed limits.

The system utilizes RFID technology to detect the presence of RFID cards installed in vehicles and IoT technology to remotely monitor and control the system's performance. The use of an embedded system provides real-time processing and regulation of vehicle speed, ensuring the system's reliability and accuracy.

Although the implementation of such a system involves significant initial costs, the long-term benefits in terms of increased safety and efficiency can outweigh the initial investment. Overall, the Automatic Vehicle Speed Control system has the potential to make private zones safer for drivers and pedestrians, reducing the number of accidents and improving traffic flow.

The proposed module can be use to implement for the vehicles in order to avoid the road accidents. With this prototype, a cost effective embedded system can be implemented which will help in reducing road accidents by following traffic rules. Since speed plays an important role while driving, by using this concept the passenger's journey will become even more safe and secure.

8.2 FUTURE ENHANCEMENTS

- Integration with Traffic Management Systems: The system can be integrated with traffic management systems to provide a more comprehensive solution for managing traffic flow in private zones. This can include the use of cameras and sensors to detect traffic congestion and adjust speed limits accordingly.

- Integration with Emergency Services: The system can be integrated with emergency services such as ambulance and fire departments, enabling them to access real-time information about the location and speed of vehicles in private zones.

- Integration with Mobile Applications: The system can be integrated with mobile applications that can provide users with real-time information about the speed limit in private zones and alert them if they are exceeding the limit.

- Multi-Lane Implementation: The system can be expanded to regulate the speed of vehicles in multi-lane roads within private zones. This can involve the use of multiple RFID readers and control units to regulate the speed of vehicles in each lane.

- Integration with Autonomous Vehicle Technology: The system can be integrated with autonomous vehicle technology to provide a more advanced solution for regulating the speed of autonomous vehicles in private zones. This can involve the use of advanced algorithms and machine learning techniques to optimize the speed and safety of autonomous vehicles.

APPENDICES

APPENDICES

A.1 CODING

Main

```
/*************lcd pins*************/
#include <LiquidCrystal.h>
LiquidCrystal lcd(13, 12, 11, 10, 9, 8);
/************rfid with serial pins**************/
#include"rfid.h"
#include"softserial.h"

/*************motor pins***************/
#define m1_pos_pos 7
#define m1_pos_neg 6
#define m2_neg_pos 5
#define m2_neg_neg 4
/*************buzzer pin****************/
#define buz A0

bool SCHOOL_STATUS = false;
bool HOSPITAL_STATUS = false;

int r_id;

void setup() {
  lcd.begin(16, 2);
  Serial.begin(9600);
//  rf.begin(9600);
  lcd.clear();

  digitalWrite(buz, LOW);
```

```
  digitalWrite(m1_pos, LOW);
  digitalWrite(m1_neg, LOW);
  digitalWrite(m2_pos, LOW);
  digitalWrite(m2_neg, LOW);


  pinMode(buz, OUTPUT);//buz
  pinMode(m1_pos, OUTPUT);
  pinMode(m1_neg, OUTPUT);
  pinMode(m2_pos, OUTPUT);
  pinMode(m2_neg, OUTPUT);
  lcd.setCursor(0, 0);
  lcd.print("AUTOMATIC SPEED");
  lcd.setCursor(2, 1);
  lcd.print(" CONTROL ");
  delay(3000);
  lcd.clear();
}

void loop() {

  lcd.setCursor(0, 0);
  lcd.print("Vehicle:");
  rfid();
  r_id = rfidno;
  if ((r_id == 1 || r_id == 2))
  {
    Serial.print("School Zone");
    lcd.setCursor(9, 0);
    lcd.print("SLOW   ");
    lcd.setCursor(0, 1);
    lcd.print("School Zone");
    digitalWrite(buz, HIGH);
    analogWrite(m1_pos, 255);
    analogWrite(m1_neg, 100);
```

```
    analogWrite(m2_pos, 150);
    analogWrite(m2_neg, 100);
    rfidno = 0;

  }
  else if ((r_id == 3 || r_id == 4))
  {
    lcd.setCursor(9, 0);
    lcd.print("SLOW   ");
    lcd.setCursor(0, 1);
    lcd.print("Hospital Zone");
    digitalWrite(buz, HIGH);
    analogWrite(m1_pos, 255);
    analogWrite(m1_neg, 100);
    analogWrite(m2_pos, 150);
    analogWrite(m2_neg, 100);
    rfidno = 0;
  }
}
void serialEvent()
{
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Vehicle:");
  while (Serial.available() > 0)
  {
    char inByte = (char)Serial.read();
    Serial.print(inByte);
    switch (inByte)
    {
      case 'W':
        lcd.setCursor(9, 0);
        lcd.print("FORWARD");
        digitalWrite(m1_pos, LOW);
        digitalWrite(m1_neg, LOW);
```

```
  digitalWrite(m2_pos, LOW);
  digitalWrite(m2_neg, LOW);
  delay(1000);
  digitalWrite(m1_pos, HIGH);
  digitalWrite(m1_neg, LOW);
  digitalWrite(m2_pos, HIGH);
  digitalWrite(m2_neg, LOW);
  digitalWrite(buz, LOW);
  break;
case 'X':
  lcd.setCursor(9, 0);
  lcd.print("REVERSE");
  digitalWrite(m1_pos, LOW);
  digitalWrite(m1_neg, LOW);
  digitalWrite(m2_pos, LOW);
  digitalWrite(m2_neg, LOW);
  delay(1000);
  digitalWrite(m1_pos, LOW);
  digitalWrite(m1_neg, HIGH);
  digitalWrite(m2_pos, LOW);
  digitalWrite(m2_neg, HIGH);
  digitalWrite(buz, LOW);
  break;
case 'Y':
  lcd.setCursor(9, 0);
  lcd.print("LEFT    ");
  digitalWrite(m1_pos, LOW);
  digitalWrite(m1_neg, LOW);
  digitalWrite(m2_pos, LOW);
  digitalWrite(m2_neg, LOW);

  delay(1000);
  digitalWrite(m1_pos, LOW);
  digitalWrite(m1_neg, HIGH);
  digitalWrite(m2_pos, HIGH);
```

```
        digitalWrite(m2_neg, LOW);
        digitalWrite(buz, LOW);
        break;
      case 'Z':
        lcd.setCursor(9, 0);
        lcd.print("RIGHT  ");
        digitalWrite(m1_pos, LOW);
        digitalWrite(m1_neg, LOW);
        digitalWrite(m2_pos, LOW);
        digitalWrite(m2_neg, LOW);
        delay(1000);
        digitalWrite(m1_pos, HIGH);
        digitalWrite(m1_neg, LOW);
        digitalWrite(m2_pos, LOW);
        digitalWrite(m2_neg, HIGH);
        digitalWrite(buz, LOW);
        break;
      case 'V':
        lcd.setCursor(9, 0);
        lcd.print("STOP   ");
        digitalWrite(m1_pos, LOW);
        digitalWrite(m1_neg, LOW);
        digitalWrite(m2_pos, LOW);
        digitalWrite(m2_neg, LOW);
        digitalWrite(buz, LOW);
        break;
    }
  }
}
```

Lcd.h

```
#ifndef LCD_H
#define LCD_H
#define LCD_MAX_LENGTH 16
#include<LiquidCrystal.h>
```

```
LiquidCrystal lcd(13, 12, 11, 10, 9, 8); // RS EN D4 D5 D6 D7
#endif
```

Rfid.h

```
#ifndef RFID_H
#define RFID_H
#include"softserial.h"
volatile String inputString = "";
volatile bool stringComplete = false;

const char rfid1[12] = {"8700840F7478"};
const char rfid2[12] = {"8700919DF77C"};
const char rfid3[12] = {"8700808AE06D"};
const char rfid4[12] = {"870091819601"};

//const char rfid5[12] = {"3B00F59C0153"};
//const char rfid6[12] = {"3B00F5B294E8"};
//const char rfid7[12] = {"3B00F5BE4F3F"};
//const char rfid8[12] = {"3B00F5C12D22"};
//const char rfid9[12] = {"3B00F5BB592C"};
//const char rfid10[12] = {"3B00F5B86B1D"};

volatile char rfidmatch[12] = {};
volatile int rfidno = 0;
volatile int rfidno_1 = 0;
volatile int count1, count2, count3, count4, count5, count6, count7, count8, count9, count10, count =
0;
volatile byte data = false;

int rfid()
{
  while (rf.available()) {
    char inChar = (char)rf.read();
```

```
  Serial.print(inChar);
  inputString += inChar;
  if (count == 11) {
    count = 0;
    stringComplete = true;
    break;
  }
  count++;
}
if (stringComplete)
{
  for (int i = 0; i < 12; i++)
  {
    rfidmatch[i] = inputString[i];
  }
  inputString = "";
  for (int i = 0; i < 12; i++)
  {
    if (rfid1[i] == rfidmatch[i])
    {
      count1++;
    }
  }
  for (int i = 0; i < 12; i++)
  {
    if (rfid2[i] == rfidmatch[i])
    {
      count2++;
    }
  }
  for (int i = 0; i < 12; i++)
  {
    if (rfid3[i] == rfidmatch[i])
    {
      count3++;
```

```
  }
}
for (int i = 0; i < 12; i++)
{
  if (rfid4[i] == rfidmatch[i])
  {
    count4++;
  }
}
for (int i = 0; i < 12; i++)
{
  if (rfid5[i] == rfidmatch[i])
  {
    count5++;
  }
}
for (int i = 0; i < 12; i++)
{
  if (rfid6[i] == rfidmatch[i])
  {
    count6++;
  }
}
for (int i = 0; i < 12; i++)
{
  if (rfid7[i] == rfidmatch[i])
  {
    count7++;
  }
}
for (int i = 0; i < 12; i++)
{
  if (rfid8[i] == rfidmatch[i])
  {
    count8++;
```

```
  }
}
for (int i = 0; i < 12; i++)
{
  if (rfid9[i] == rfidmatch[i])
  {
    count9++;
  }
}
for (int i = 0; i < 12; i++)
{
  if (rfid10[i] == rfidmatch[i])
  {
    count10++;
  }
}
if (count1 == 12)
{
  rfidno = 1;
}
else if (count2 == 12)
{
  rfidno = 2;
}
else if (count3 == 12)
{
  rfidno = 3;
}
else if (count4 == 12)
{
  rfidno = 4;
}
else if (count5 == 12)
{
  rfidno = 5;
```

```
  }
  else if (count6 == 12)
  {
    rfidno = 6;
  }
  else if (count7 == 12)
  {
    rfidno = 7;
  }
  else if (count8 == 12)
  {
    rfidno = 8;
  }
  else if (count9 == 12)
  {
    rfidno = 9;
  }
  else if (count10 == 12)
  {
    rfidno = 10;
  }
  else
  {
    rfidno = 0;
  }
  stringComplete = false;
}
count1 = 0;
count2 = 0;
count3 = 0;
count4 = 0;
count5 = 0;
count6 = 0;
count7 = 0;
count8 = 0;
```

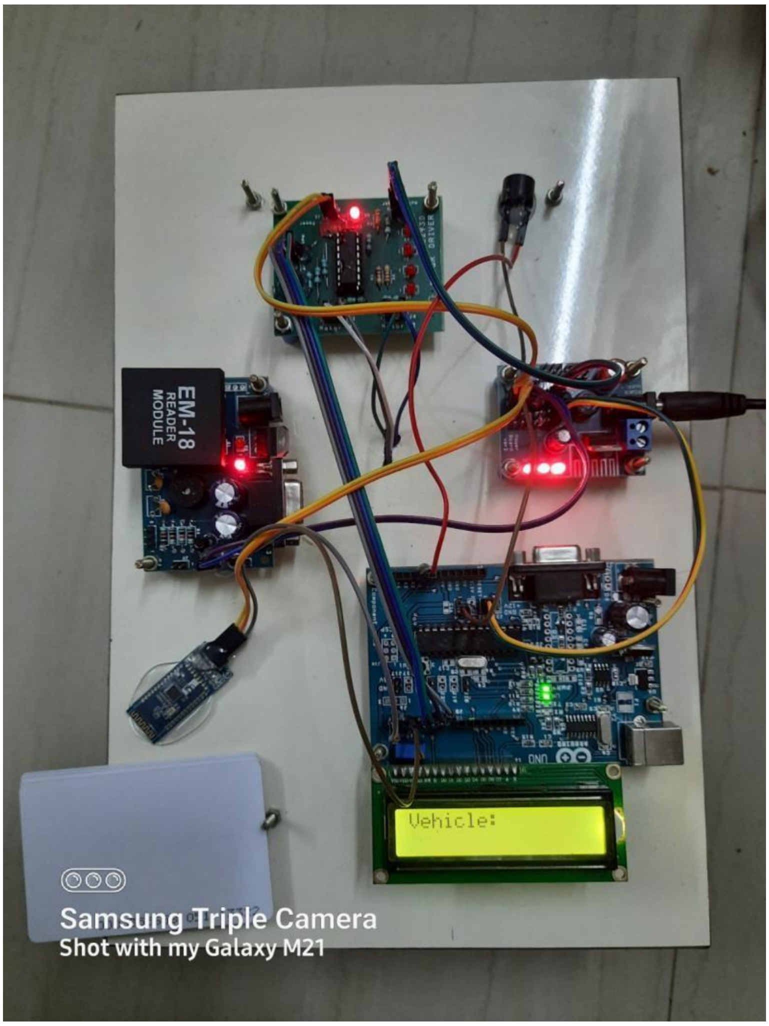
```
  count9 = 0;
  count10 = 0;

  return rfidno;
}
#endif
```

Softserial.h

```
#ifndef SS_H
#define SS_H
#include<SoftwareSerial.h>
SoftwareSerial rf(2, 3); //rx tx
#endif
```

A.2 SAMPLE SCREENS



FigA2.1 Hardware Implementation

In figA2.1, the hardware implantation and working is shown

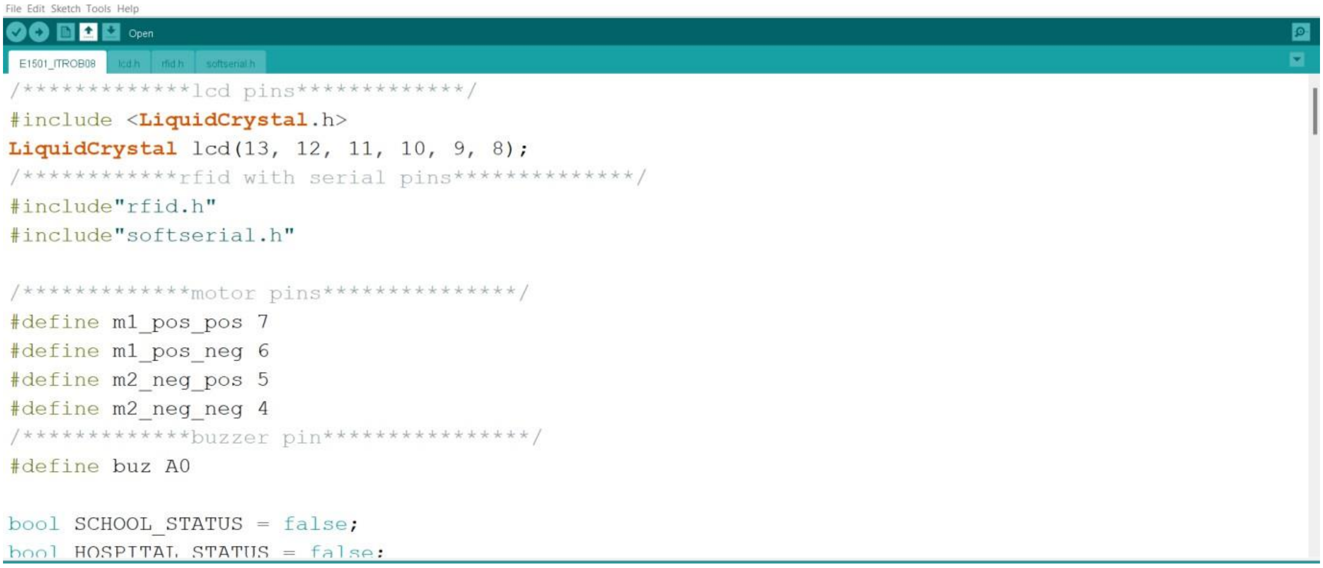


Fig A2.2 Coding Image

In the fig A2.2 An example of a coding image is show

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