ACCIDENT PREVENTION SYSTEM

Project report submitted in partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

By

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UNDER THE GUIDANCE OF

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DECLARATION

We hereby declare that the work reported in the B.Tech Project Report entitled **"Accident Prevention System"** submitted at **Jaypee University of Information Technology, Waknaghat, India** is an authentic record of our work carried out under the supervision of **Dr. Nishant Jain.** We have not submitted this work elsewhere for any other degree or diploma.

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This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Dr. Nishant Jain
Date: 08/05/23

Head of the Department/Project Coordinator

ACKNOWLEDGEMENT

It is our team's honor to express the feelings of gratitude and thankfulness towards our project supervisor Prof. **Dr. Nishant Jain**, who with his sincere guidance and knowledge helped us in completing this project report on the topic "Accident Prevention System".

Without his motivation, this work would not have possible. Our team is forever indebted for his kind guidance and encouragement.

I would also like to mention the sincere contribution of the teammates, who with their hard work and dedication made this project report possible. This study has indeed helped us explore and develop more knowledge avenues related to our project work and I am certain it will help us in the future.

THANK YOU

LIST OF ACRONYMS AND ABBREVIATIONS

1 **GPS:** Global Positioning System
2 **NFC:** Near Field Communication
3 **CM:** Centimeter
4 **RAM:** Random Access Memory
5 **GB:** Gigabytes

LIST OF SYMBOLS

1. **‘-‘:** Short Terminal/ Negative

2. **‘+’:** Longer Terminal/ Positive

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ABSTRACT

The roads in various regions of India are not only just curvy, but also very steep to the extent that there is nothing but ditch all the way down to hundreds of meters. As a result, it becomes difficult to drive in such areas. There is always a chance for accidents, and as we witness every day, mountainous areas are the ones where most tragedies occur.

Now one might wonder what about traffic signals and other technologies? Up to some extent, the use of traffic lights is debatable, but they simply cannot be implemented everywhere. There are areas in hearts of mountains, where traffic lights are not or cannot be implemented as they have major drawbacks in these areas. To elaborate, they cannot be implemented in areas where the roads are not so wide, thus covering up space. Especially during the times of heavy traffic, traffic can becomes quite something to deal with. Furthermore, the implementation cost is also very high.

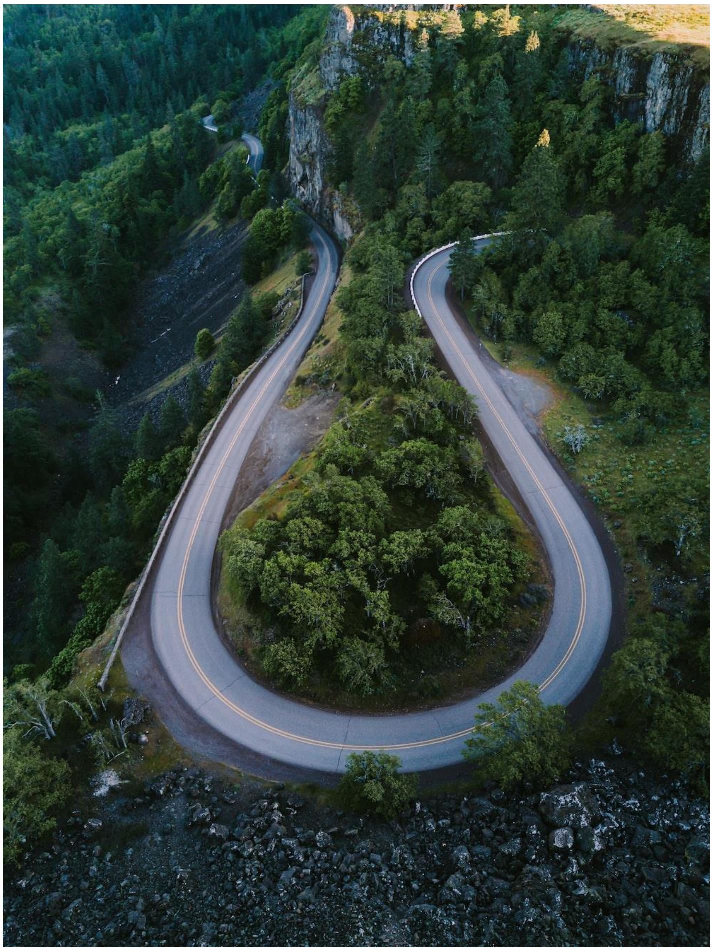
We conducted a deep research on various accident prevention systems in hilly areas of India, and were able to find practical difficulties in implementing past technologies to prevent accidents. With this project, we would be able to fix these problems not only at good accuracy, but also at a low cost setup.

CHAPTER 1

INTRODUCTION

With the growing technology comes growing complications. Ever since the introduction of vehicles, we have seen them being used massively. The use has gone up to such an extent that nearly everyone in cities throughout the world use cars in their daily life. But with the rising of road vehicles, we cannot ignore the complications that road accidents bring.

For a country that is currently the second highest populated in the world, and is on its way to become the first, India sits at around a population 1.4 billion people, which is almost 18% of the world's total population. Now that is a big number in a country which is not the largest in its area. Therefore population density is among the highest. This implies to more vehicles on roads, and thus, a greater chance of road accidents.



But as the technology take over metro cities, they are considered to be safer than many other areas of India. Traffic lights, traffic police, better facilities, and most importantly, a very large investment contributes to the safety of people driving cars. Since India is a 'developing' country, there are areas left unattended and they do not share the news in ways that bigger cities do. As a result, the exposure is lesser and so are the facilities.

A large portion of these not so metro cities includes hilly areas of the country, especially the ones at higher altitude. Towns, villages, remote locations, etc., are within little to no reach. However over the past decade, some of these remote locations have caught attention as among the most beautiful tourist locations in the country. Some of such hilly areas include the whole of Himachal Pradesh, and many spread throughout the different states including Tamil Nadu, Rajasthan, Jammu and Kashmir, Meghalaya, etc. In fact, majority of the inhabitants' survival is dependent on tourism.

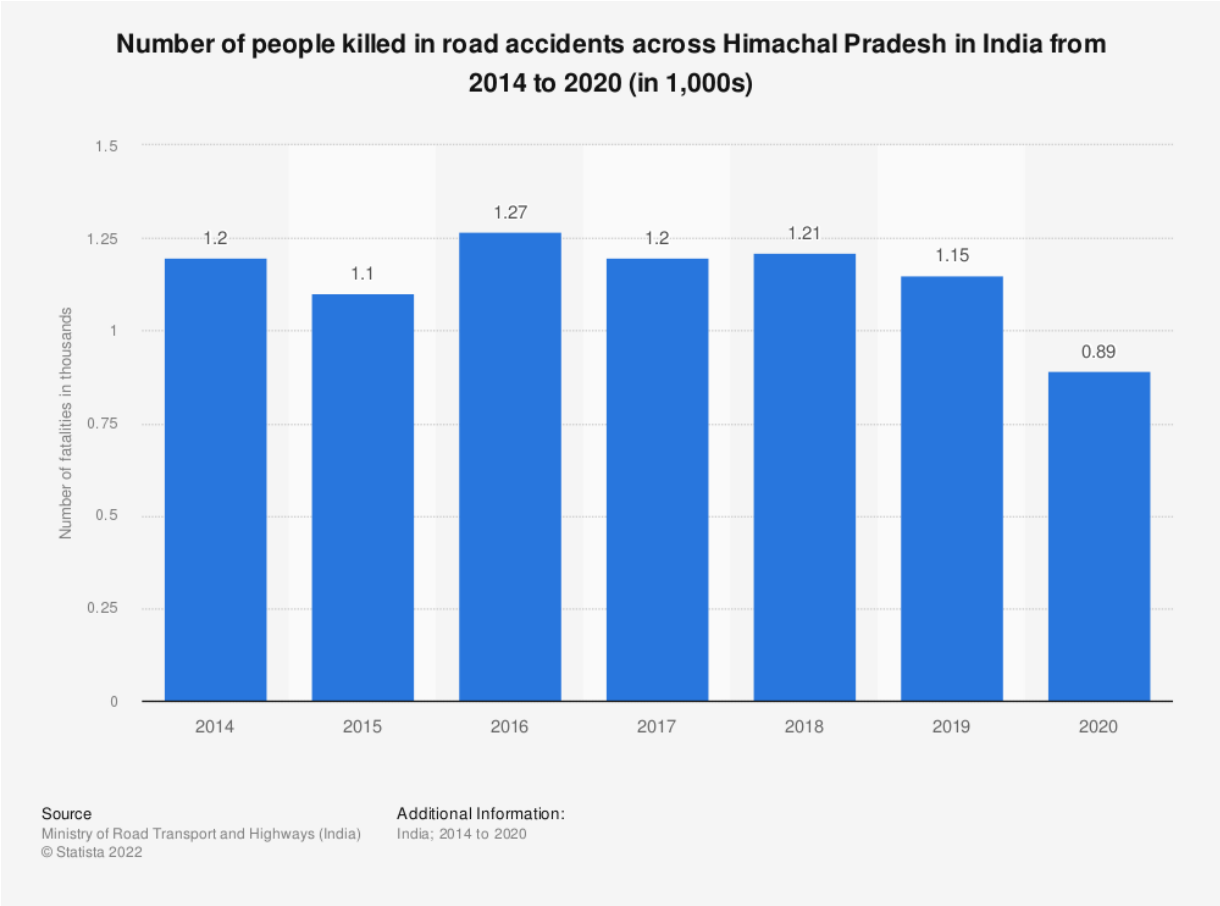
More tourism directly increases the number of vehicles moving in these areas every day. Considering the sensitivity of steepness on such routes, it takes an altogether expertise to drive vehicles. Hence, driving becomes a difficult task. It is easy to say that travelling can be dangerous on such roads, especially for tourists who live in big cities and drive on wider roads. As a result, a large number of accidents take place every day.

With ditches going up to hundreds and thousands of meters in these areas, little driving mistakes lead to massive casualties every day, which is further demonstrated in the chart below, covering the last decade.

ACCIDENT DATA OF LAST 10 YEARS

Year	Total	Injured	Killed
2009	3,076	5,579	1140
2010	3,073	5,325	1,102
2011	3,099	5,462	1,353
2012	2,901	5,248	1,109
2013	2,981	5,081	1,054
2014	3,059	5,680	1,199
2015	3,010	5,109	1,097
2016	3,156	5,587	1,163
2017	3,119	5,338	1,176
2018	3,119	5,444	1,168
2019*	1,168	430	2,155

Table 1.1: Casualty Count in Himachal Pradesh for the last 10 years.


Number of people killed in road accidents across Himachal Pradesh in India from 2014 to 2020 (in 1,000s)
Number of fatalities in thousands
1.5
1.25
1
0.75
0.5
0.25
0
1.2
1.1
1.27
1.2
1.21
1.15
0.89
2014
2015
2016
2017
2018
2019
2020
Source
Ministry of Road Transport and Highways (India)
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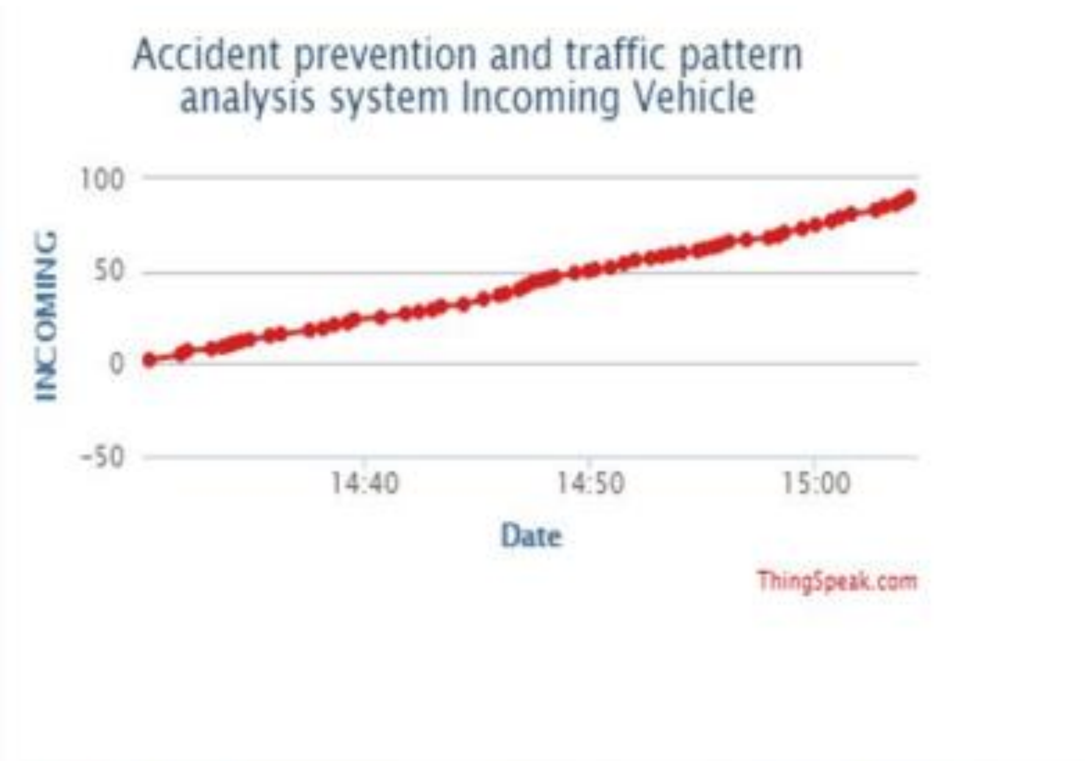
Additional Information:
India; 2014 to 2020


Accident prevention and traffic pattern analysis system Incoming Vehicle
INCOMING
100
50
0
-50
14:40
14:50
15:00
Date
ThingSpeak.com

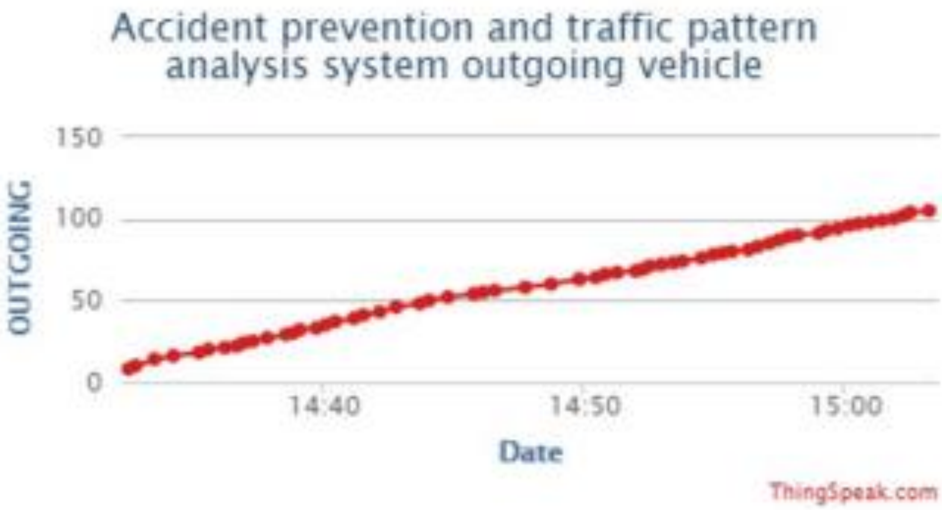


Table 1.2: Road Accident Data

1.1 Literature Survey

The **sensor-based accident prevention system** is a research paper that focuses on developing a technology-driven solution to mitigate the risk of accidents. Accidents are a significant cause of injuries and fatalities worldwide, leading to economic and social consequences. This paper proposes an innovative approach that utilizes sensor technology to detect potential hazards and provide real-time warnings to users, thus preventing accidents and improving overall safety.

Overview of the Sensor-Based Accident Prevention System:

The sensor-based accident prevention system comprises a network of sensors strategically placed in various locations to monitor and collect data on environmental conditions, human behavior, and vehicle movements. These sensors are equipped with advanced technologies such as computer vision, infrared, radar, and lidar, enabling them to capture comprehensive information about the surroundings.

Data Collection and Analysis:

The collected sensor data is analyzed using sophisticated algorithms and machine learning techniques. This analysis allows the system to identify patterns, anomalies, and potential risks. By processing and interpreting the data, the system can detect hazardous situations in real-time and take proactive measures to prevent accidents.

Environmental Monitoring:

The system monitors the environmental conditions, including weather parameters (e.g., rain, fog, and snow), road conditions (e.g., slippery surfaces or potholes), and visibility. By continuously monitoring these factors, the system can alert drivers and pedestrians about potentially dangerous situations, allowing them to adjust their behavior accordingly.

Vehicle Detection and Collision Avoidance:

One of the key functionalities of the system is vehicle detection and collision avoidance. The sensors can accurately detect the presence, speed, and trajectory of vehicles on the road. By analyzing this information, the system can predict potential collisions and issue warnings to the drivers involved. In advanced implementations, the system can even automatically apply brakes or steer the vehicle to avoid a collision.

Pedestrian Safety:

Pedestrian safety is another critical aspect addressed by the sensor-based accident prevention system. The sensors can detect the presence of pedestrians in the vicinity and assess their behavior, such as jaywalking or sudden movements. In case of a potential danger, the system can issue alerts to both the pedestrians and nearby drivers, enabling them to take necessary precautions and avoid accidents.

Driver Behavior Monitoring:

The system also incorporates driver behavior monitoring to identify risky driving patterns. By analyzing factors such as speed, acceleration, lane changes, and adherence to traffic rules, the system can detect aggressive or distracted driving. It can then issue warnings to the driver, encouraging safer driving practices and reducing the likelihood of accidents.

Real-time Notifications and Alerts:

To ensure the effectiveness of the accident prevention system, real-time notifications and alerts are sent to relevant parties, such as drivers, pedestrians, and nearby vehicles. These notifications can be in the form of visual cues, audible alarms, or even haptic feedback. By providing immediate feedback, the system helps users make informed decisions and avoid potential accidents.

Benefits and Limitations:

The sensor-based accident prevention system offers several benefits. It enhances overall safety by providing early warnings, reducing the risk of accidents, injuries, and fatalities. It also contributes to improved traffic flow, as drivers can anticipate and respond to potential hazards in advance. Additionally, the system's ability to monitor driver behavior promotes safer driving habits, leading to a decrease in the number of accidents caused by human error.

However, there are some limitations to consider. The system heavily relies on the accuracy and reliability of the sensor data and the performance of the underlying algorithms. Environmental factors such as severe weather conditions or sensor malfunctioning can impact the system's effectiveness. Furthermore, the implementation and maintenance costs of such a system might be substantial, requiring a comprehensive infrastructure and continuous updates.

Conclusion:

The sensor-based accident prevention system is a promising technological advancement aimed at mitigating the risk of accidents. By leveraging sensor technology, data analysis, and real-time notifications, the system can detect

The research paper titled **"Diminishing Road Accidents on Sharp Curves Using Arduino"** proposes an innovative solution to reduce the occurrence of accidents on sharp curves through the application of Arduino technology. Sharp curves present a significant challenge to drivers, often leading to accidents due to high speeds, reduced visibility, and inadequate maneuvering. This paper explores the use of Arduino microcontrollers to implement a real-time warning system that alerts drivers of approaching curves, enabling them to adjust their speed and maneuver safely.

Overview of the Solution:

The proposed solution utilizes **Arduino microcontrollers** as the core technology for collecting and processing data, as well as controlling the warning system. By strategically installing sensors along the road, the system can detect approaching vehicles, measure their speed, and calculate the curvature of the upcoming curve. Based on this information, the Arduino microcontroller triggers appropriate warning mechanisms, such as visual signs, audible alarms, or both, to alert the driver of the approaching sharp curve.

Data Collection and Processing:

To collect relevant data, the system employs various sensors, including distance sensors, speed sensors, and gyroscopes. The distance sensors measure the distance between the vehicle and the upcoming curve, while the speed sensors capture the vehicle's speed. Additionally, gyroscopes help determine the angle of the curve. The Arduino microcontroller processes the data received from these sensors to calculate the appropriate warning parameters.

Curvature Calculation:

By using the collected data, the Arduino microcontroller applies mathematical algorithms to calculate the curvature of the upcoming curve. This information is crucial in determining the severity of the curve and the necessary adjustments the driver should make. The calculation involves analyzing the speed of the vehicle, the distance to the curve, and the angle of the curve.

Warning System Activation:

Once the Arduino microcontroller determines the curvature of the upcoming curve, it triggers the warning system. The warning system consists of visual signs and audible alarms placed strategically along the road. The visual signs are equipped with LED displays that indicate the recommended speed for the approaching curve. The audible alarms emit sound signals to draw the driver's attention and alert them of the potential danger ahead. The Arduino microcontroller synchronizes the activation of these warning mechanisms based on the calculated curvature and the vehicle's speed.

User Feedback and Adjustments:

To enhance the effectiveness of the warning system, the proposed solution also includes user feedback and adjustment mechanisms. The Arduino microcontroller can collect data on how drivers respond to the warnings and analyze their behavior. By evaluating this feedback, the system can make necessary adjustments to optimize the warning parameters and improve the overall safety of sharp curves.

Benefits and Limitations:

The implementation of the Arduino-based warning system for sharp curves offers several benefits. Firstly, it significantly reduces the risk of accidents by providing real-time warnings to drivers, allowing them to adjust their speed and approach curves more safely. Secondly, the system enhances overall road safety by promoting driver awareness and attentiveness. Additionally, the solution can be implemented cost-effectively, as Arduino microcontrollers are relatively inexpensive and widely available.

However, there are certain limitations to consider. The accuracy of the warning system relies on the precision and reliability of the sensors used to collect data. Adverse weather conditions, sensor malfunctions, or incorrect sensor placement may affect the system's performance. Furthermore, the successful implementation of the solution requires collaboration with transportation authorities and proper road infrastructure modification to accommodate the warning signs and alarms.

Conclusion:
The research paper presents a solution to reduce accidents on sharp curves using Arduino microcontrollers. By utilizing sensors, data processing algorithms, and a warning system, the proposed solution effectively alerts drivers of approaching curves, enabling them to adjust their speed and maneuver safely. The implementation of this system has the potential to significantly diminish accidents on sharp curves, enhancing overall road safety and reducing fatalities.

The research paper titled "Smart Road Safety and Vehicle Accident Prevention System for Mountain Roads" focuses on addressing the unique challenges posed by mountainous regions and proposes a comprehensive solution to enhance road safety and prevent accidents. Mountain roads are characterized by steep gradients, sharp turns, adverse weather conditions, and limited visibility, making them prone to accidents. This paper introduces a smart system that combines various technologies, including sensors, communication systems, and data analysis, to provide real-time information and warnings to drivers, thus mitigating the risks associated with mountain road travel.

Challenges of Mountain Roads:

Mountain roads present several challenges that increase the likelihood of accidents. Steep gradients require careful control of vehicle speed, while sharp turns demand precise maneuvering. Limited visibility due to fog, rain, or darkness further adds to the complexity of driving in mountainous regions. Additionally, the presence of unpredictable factors like falling rocks or landslides exacerbates the risks. The research paper aims to address these challenges and reduce the occurrence of accidents through an integrated smart road safety system.

Components of the Smart Road Safety System:

The proposed system consists of various components working together to enhance road safety and prevent accidents.

1. Sensor Network: A network of sensors is installed along the mountain roads to collect real-time data on various parameters. These sensors include weather sensors, visibility sensors, vehicle detection sensors, and road condition sensors. Weather sensors monitor parameters like temperature, humidity, and precipitation, providing crucial information on current weather conditions. Visibility sensors measure fog density or visibility range. Vehicle detection sensors detect the presence and speed of vehicles on the road, enabling accurate traffic monitoring. Road condition sensors assess factors like surface grip, potholes, or debris on the road.

2. Communication Infrastructure: The system utilizes a robust communication infrastructure to transmit data between the sensors, vehicles, and the central control center. This infrastructure may include wireless networks, satellite communication, or a combination of both. The seamless flow of data enables real-time analysis and timely warning dissemination.

3. Central Control Center: The central control center serves as the nerve center of the system. It receives and processes data from the sensors, analyzes it, and generates appropriate warnings or alerts. The control center uses advanced algorithms and machine learning techniques to interpret the data and identify potential risks or hazards on the road.

4. Driver Warning Mechanisms: Once potential risks are identified, the system employs various warning mechanisms to alert drivers and prevent accidents. These mechanisms include visual signs, dynamic message boards, audio alerts, and even vehicle-to-vehicle communication. Visual signs provide important information such as recommended speeds for curves or upcoming hazards. Dynamic message boards display real-time warnings based on the current road conditions. Audio alerts can be triggered in vehicles to notify drivers of immediate dangers. Vehicle-to-vehicle communication allows vehicles to share information and warnings, enabling cooperative collision avoidance.

5. Emergency Response Integration: The smart system integrates with emergency response services to ensure rapid response in case of accidents or emergencies. The control center can directly notify emergency services about an incident, providing them with accurate location and situational data. This integration facilitates prompt medical assistance and improves overall emergency management on mountain roads.

Benefits and Limitations:
The implementation of a smart road safety system for mountain roads offers numerous benefits. Firstly, it significantly reduces the occurrence of accidents by providing real-time information and warnings to drivers, enabling them to adjust their driving behavior accordingly. Secondly, the system improves overall road safety by addressing specific challenges such as steep gradients, sharp turns, and adverse weather conditions. It also enhances communication and coordination among drivers, vehicles, and emergency services, streamlining the response to accidents or emergencies.

However, certain limitations should be considered. The effectiveness of the system relies on the accuracy and reliability of the sensor network

1.2 Problems caused by Road Accidents in Hilly Areas

1.2.1 Loss of Life

With people traveling in personal cars, in bulk, or even through public sometimes have to travel on steep roads with cuts, driving on which, it is simply not possible to look at the other side of the road. And hence, accidents occur and in many cases, the vehicle can drop off the cliff, leaving little to no chance of survival. Annually, **about 3,000 people lose their lives in road accidents in Himachal Pradesh**, while the number is around 105 in 200 accidents reported in just one month. Undoubtedly, loss of life is the biggest concern when accidents are concerned.

1.2.2 Financial Loss in Transportation

Transport is a major part of businesses. It involves large trucks, vans, transporting all kinds of goods over large distances all around the world, including hilly areas. Accidents not only cause loss of life, but also loss of goods, and products. Considering that transportation runs throughout the year, a huge financial loss is observed every year a lot more in hilly areas than plains.

1.2.3 Traffic Jams

Not so wide roads mean that there is less space for vehicles to move. Furthermore, irresponsibility of some drivers such as driving in the opposite lane, driving over the speed limit can get the routes stuck. Not even considering accidents, a minor restriction in the road can lead to hundreds of cars stuck in a row, with no space to move. This situation gets worse in the case of accidents, when even if there is a space to move, damaged vehicles can't move and hence can lead up to days of people stuck in the same place with limited resources to survive. Especially during the times of winters, the rate of accidents and traffic jams go rapidly high.

1.3 Previously used Techniques

In order to address this issue, various techniques have been implemented in the past by both government and private parties. However, there were many boundaries to each of them. As a result, no method could make accidents go down in a way that is needed. A few of these methods and their drawbacks are discussed further.

1.3.1 Traffic Lights

Traffic Lights are the first solution that comes to anybody's mind. And rightly so, since traffic lights have been proved effective throughout the world to ensure a stable and safe route for every vehicle. However, the scenario changes when we consider hilly areas. The roads are not wide, the traffic is not adequate, the expertise needed to drive in such places is not easy to achieve.

Although, there are traffic lights and they are effective in many cases, and hence cannot be told to be declared ineffective. But the problem comes at higher altitudes, the remote locations, where the implementation of traffic lights is simply not possible yet, both practically and politically. The area and investment needed to plant the lights is not feasible, also considering the low level of connection to the outside world. Hence, the traffic lights are only limited to more renowned and open areas in mountains, where the investment is mostly concentrated.

1.3.2 GPS

GPS stands for Global Positioning System. There have been numerous attempts in the past to use the cars' GPS system so that it can communicate with the cars moving in the opposite direction. But surprisingly, it couldn't prove to be any more effective than traffic lights. When we go up to higher altitudes, catching networks becomes a huge problem. No network means no communication with other cars, and hence, it is also only limited to places where network is not lost. Nevertheless, GPS paved the way for NFC to be considered.

1.3.3 NFC

NFC stands for Near Field Communication. The name itself describes the advantage and disadvantage of this technology. NFC allows communication between two devices when they reach a minimum distance of 4 cm towards each other. Even though it allows a connection between cars, the minimum distance of 4 cm is very low to prevent an accident.
Furthermore, it carries an additional disadvantage similar to that of GPS. At higher altitudes, the networks are lost, and hence, it becomes inoperable.

NFC, however, paves the way for the technique that is **the main idea of this project.**

1.4 Future Scope

Since the project is new, there are many factors that would be need to considered for the core device is up and running. For example, it needs to be figured how and where the device will be fitted inside an already full car system.

With emerging technology in the near future, the device can be made even more feature-rich, so that it isn’t technically limited. For example, with some research and the right components, the device might also be able to detect the number of cars on the other side of road. Furthermore, the device can be built in an even more compact way, and hence will need less space.

Most importantly, since the device has a good accuracy and is very cost efficient, it can become inbuilt for cars in the near future. The little investment would be able to make a massive difference in accident prevention.

CHAPTER 2

OVERVIEW OF THE INITIAL IDEA

2.1 Objective

In the initially proposed project, we approached the problem with a new solution that will not only be able to prevent accidents at a much higher accuracy, but can also be easily implemented, has a low investment, and most importantly, it can work in all weather conditions.

2.2 Requirements

2.2.1 Hardware Requirements

S.No	Quantity	Component Name
1	1	Microcontroller
2	1	LDR
3	1	IR Sensor
4	1	Buzzer
5	1	Breadboard
6	-	Wires
7	1	Light Reflecting Surface

Table 2.1: Components

3.2.2 Software Requirements

In order to do the software implementation of the device, all we need is a computer device capable of running Arduino IDE software. Generally, a windows operating system with 2GB of RAM and an i3 processor is enough.

2.3 Understanding The Components

2.3.1 Arduino Microcontroller

Arduino Uno R3 is one kind of ATmega328P based microcontroller board. ATmega328p is One of the most famous 8-bit microchip technologies, which includes a 32-bit memory. It Includes the whole thing required to hold up the microcontroller; just attach it to a PC with the help of a USB cable, and give the supply using AC-DC adapter or a battery to get started. The main advantage of this board is if we make a mistake, we can change the microcontroller on the board without changing much in the program. This is because this specific microcontroller has a huge support from the Arduino community, and hence allows easy transition. Additionally, it has minimum power consumption and an easily programmable interface. The programming of an Arduino Uno R3 can be done using Arduino's IDE software, which is further described in software implementation.

The Arduino Uno R3 pin diagram is shown below:

It comprises 14-digit I/O pins. From these pins, 6-pins can be utilized like PWM outputs. This board includes 14 digital input/output pins, Analog inputs-6, a USB connection, quartz crystal-16 MHz, a power jack, a USB connection, resonator-16Mhz, a power jack, an ICSP header an RST button.

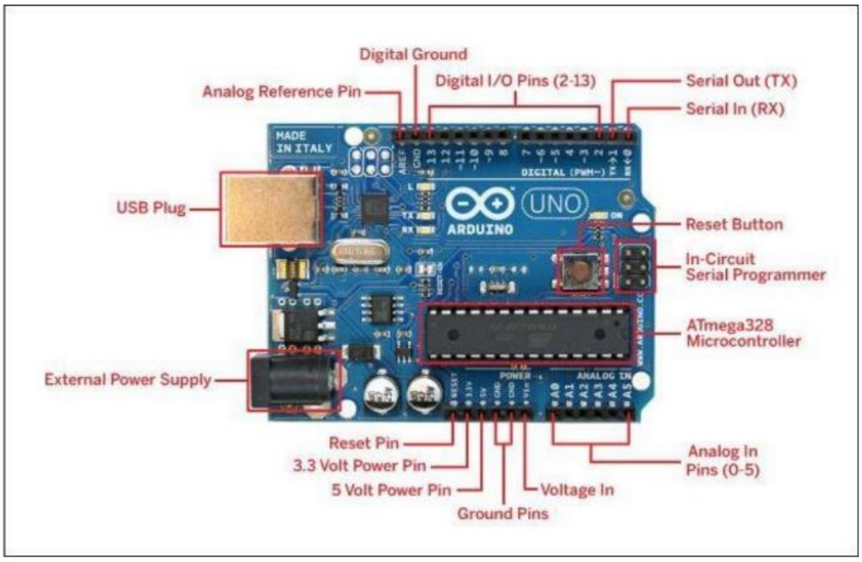


Figure 2.1: Arduino UNOR3

2.3.2 IR Sensor

An electronic gadget called an infrared (IR) sensor measure and picks up infrared radiation from its surroundings. William Herchel, an astronomer, made the unintentional discovery of infrared radiation in 1800. He saw that the temperature was highest just beyond the red light as he measured the temperatures of each color of light (separated by a prism). Since IR's wavelength is longer than that of visible light, it is not visible to the human eye (though it is still on the same electromagnetic spectrum). Infrared radiation is produced by everything that emits heat (i.e., everything with a temperature higher than about five degrees Kelvin).

Infrared sensors come in two varieties: active and passive. Infrared radiation is both produced and detected by active infrared sensors. A light emitting diode (LED) and a receiver are the two components of an active IR sensor. The receiver detects the infrared light from the LED that reflects off an object as it gets close to the sensor. Active IR sensors serve as proximity sensors, and obstacle detection systems frequently employ them (such as in robots).

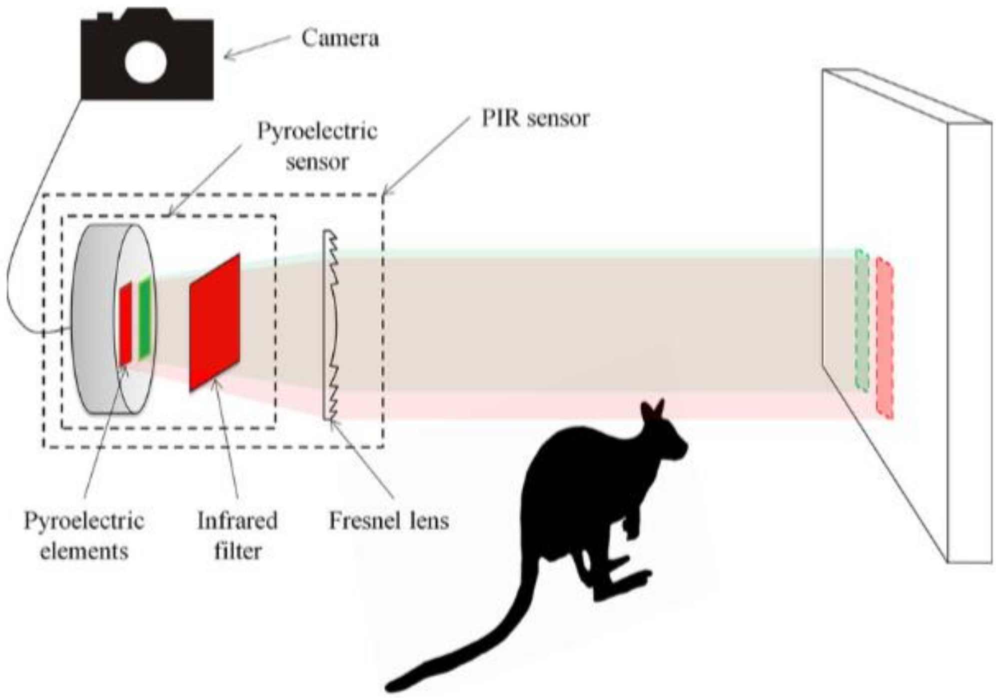


Figure 2.2: Working of IR Sensor

Infrared radiation is not produced by an LED and is not visible to passive infrared (PIR) sensors. The components of passive infrared sensors include:

Two pyroelectric material strips (a pyroelectric sensor), a filter for infrared (that blocks out all other wavelengths of light), Fresnel lenses (which collects light from many angles into a single point), a habitation (to protect the sensor from other environmental variables, such as humidity).

2.3.3 Light Dependent Resistor (LDR)

In electrical circuit designs where it is important to detect the presence or level of light, light dependent resistors, also known as LDRs or photo resistors, are electronic components that are frequently utilized.
The carbon film resistor, metal oxide film resistor, metal film resistor, and similar resistors that are frequently used in other electronic systems are very different from LDRs. They are made expressly for the change in resistance caused by their light sensitivity.

Figure 2.3: Light Dependent Resistor (LDR)

These electronic parts can be referred to by several names, including light dependent resistor (LDR), photo resistor, photo cell, and photoconductor.
LDRs or photo-resistors are very practical to utilize in many electronic circuit designs, while other electronic components like photodiodes or photo-transistors can also be used. For variations in light level, they offer a significant shift in resistance.
LDRs have been employed in a wide range of applications due to their inexpensive cost, ease of fabrication, and simplicity of usage. LDRs are still utilized in a number of applications where it is important to detect light levels, even though they were once used in photographic light meters.

2.3.4 Buzzer

A mechanical, electromechanical, piezoelectric, or other sort of audio signaling device, such as a buzzer or beeper, is also possible. The signal is converted from audio to sound as its primary function. It is often powered by DC voltage and used in timers, alarm clocks, printers, computers, and other electronic devices. It can produce a variety of sounds, including alarm, music, bell, and siren, according on the varied designs.

Figure 2.4: Buzzer

The pin configuration of the buzzer is shown below. It includes two pins namely positive and negative. The positive terminal of this is represented with the ‘+’ symbol or a longer terminal. This terminal is powered through 6Volts whereas the negative terminal is represented with the ‘- ‘symbol or short terminal and it is connected to the GND terminal.

2.3.5 Light Reflecting Surface

Reflection of light is an important aspect to make this device working right. When the rays of light from one vehicle will move in one straight line, they would need to be reflected using a highly smooth and polished surface, and onto the receiving end of the other vehicle. It is important that the surface is highly polished and does not in any way deflect the light any unusual angle. That would cause the whole system to collapse as the rays wouldn't get to the receiving end.

The most widely used reflecting surfaces include polished metal like aluminum, or glass mirrors.

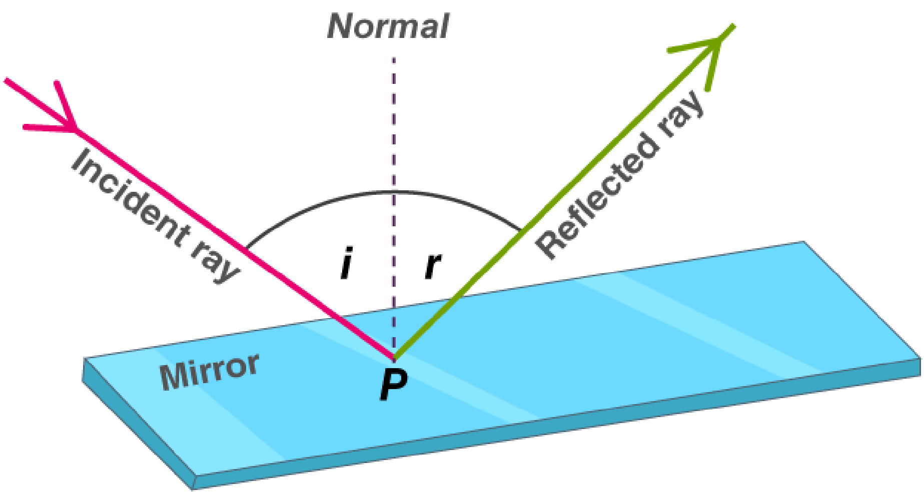


Figure 2.5: Reflection of Light

Additional components required to complete the device include regular **breadboard and wires.**

CHAPTER 3

PRACTICAL IMPLEMENTATION 1

3.1 Initial System Design

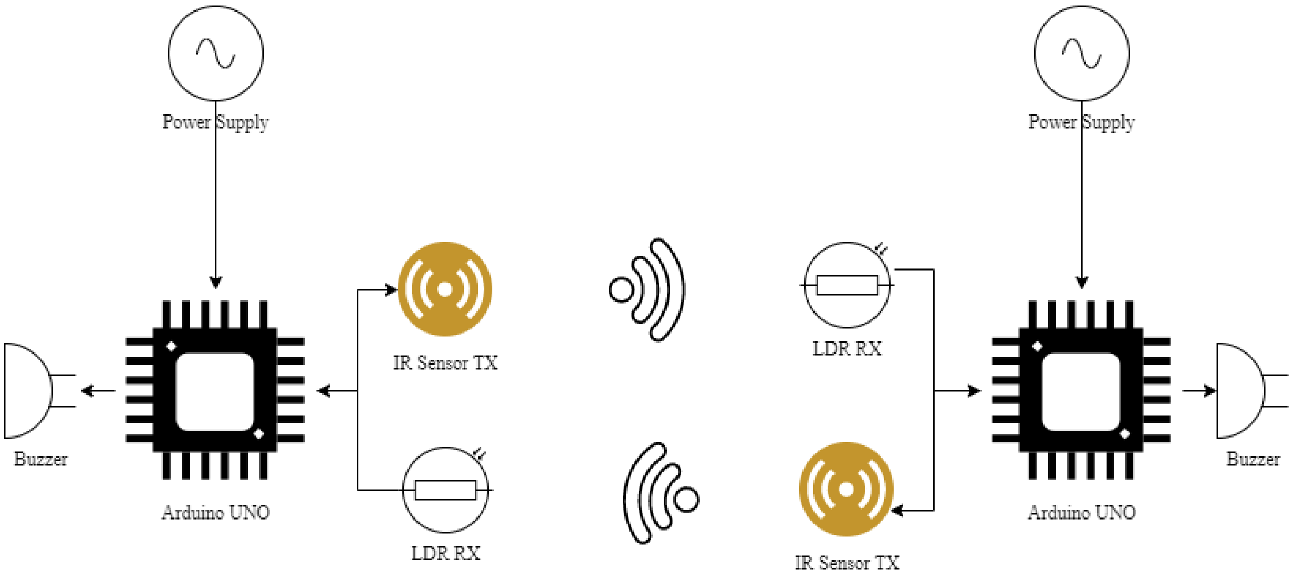


Figure 3.1: Block Diagram

3.2 Initial Working Principle

The device works in pairs and is installed on automobiles. The main goal of this project is to prevent accidents in mountains on corners. We've seen that there are concave mirrors installed by the Government of India at blind turns. Those mirrors are installed in order to prevent accidents caused due to over speeding. These mirrors reflect the light from the fog lamps of automobiles coming from either end.

This device proposes the reflection of infrared light signals transmitted from either of the automobiles and it will be processed from the Arduino Uno on the either end. The interpreted data will be used to determine whether there is a possibility of accident.

The Arduino Uno installed in the automobiles is used as a central processing unit for the device. The microcontroller is interfaced with an infrared sensor, light dependent resistor, and a buzzer.
The infrared sensor is used as a transmitter to emit infrared signals from the either automobile. This signal is reflected from the concave mirror installed at the blind corners and is received by the light dependent resistor. A light dependent resistor is a device that changes its internal resistance based on the intensity of light falling on the resistor. This change in resistance is further calculated by the Arduino Uno. It will determine the whether there is a possibility of any mishap at the current state of the vehicle i.e., speed and distance. If the calculation in the Arduino Uno predicts the chances of an accident, the buzzer will be activated creating an alarming sound that will alert the driver of both vehicles to decrease their speed and avert the collision. Thus, saving the lives of innocent people and also the damages done to public property.

3.3 Setting up Arduino UNOR3

Step 1: Download and Install the IDE

Since the Arduino uses a USB to serial converter, the Arduino board is compatible with most computers that have a USB port. Of course, you will need the IDE first. Luckily, the Arduino designers have released multiple versions of the IDE for different operating systems, including Windows, Mac, and Linux. In this tutorial, we will use Window 11, so ensure that you download the correct version of the IDE if you do not have Windows 11.
Once downloaded, install the IDE and ensure that you enable most (if not all) of the options, including the drivers.

Figure 3.2: Official download page for Arduino

Step 2: Get the Arduino COM Port Number

Next, you'll need to connect the Arduino Uno board to the computer. This is done via a USB B connection. Once it's recognized, we will need to find out what port number it has been assigned. The easiest way to do this is to type "Device Manager" into Windows Search and select Device Manager when it shows. In Device Manager, the Arduino shows up as COM5 in our project, which is port 5.

NOTE: The Arduino won't always be recognized automatically. If your Arduino is not recognized. then uninstall the driver, remove the Arduino, reinsert the Arduino, find the unrecognized device, right click "Update driver", and then click "Search automatically".

Step 3: Configure the IDE

Now that we have determined the COM port that the Arduino is on, it's time to load the Arduino IDE and configure it to use the same device and port. Start by loading the IDE. Once it's loaded, navigate to Tools > Board > Arduino Uno. Next, you must tell the IDE which COM port the Arduino is on. To do this, navigate to Tools > Port > COM7.

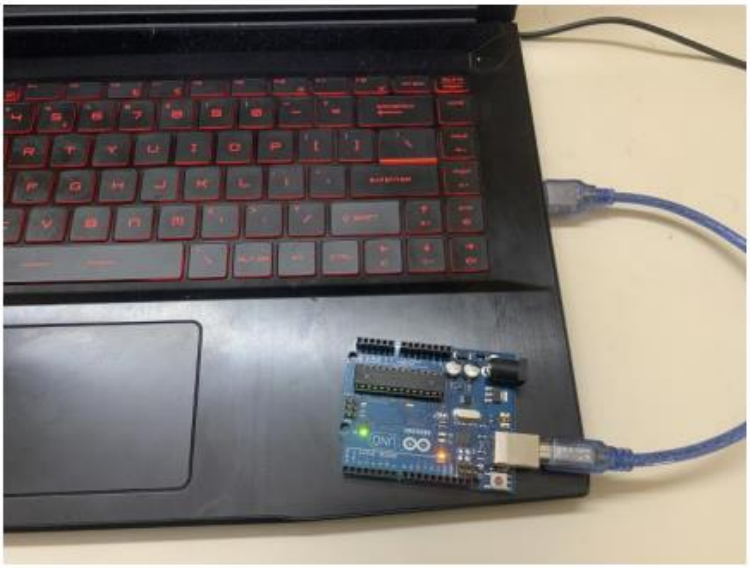


Figure 3.3: Arduino UNO R3 glowing on successful identification

Step 4: Loading a Basic Example

For the sake of simplicity, we will load an example project that the Arduino IDE comes with. This example will make the onboard LED blink for a second continuously. To run this, we'll simply write the code and compile.

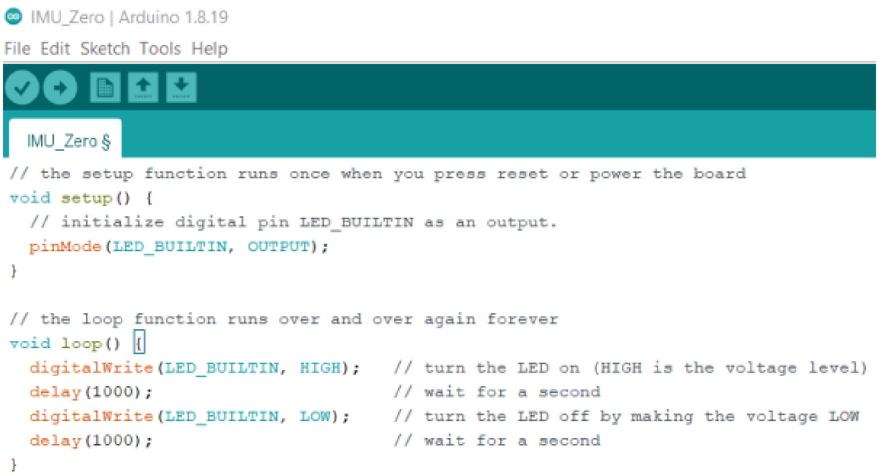


Figure 3.4: Basic Code to glow the LED

On successful compilation, the following message illustrated in figure will show:

Figure 3.5: Appeared Window after successful compilation

With the code compiled, you must now upload it the Arduino Uno. To do this, click the arrow next to the check mark

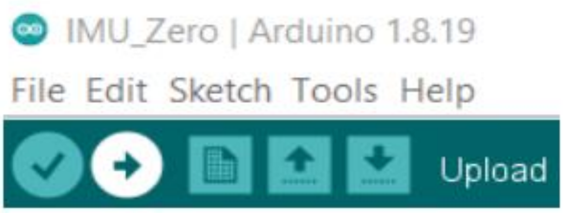


Figure 3.6: Upload Key Point in IDE

3.3 Experimental Software Implementation

The figure attached below shows the software implementation which defines the working principle of the device. it shows the receiving end vehicle, which is used to detect the signal sent by the transmitter end vehicle.

File Edit Sketch Tools Help

reciever_code

```
#include<LiquidCrystal.h>
#define LDR_PIN A0
#define LED A4
#define Buzzer 13
#define SAMPLING_TIME 100

LiquidCrystal lcd (2, 3, 4, 5, 6, 7);

//Declaration
bool led_state = false;
bool previous_state = true;
bool current_state = true;
char buff[64];
char temp[64];
void setup()
{
  pinMode(LED,OUTPUT);
  pinMode(Buzzer,OUTPUT);
  lcd.begin(16,2);
  lcd.clear();
  lcd.print("Accident Prevention System");
  delay(3000);
  lcd.clear();
  lcd.print("Innovated by..");
  lcd.setCursor(0,1);
  lcd.print("Abhishek & Vimal");
  delay(3000);
  lcd.clear();
  lcd.print("Receiving...");
  lcd.setCursor(0,1);
  delay(3000);
```

File Edit Sketch Tools Help

reciever_code

```
  delay(3000);

}

void loop()
{
  current_state = get_ldr();
  if(!current_state && previous_state)
  {
    sprintf(buff, "%c", get_byte());
    Serial.print(buff);
    lcd.print(buff);

  }

  digitalWrite(LED, current_state);
  previous_state = current_state;
  if (current_state>=1){
  digitalWrite(13,HIGH);
}
else{
  digitalWrite(13,LOW);
}
}
bool get_ldr()
{
  bool val = analogRead(LDR_PIN) > 90 ? true : false;
  digitalWrite(LED, val);
  return val;
}
```

```
  {
    sprintf(buff, "%c", get_byte());
    Serial.print(buff);
    lcd.print(buff);

  }

  digitalWrite(LED, current_state);
  previous_state = current_state;
  if (current_state>=1){
  digitalWrite(13,HIGH);
}
else{
  digitalWrite(13,LOW);
}
}
bool get_ldr()
{
  bool val = analogRead(LDR_PIN) > 90 ? true : false;
  digitalWrite(LED, val);
  return val;
}


char get_byte()
{
  char data_byte = 0;
  delay(SAMPLING_TIME * 1.5);
  for(int i = 0; i < 8; i++)
  {
    data_byte = data_byte | (char)get_ldr() << i;
    delay(SAMPLING_TIME);
  }
  return data_byte;
}
```

Figure 3.7: Detection of Signal at the receiver end

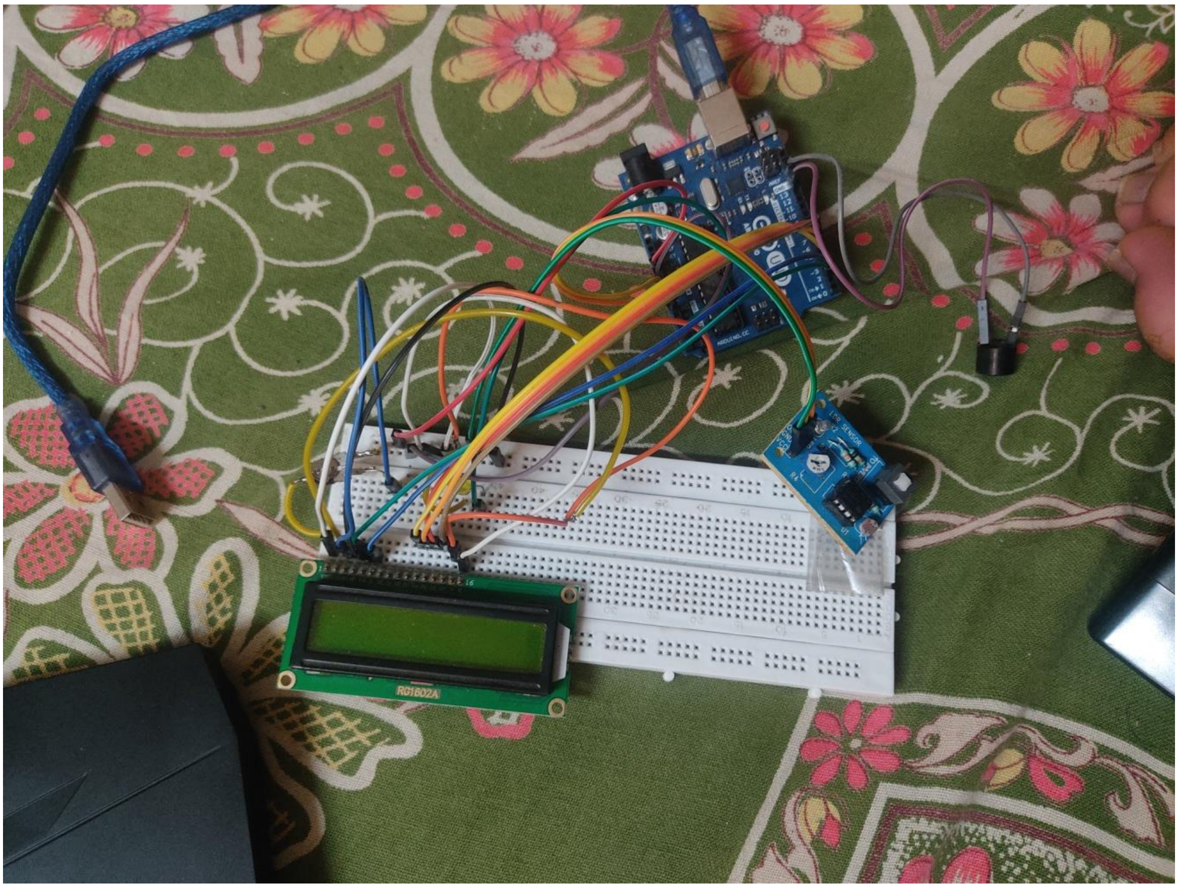


Figure 3.8 : Assembled components

CHAPTER 4

PRACTICAL DIFFICULTIES AND SOLUTIONS

Even though the technical adversities were come over using the various tools used in the development of the device, there were several practical difficulties that would go on to become critical limitations.

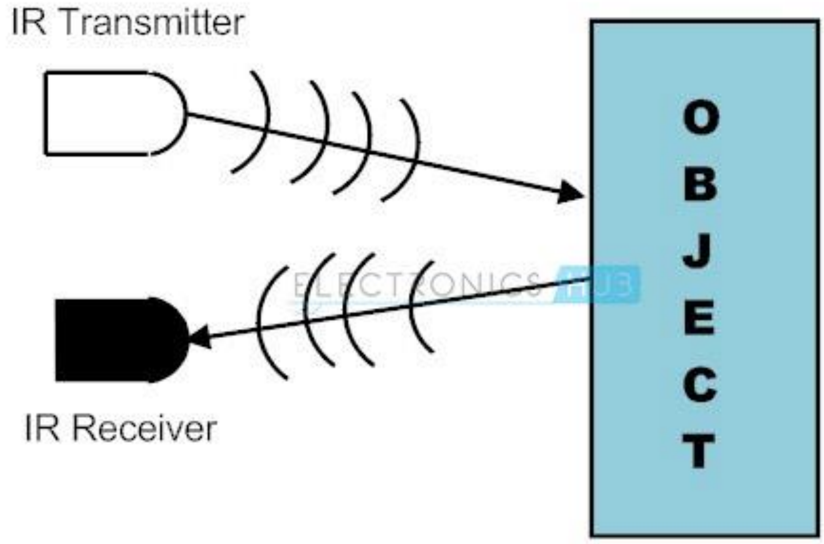


Figure 4.1: Line of Sight

As it is shown in the figure, the angle of transmitter and receiver need to be aligned at a specific angle to be synchronized.

The biggest challenge faced was to get the signal detected as the **line of sight** transmitted by the IR sensor wouldn't travel at the right angle with respect to the receiving end on the other car. When a signal is transmitted from the transmitting end, it reflects back from the shiny mirror but is unable to be detected by the receiving end as the angle of sight would not align with the receiving car. The accuracy of detection was directly compromised with this factor, and the device would often fail to be useful at various instances.

In order to deal with this situation, the project was needed to be modified with respect to its purpose. As the technical aspect held together well, a method was needed to get the two cars synchronized together. As a result, some changes were made, and altered; much simpler techniques were used to attain the same objective and **the final model was developed.**

4.1 Changing Components

Instead of using IR sensor and LDR, we have used an **Ultrasonic Sensor**, which will make things much simpler and effective.

Ultrasonic Sensor

An ultrasonic sensor is a digital device that measures the distance of a particular object in front of the phenomenon of ultrasonic waves.

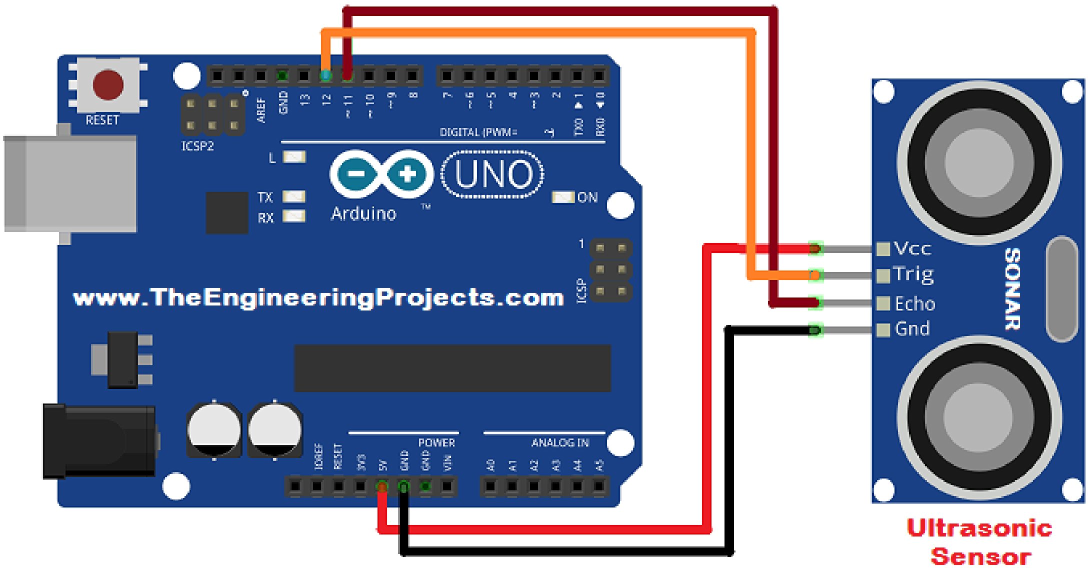


Figure 4.2: Ultrasonic Sensor using Arduino Interface

CHAPTER 5
FINAL IMPLEMENTATION

5.1 Implemented Idea

After some alterations to the initial idea, the final project is implemented using different cases. Below are explained the three cases with block diagrams in which the device would be practically performing.

Case 1 (When no vehicle is approaching)

When no vehicle is approaching from either end of the road, **both red and green lights on the signal are off** signaling that no object is approaching nearby.

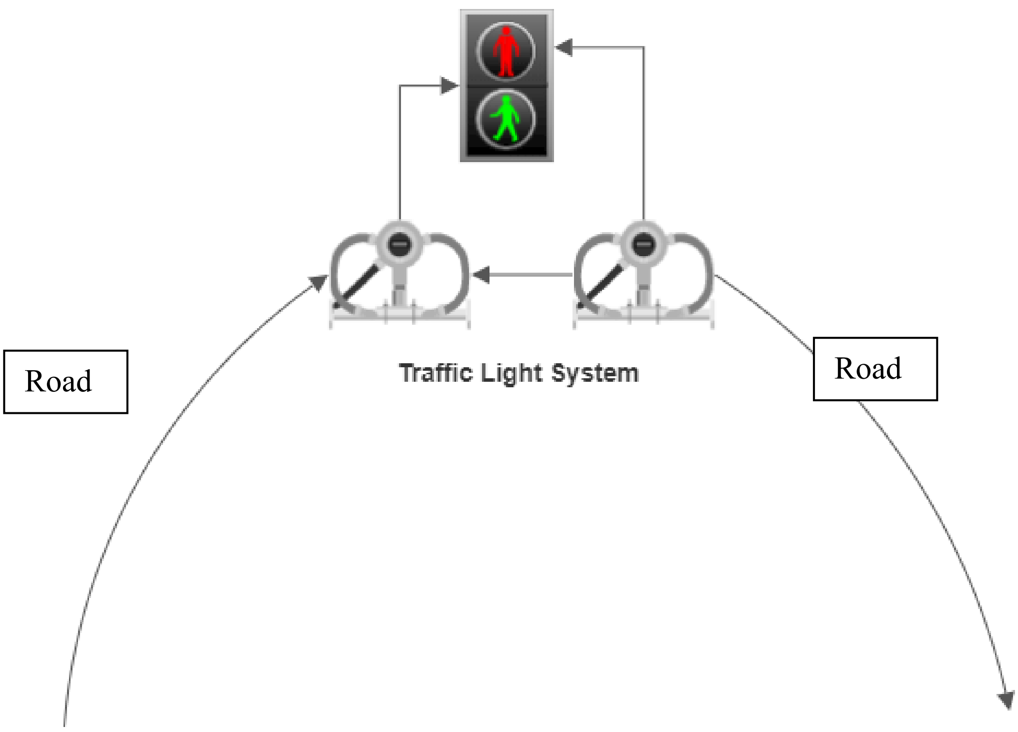


Fig 5.1: Case 1 Block Diagram

Case 2 (When only one vehicle is approaching)

When vehicle is approaching from only one end of the road, **only the green light is turned on** indicating that the road is safe to proceed since no object is approaching from the opposite end.

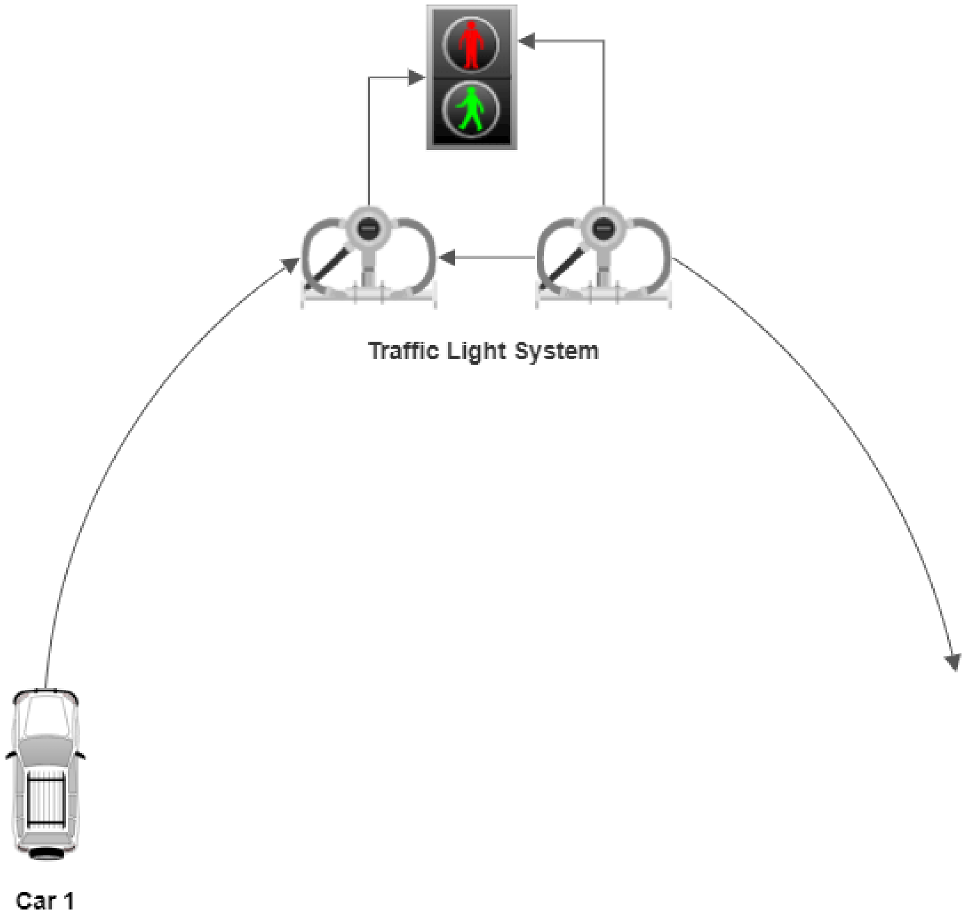


Figure 5.2: Case 2 Block Diagram

Case 3 (When cars are approaching from both ends)

When the vehicles are approaching from both ends of the roads, **the signal will show red light only** indicating to slow down the speed and be careful as an object is approaching from other end of the road.

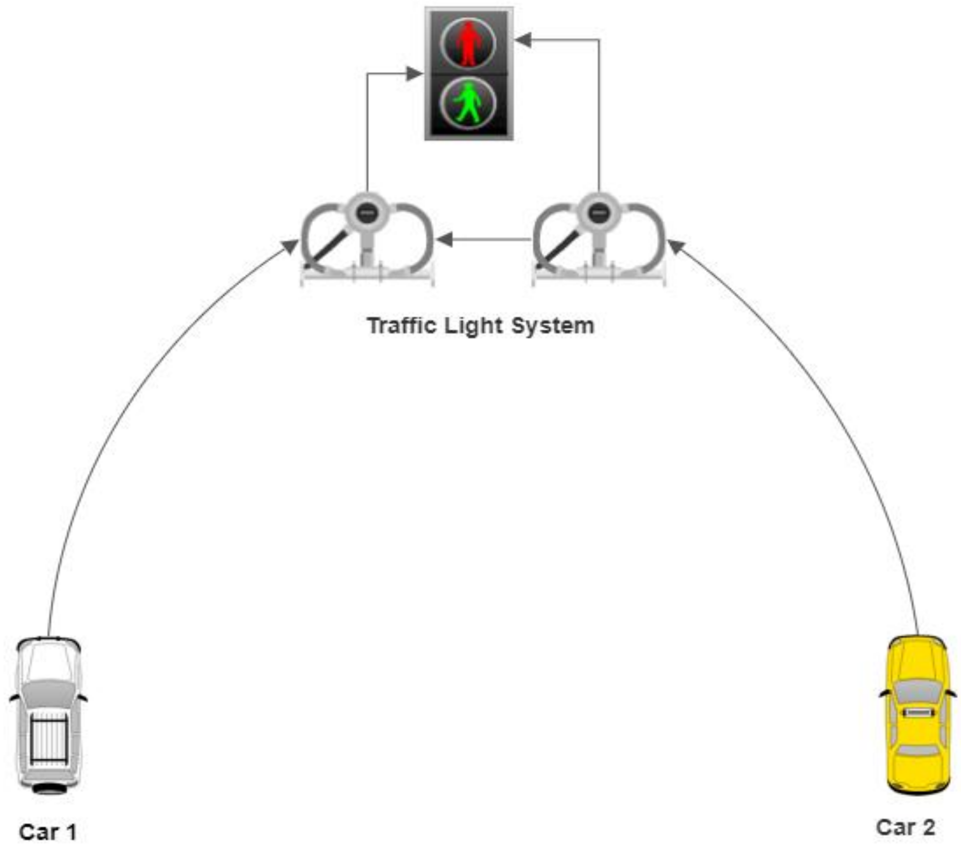
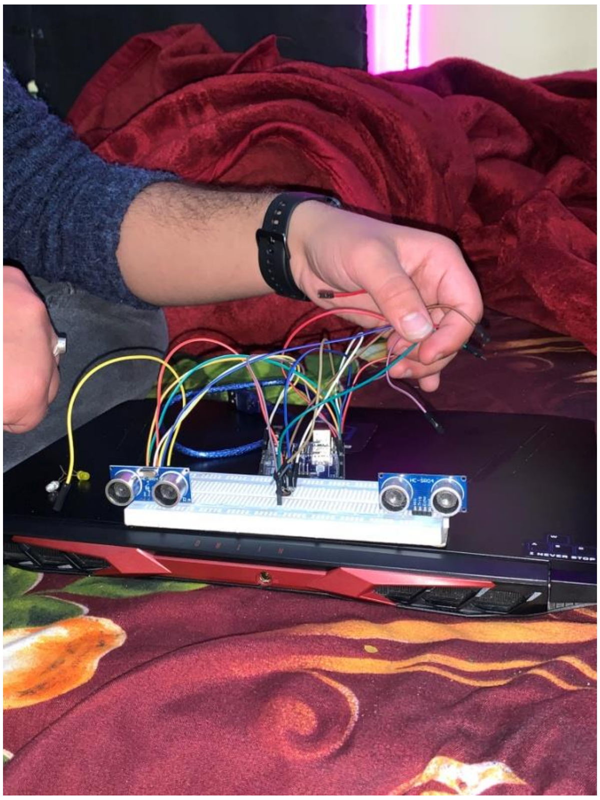


Figure 5.3: Case 3 Block Diagram

5.2 Working Principle

The working principle of the device is based on a simple setup using traffic lights. As it is shown in the block diagrams above, vehicles approach towards blind turns on curvy roads and hence is not able to see objects on the other side. The traffic light is installed around many turns to avoid accidents.

In this device, an ultrasonic sensor is installed in a red/green traffic light which detects any object in its range. The ultrasonic sensor is the only factor that will influence the display of red and green color in the traffic light. Therefore, when a vehicle approaches the blind turn, the ultrasonic sensor will detect its presence and change the color light on the traffic signal, which is visible to the driver on the other side of the road, who can be cautioned about with the red light and reduce his vehicle's speed, hence preventing any sort of last second mishappenings.



5.3 Software Integration

The below mentioned figure shows the programming of Arduino software to detect objects in range and influence the lights.

transmiter_code §

```
const int pingPin = 7;

void setup() {

  Serial.begin(9600);
}

void loop() {

  long duration, inches, cm;


  pinMode(pingPin, OUTPUT);
  digitalWrite(pingPin, LOW);
  delayMicroseconds(2);
  digitalWrite(pingPin, HIGH);
  delayMicroseconds(5);
  digitalWrite(pingPin, LOW);


  pinMode(pingPin, INPUT);
  duration = pulseIn(pingPin, HIGH);


  inches = microsecondsToInches(duration);
  cm = microsecondsToCentimeters(duration);

  Serial.print(inches);
  Serial.print("in, ");
  Serial.print(cm);
  Serial.print("cm");
  Serial.println();

  delay(100);
```

```
long duration, inches, cm;


pinMode(pingPin, OUTPUT);
digitalWrite(pingPin, LOW);
delayMicroseconds(2);
digitalWrite(pingPin, HIGH);
delayMicroseconds(5);
digitalWrite(pingPin, LOW);


pinMode(pingPin, INPUT);
duration = pulseIn(pingPin, HIGH);


inches = microsecondsToInches(duration);
cm = microsecondsToCentimeters(duration);

Serial.print(inches);
Serial.print("in, ");
Serial.print(cm);
Serial.print("cm");
Serial.println();

delay(100);


ong microsecondsToInches(long microseconds) {
```

Figure 5.4: Objection Detection

5.4 Conclusion

During the all stages of this project, the motivation and purpose of the whole idea was prioritized. The initial implementation of the project included a lot of technical complexities, but couldn't prove to be feasible in a real world environment.

The line of sight became a big drawback, due to which the accuracy was dropped very low. Hence, an altered and simpler way was used to improve the accuracy. The installation of a simple ultrasonic sensor in the traffic light proved to be effective in fulfilling the purpose. Furthermore, it also included a major feature added to the device.

In the earlier implementation, the device would only detect approaching vehicles. However, in the final setup, the ultrasonic sensor will not only detect vehicles, but also any other objects including humans, animals, fallen trees, etc. This feature helps avoid all sorts of accidents including all road obstructions. With high end detectors, this simple idea will become feature rich and valuable.

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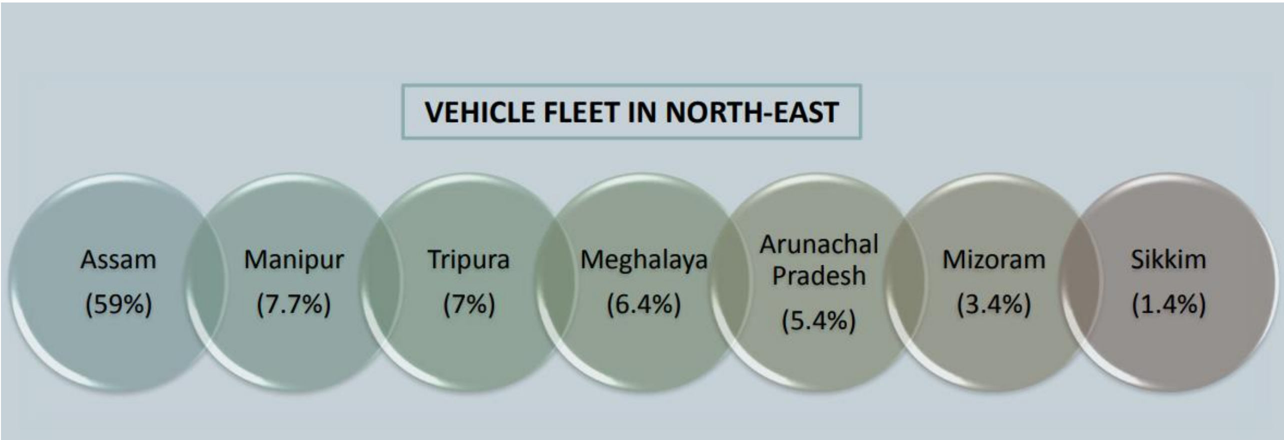
APPENDIX A

A.1 Vehicles in Hilly Areas

A sudden and explosive rise in vehicle number and growing congestions is crippling hilly areas of India. The north eastern states have together a 2.7 million of registered vehicles.



A.2 Key Challenges in Hilly Areas

1. The typical terrain and network constraints prevent the expansion of road widths, and the road conditions also limit the number of lanes that can be supported. Only 40% of a 429 km of very narrow roads have a ROW of more than 10 meters.

2. On-street parking for vehicles is observed to obstruct at least 1.8 meters of the road width in several locations, particularly in busy neighborhoods. There is little room for capacity expansion on the congested urban road network in the downtown area.

3. Because the carriageway width is narrower, stopping public transportation vehicles frequently causes congestion. Most of them opt to stroll along the carriageway due to a lack of suitable pedestrian facilities. This severely hinders the movement of vehicular traffic along the highway, which results in slow travel times

4. Due to the lack of sufficient walkways on both sides of the majority of the linkages, pedestrians are forced to use the carriageway because of the large volume of pedestrian traffic. One of the main causes of the traffic, especially in the core area, is taxi parking along the carriageway and low occupancy of these taxis.

5. Tourists and other inter-city travelers are inconvenienced by the lack of established facilities such as bus or taxi terminals. The City Center is home to the majority of intercity cab businesses. The problems of conflict and congestion are exacerbated by the mixing of inter- and intra-city traffic. There is no centralized infrastructure for the movement of commercial commodities.