M.KUMARASAMY
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ACCIDENT PREVENTION SYSTEM AT HAIRPIN BENDS

A MINOR PROJECT- II REPORT

Submitted by

INFANT BENA.B	**927622BEC076**
JEEVITHA.P	**927622BEC084**
MAGUDEESHWARI.V	**927622BEC108**
KAVIKA.V	**927622BEC093**

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BONAFIDE CERTIFICATE

Certified that this **18ECP104L-Minor Project II** report "ACCIDENT PREVENTION AT HAIRPIN BENDS**"**is the bonafide work of B.Infant bena (927622BEC076),P.Jeevitha(927622BEC084),V.Kavika(927622BEC093),V.Mag udeeshwari(927622BEC108) who carried out the project work under my supervision in the academic year 2023-2024 -EVEN

SIGNATURE **Dr.A.KAVITHA B.E., M.E., Ph.D.,** **HEAD OF THE DEPARTMENT,** Professor, Department of Electronics and Communication Engineering, M.Kumarasamy College of Engineering, Thalavapalayam, Karur-639113.	**SIGNATURE** **Mrs.S.NIVISHNA,M.E,** **SUPERVISOR,** Assistant Professor, Department of Electronics and Communication Engineering, M.Kumarasamy College of Engineering, Thalavapalayam, Karur-639113.

This report has been submitted for the **18ECP104L – Minor Project-II** final review held at M. Kumarasamy College of Engineering, Karur on_____.

PROJECT COORDINATOR

INSTITUTION VISION AND MISSION

Vision

To emerge as a leader among the top institutions in the field of technical education.

Mission

M1: Produce smart technocrats with empirical knowledge who can surmount the global challenges.

M2: Create a diverse, fully -engaged, learner -centric campus environment to provide quality education to the students.

M3: Maintain mutually beneficial partnerships with our alumni, industry and professional associations

DEPARTMENT VISION, MISSION, PEO, PO AND PSO

Vision

To empower the Electronics and Communication Engineering students with emerging technologies, professionalism, innovative research and social responsibility.

Mission

M1: Attain the academic excellence through innovative teaching learning process, research areas & laboratories and Consultancy projects.

M2: Inculcate the students in problem solving and lifelong learning ability.

M3: Provide entrepreneurial skills and leadership qualities.

M4: Render the technical knowledge and skills of faculty members.

Program Educational Objectives

PEO1: **Core Competence:** Graduates will have a successful career in

academia or industry associated with Electronics and Communication Engineering

PEO2: Professionalism: Graduates will provide feasible solutions for the challenging problems through comprehensive research and innovation in the allied areas of Electronics and Communication Engineering.

PEO3: Lifelong Learning: Graduates will contribute to the social needs through lifelong learning, practicing professional ethics and leadershipquality

Program Outcomes

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Applying knowledge in various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of Engineering application.

PSO2: Able to solve complex problems in Electronics and Communication Engineering with analytical and managerial skills either independently or in team using latest hardware and software tools to fulfil the industrial expectations.

Abstract	**Matching with POs,PSOs**
SENSORS ALARM SYSTEM	**PO1, PO3, PO6,PO9, PSO1, PSO2**

ACKNOWLEDGEMENT

Our sincere thanks to **Thiru.M.Kumarasamy, Founder** and **Dr.K.Ramakrishnan, Chairman** of **M.Kumarasamy College of Engineering** for providing extraordinary infrastructure, which helped us to complete this project in time.

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ABSTRACT

According to survey, 10% of the total vehicle accidents happen on curved segments in hill stations. It is risky while driving in bends and curves. In order to provide solution, an IoT based Accident Prevention System for Hairpin Bend Roads has been proposed in this work. The objectives of the proposed work are to provide a safe and comfort hill travel by avoiding accidents mainly at the Hairpin bends and U curves, and to alert the drivers of both the vehicles approaching the bend, by generating traffic warning signal that indicates the arrival of a vehicle ahead on the opposite side of the bend. The proposed system includes ir sensor to detect any vehicle reaching the hairpin bend and alert immediately the vehicles on the other side by enabling an red signal. Therefore, this system reduces the incidence of vehicle collision especially in the forest or hilly region which has poor internet connection. To solve connectivity issues, it has been implemented with machine-to-machine communication protocol without internet. Keywords: IR sensor,Diode-IN4007,Relay-5V,Photo Diode, two stages of LED.

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LIST OF ABBREVIATIONS

ACRONYM	ABBREVIATION
IR	INFRARED SENSOR
LED	LIGHT EMITTING DIODE
PCB	PRINTED CIRCUIT BOARD

CHAPTER 1

INTRODUCTION

An accident avoidance system is an automobile safety system designed to reduce the severity of an accident. Many studies about the operational and safety effects of U-turns at signalized and non-signalized intersections have been conducted. Past results from researches have no evidence to prove that U-turns at signalized intersections present major safety or operational problem. On detecting the vehicle approaching from the other side the system provides a warning to the driver to avoid the mishap. By allocating the right of way to different sets of mutually compatible traffic movements during distinct time intervals the traffic signals have been effectively used to manage conflicting requirements for the use of road space. Considerable work has been done to develop various approaches in order to boost traffic efficiency, which can be categorized as fixed-time, traffic responsive and predictive control ones. However, few researches have been found to deal with heavy vehicle U turns. This system focuses on providing an alternative design for accommodating a safe U-turn at a signalized intersection.

OBJECTIVES

This notifies the driver about the vehicles approaching from the other side of the blind corner. The driver then can carefully take the turn and ensure a pleasant and safe journey. Accidents can be prevented and a lot of lives and loss of vehicles can be saved when implemented at hairpin curves in the real world.

CHAPTER 2

LITERATURE SURVEY

Accident prevention systems at hairpin bends are critical for enhancing road safety in challenging terrains. A literature survey reveals a multifaceted exploration of methodologies and technologies aimed at mitigating the risks associated with these intricate road geometries.

One prominent approach involves the utilization of sensor-based warning systems. These systems leverage technologies such as radar, infrared sensors, and ultrasonic sensors to detect approaching vehicles and provide real-time alerts to drivers. The objective is to enhance situational awareness, giving drivers crucial information to navigate hairpin bends safely.

In the realm of advanced driver assistance systems (ADAS), researchers are exploring the integration of cutting-edge technologies, including computer vision and machine learning algorithms. These systems go beyond traditional warning signals, aiming to predict potential hazards and dynamically adapt driving conditions. By analyzing patterns in data, ADAS can contribute to proactive accident prevention at hairpin bends.

Furthermore, studies underscore the importance of road design modifications in conjunction with technological solutions. Improved signage, road markings, and barriers are identified as crucial elements in creating a safer environment for drivers negotiating hairpin bends. These enhancements complement the capabilities of sensor-based and ADAS technologies, forming a comprehensive strategy for accident prevention.

Driver education and awareness emerge as recurring themes in the literature. Researchers emphasize the need for educating drivers about the unique challenges posed by hairpin bends and the utilization of preventive technologies.By fostering an understanding of safe driving practices in these specific scenarios, the literature suggests that accidents can be further reduced.

In conclusion, the literature on accident prevention systems at hairpin bends reflects a holistic approach that combines sensor technologies, advanced driver assistance systems, road design improvements, and driver education. This multifaceted strategy aims to address the complexities of negotiating hairpin bends, ultimately contributing to a safer road environment for all.

CHAPTER 3

EXISTING SYSTEM

Driving is one of the very difficult tasks in hills. Drivers have to be alert all the time while driving in these regions. Researchers for hilly regions have proposed several accident prevention systems. Among the causes for accidents in hilly regions, the driver does not know the vehicle coming from the opposite side in curves and hairpin bends is the major cause.

To avoid these problems in curves or hairpin bends a piezoelectric sensor based system is implemented the system was able to alert the vehicles in the opposite side, but not able to detectvehiclewhen the vehicle is not over the piezo sendor.Identifying the direction of the vehicle is also a concern, as the system wasnot able to detect whether the vehicle is approaching the uphill or downhill direction. An automatic road accident detection and prevention system was proposed by Khalil et al the system is deployed in the individual car and only the simulation is tested.

Driver fatigue and drowsy detection system is been designed and the system wasable to detect only the driver drowsiness and it will not intimate about the approaching vehicle from a blind spot or curve. Image processing based traffic control and accident detection system is designed the processing in real time is slow and incurs high deployment cost. An instinctive speed and accident control system is designed using ultrasound sensor and the system is for an individual vehicle and serves as a part of the autonomous vehicle model.

Mobile application based automatic accident prevention and detection system

was designed, the detection possibility of small accidents and support of the applicationfrom different mobile processors were major concerns to be addressed.

A.CONVEX MIRROR:

Nowadays this setup is widely used in all the hilly regions. These mirrors had beeninstalled in curves and hairpin bends where the increasing possibility of accidents. These mirrors reflect the vehicles coming in the opposite side. The main disadvantage of this system is it is difficult to keep the mirrors clean at all time. It may reduce the reflection rate and provide poor judgment to the driver.

.SIGNBOARDS:

The signboards for hairpin bends and curves are installed in the hilly region. Thesesign boards for hairpin bends will just represent there are sharp bends greater than 90 degrees is coming upon the road ahead and alert to go slow. Nevertheless, this will not provide any details about the vehicles coming in the opposite side. This may provide confusion to the drivers.

C. HORN:

Vehicle horn is one of the most common methods used to alert the drivers inturnings like curves and hairpin bends. The drivers on both sides judge the distance of another vehicle based on the intensities of sound from their respective horns. This method is inefficient because horn sound may not be clear in raining time and causing a lot of confusion between drivers.

D. HEADLIGHTS:

Flashing the headlights while driving is similar to the vehicle horn but it is

usedonly in night times. This is also inefficient method because we cannot use headlights in the daytime.

E. CCTV CAMERAAND LCD DISPLAY:

In this system, a CCTV camera in one side captures the vehicle and display it to the opposite side through the LCD display. The main issue in this system is it mustbe installed incorrect angle and if anything that falls on the lens of thecamera, it will not provide a clear vision to the drivers. This may cause confusion to the drivers.To overcome the issues in the existing methods the system using ultrasonic sensor is introduced. The sensor will sense the vehicle and calculate the distance of the vehicle, then alerts the drivers while driving in hills through LED and buzzer. This system also counts the number of uphill and downhill vehicles, used for traffic pattern analysis in hills. This system provides the way for the people to analyze the traffic.

CHAPTER 4

PROPOSED SYSTEM

In this system, a distance of the vehicle is sensed and give three stages of alerts to the opposite side driver, these alerts are based on the distance from the vehicle to the sensor position. Using this system, the drivers can easily judge the arrival of vehicles from the other side more confidently. This system also senses the speed of the vehicle and if the vehicle speed is high, it alerts the drivers to go slow in curves and hairpin bends. In this system, the data for the number of uphill and downhill vehicles are allowed to store in the cloud and use these data for analysis purpose. This is done using Thingspeak, which is the open IoT platform with MATLAB analytics. The traffic analysis is done with the help of web application.

CHAPTER 5

METHODOLOGY

This paper proposes a simplistic approach for the implementation of a Collision Avoidance System in hairpin bends on a hilly track, Ghats, or zero visibility turns using proximity sensors.Ghat Roads are access routes into the mountainous with the number of hairpin bends, which is very risky as compared to normal routes. So chances of accidents in ghat sections is more because of narrow road width, sharp bends, improper camber, valley side etc. We plan to overcome this problem by placing an IR sensor on one side of the roads and alerting the driver about the obstacle or vehicle in Ghat sections. When the signal is green it indicates that it is safe to take turn which means there is no vehicle coming in the opposite direction. These two IR sensors can give input to the Arduino and this Arduino will send data to the LED lights which directs for vehicle.

Define the problem:

Clearly define the problem you want to solve, which is the prevention of accidents at hairpin bends. Gather information on the statistics of accidents at hairpin bends, their causes, and the factors that contribute to accidents.

Determine the solution:

Explore different solutions to prevent accidents at hairpin bends, and select the most appropriate one. In this case, an IoT-based solution could be used to detect and alert drivers of potential danger when approaching hairpin bends.

Design the system:

Create a design for the IoT system, including the sensors that will be used to detect approaching vehicles and the algorithms that will analyze the sensor data. Identify the hardware and software components required to build the system.

Develop the prototype:

Develop a prototype of the system to test its functionality. This mayinvolve programming microcontrollers, building circuits, and testing the system in acontrolled environment.

Test the prototype:

Once the prototype is built, test it to ensure that it functions as intended. Use simulated data or real-world data to test the system's accuracy and reliability.

Refine the system:

Analyze the results of the testing and refine the system to improve itsaccuracy, reliability, and overall performance.

Deployment:

Collect data on the system's performance and use it to further refine the system.Continuous

Improvement:

In summary, the methodology for developing a working model for the prevention of accidents at hairpin bends using IOT involves defining the problem, determining the solution, designing the system, developing a prototype, testing the prototype, refining the system, deploying it in real-world settings, and continuously improving it.

CHAPTER 6

HARDWARE COMPONENTS

- IR SENSOR
- LED LIGHTS
- PHOTODIODE
- TRANSISTOR
- RESISTOR
- DIODE
- RELAY
- BUZZER
- PCB BOARD

IR SENSOR :

Infrared sensors are being used as proximity sensors and they can be passive or active. Passive infrared sensors are basically Infrared detectors. These sensors do not use any infrared source and detects energy emitted by obstacles in the field of view. The active infrared sensors consist of twoelements which are infrared source and infrared detector. Infrared source includes an infrared laser diode. Infrared detectors include photodiodes or phototransistors. The energy emitted by the infrared source is reflected by a purpose and falls on the infrared detector. An IR sensor consists of an IR LED then an IR Photodiode; mutually they are called as Photo – Coupler or Opto – Coupler. When the IR transmitter emits radiation, it reaches the thing and some of the radiation reflects reverse to the IR receiver. Based on the force of the reception by the IR receiver, the output of the sensor is defined.

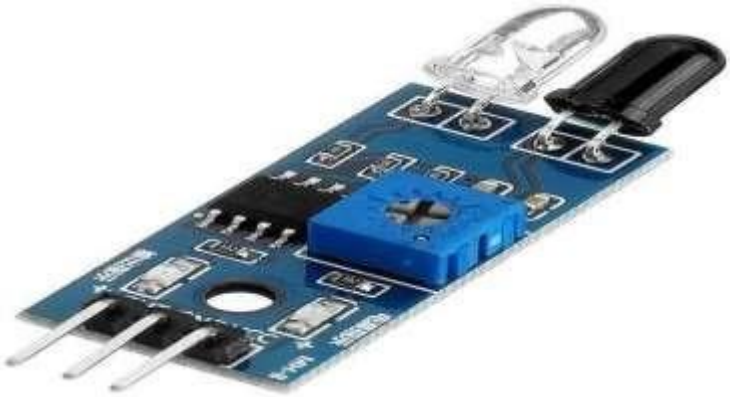


FIG:1

LED LIGHTS:

LED (Light Emitting Diode) lights are a type of lighting technology that uses a semiconductor to turn electrical energy into light. LEDs are highly efficient, longlasting, and available in a wide range of colours and intensities, making them attractive for a wide range of lighting applications.One of the primary benefits of LED lighting is its efficiency. They use significantly less energy than standard incandescent bulbs, which means they can assist to cut energy expenses and carbon emissions.

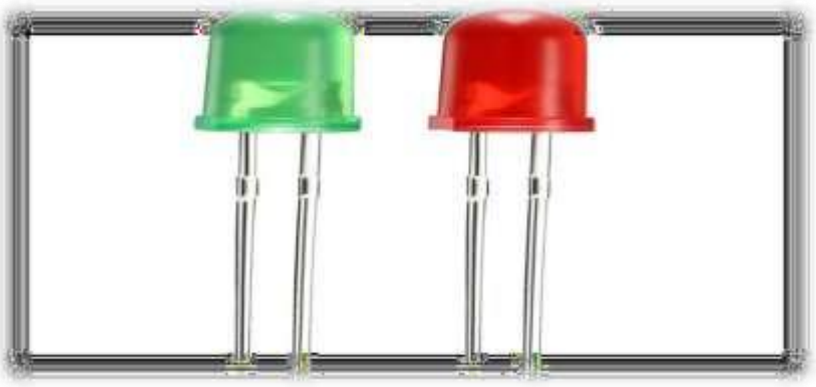


FIG:2

BUZZER:

A buzzer is an electronic device that emits an audible tone or sound when an electrical signal is applied to it. Buzzers are a sort of sounder that typically comprises of a piezoelectric device or an electromagnetic coil and diaphragm. Electromagnetic buzzers create a magnetic field by energizing a magnetic coil with an electrical signal. The magnetic field vibrates the diaphragm, resulting in an audible tone.

FIG:3

DIODE-IN4007:

A general-purpose rectifier diode is the IN4007 type.A diode is an electrical component that only permits one path of electricity to pass while blocking the other way. The IN4007 diode has a maximum forward current capacity of 1A and amaximum reverse voltage capacity of 1000V. Power supply and other circuits that need to convert alternating current (AC) to direct current (DC) frequently employ rectifier diodes like the IN4007. The diode conducts and enables current to flow in the forward direction while obstructing flowing in the

reverse direction when the AC input voltage is positive. The diode inhibits forward current while permitting a modest amount of reverse current when the AC input voltage is negative.

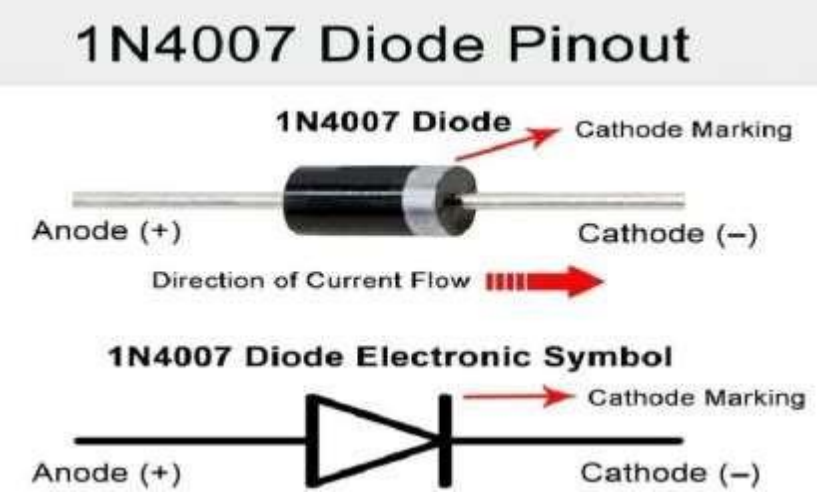


FIG:4

PHOTO DIODE:

A photodiode is a semiconductor device that converts light into an electrical current. It functions as a light detector by generating a flow of current when exposed to photons. This property makes photodiodes essential in various applications, such as light sensors, solar cells, and optical communication devices.

FIG:5

TRANSISTOR:

The transistor 547, or any transistor, can be used in an accident prevention system at a hairpin bend by serving as a component in a circuit that detects and responds to certain conditions. For example, it could be part of a sensor circuit that monitors the speed of approaching vehicles or the road conditions. Based on this information, the circuit can trigger actions such as activating warning signs, flashing lights, or even controlling speed-limiting devices to enhance safety at the hairpin bend.

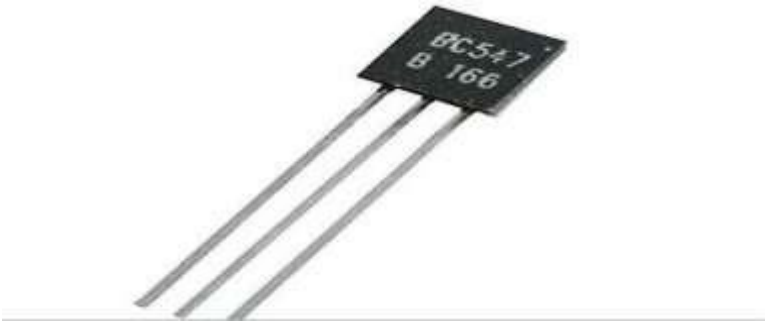


FIG:6

RELAY:

In a hairpin bend accident prevention project, a relay component could be used to control various safety features. For example, the relay could be part of a system that activates warning signs, signals, or barriers when a vehicle approaches the hairpin bend. It may also play a role in triggering an alert system for drivers, ensuring timely communication about the bend's curvature and potential risks. The specific functionality would depend on the project's design and goals

FIG:7

RESISTOR:

In a hairpin bend accident prevention project, a resistor may be used in various ways depending on the specifics of your design. One common application is in voltage dividers or current-limiting circuits. Resistor role may include:

1. **Voltage Divider:** Resistor networks can be employed to create voltage dividers. This can be useful in sensor circuits, where the output voltage needs to bewithin a specific range for proper processing.

2. **Current Limiting:** Resistors can restrict the flow of current in a circuit. This is beneficial in preventing damage to components or ensuring that certain devices operate within their specified current limits.

3. **Filtering and Signal Conditioning:** Resistors can be part of filters or signal conditioning circuits to refine sensor inputs or control signals.

4. **Safety M echanisms:** Resistors can be integrated into safety features, such as providing a discharge path for capacitors to enhance electrical safety.

FIG:8

PCB BOARD:

A PCB (Printed Circuit Board) can be crucial in implementing an accident prevention system at a hairpin bend. It can be utilized to integrate various components and sensors that contribute to the safety system. For instance, you might incorporate gyroscopes, accelerometers, and proximity sensors on the PCB to detect vehicle speed, tilt, and proximity to the bend. The PCB can then process this data to trigger warnings or interventions, such as activating brake assistance or providing alerts to the driver. Properly designed PCBs ensure efficient communication and coordination among the system's components, enhancing the overall effectiveness of the accident prevention system.

FIG:6

CHAPTER 7

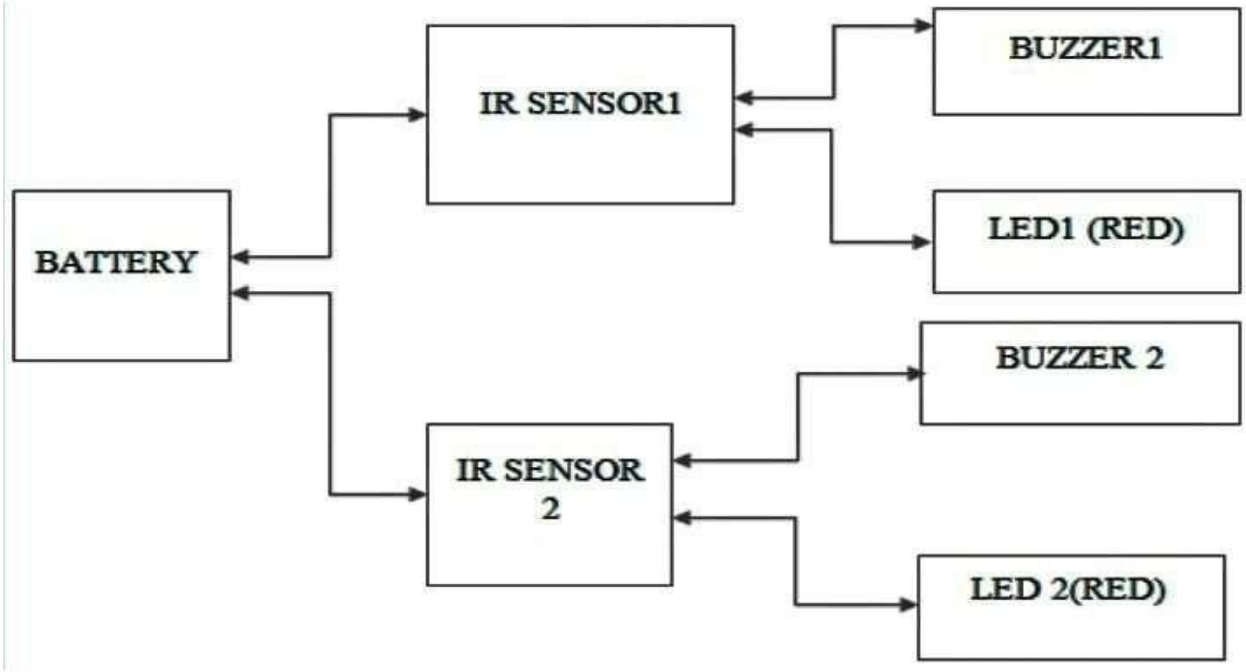
WORKING PRINCIPLE

A sensor is a device that detects and responds to a specific type of input from the physical environment. Sensors are used in various applications and industries such as in smartphones, automotive, security systems,medical equipment, and many others. They are designed to measure various physical quantities such as temperature, light, humidity, motion, pressure, and others, and then convert that measurement into an electrical signal that can be processed by a computer or 11 other device. Automatic Signal Alert for Preventing Accidents in Hair Pin Bend Roads. Automatic signal for hairpin bend and hill side road turns. Hairpin bend accidents occur mostly because of the driver unable to see the vehicle coming from the opposite sides of the road curves. Our system uses sensors to detect any vehicles reaching hair pin bend and alerts immediately on other side vehicles by red signal and also producing alert sound. It hair pin bend road is clear green signal is produced. Thus this system provides safety for drivers to prevent hill side accidents and ride safely in hill side roads An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation rather then emitting it that is called as a passive IR sensor is usually in the infrared spectrum, all the objects a late some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector issimply an IR photodiode which is sensitive to IR light of the same

wavelength as that emitted by the IR LED. When IR light fallson the photodiode the resistance sand these output voltages.

BLOCK DIAGRAM

FIG:6



STATES OF LED ALERTS

Condition	S_A	S_B	Output
1#	Red	Red	Stop
2#	Red	Green	Vehicle on side A will stop
3#	Green	Red	Vehicle on side B will stop
4#	Green	Green	Empty road

TABLE:1

MODEL

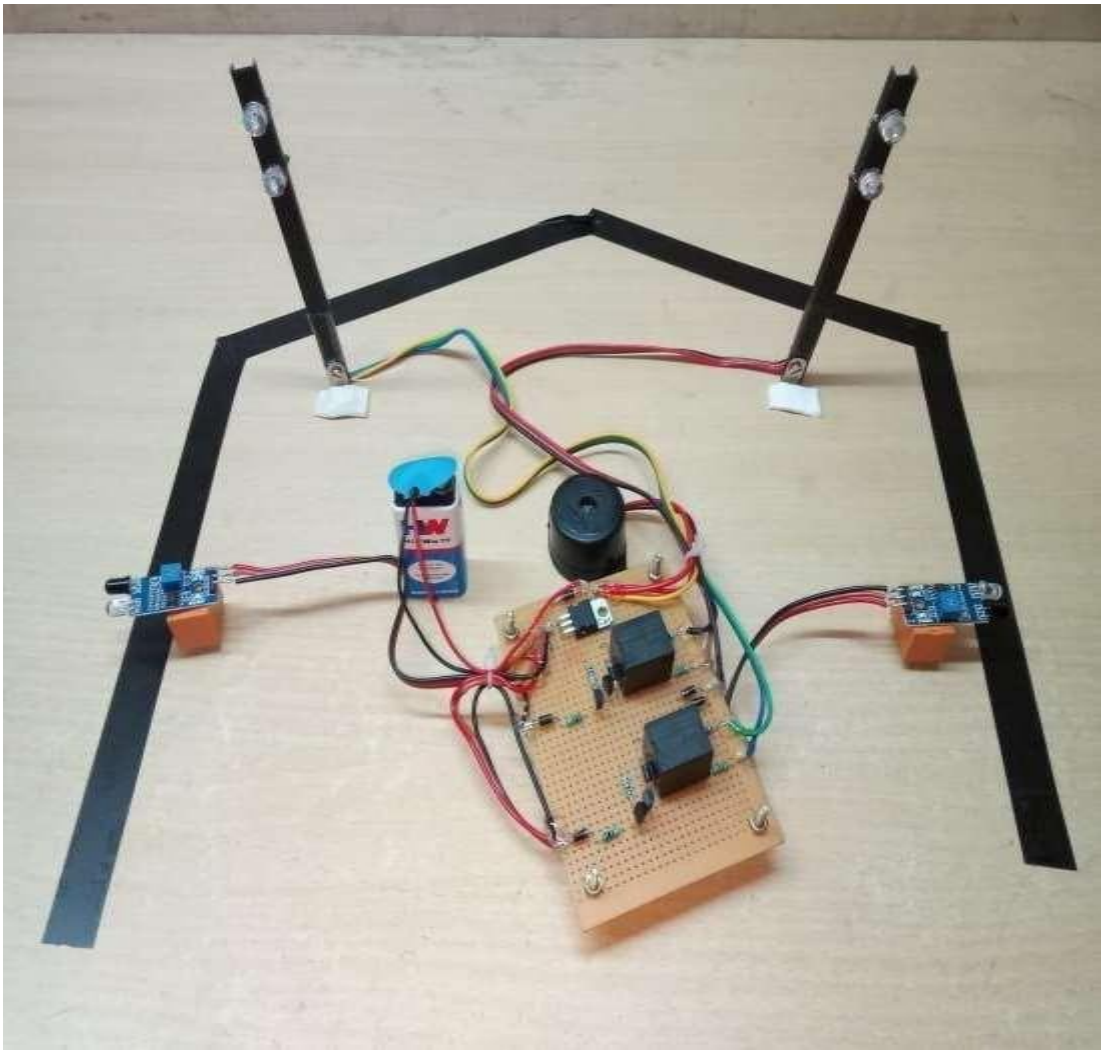


FIG:10

CHAPTER 8

CONCLUSION

The experiment are started with sensor, it senses the vehicle with the help of IR Sensor. In this project we are alert the driver by blinking. The clash avoidance at hairpin bend is able to transmit data which is sensed from other side of the road. The system is completely integrated and can give alert to the driver by using LED. This system helps to detect the vehicles by Using their IR Sensor. Thissystem provides the information about the vehicles coming from the oppositeside of the vehicles in the Ghats section. This system is useful when the driver can't seethe vehicle in the opposite side of the vehicle because of long curve roads in the Ghats section. Thus the system offers the safety and security to the driver.

CHAPTER 9

FUTURE SCOPE

The purpose of this paper is to reduce the number of accidents in curve roads. This is done by warning the driver by means of LED light which glows when vehicle comes from the other side of the curve. The vehicle is detected by the help of IR Transmitter and Receiver sensor which is interfaced to the microcontroller Arduino Uno. In this we can save thousands of lives in the curve roads on the ghat section. We recognize the causes and effect of accidents and then find out a solution introducing a new technique to avoid such accident. The new technique consists of two IR sensors to alert the vehicle of the opposite road. We have not done anything to safeguard from accidents in the Ghats section. Hence we can add GSM module if driver meets with an accident in the Ghats section it will send messages directly to police stations and hospitals.This system requires an external power supply, implementation of a self-powered system using renewable energy like wind and solar will make the system more effective and efficient.

CHAPTER 10

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21)Anand M G,2)A Dhanyakumar,3)Bhaskar N,4)MahalingS B*"Sensor Based Accident Prevention System in Curving" 1,2,3,4 Students, B.E, Mechanical Engineering, Alva's Institute of Engineering &Technology, Mangalore, Karnataka.

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41)Chitransh Srivastava, 2)Nikhil Acharya,3)Fervez Jaffer B.M.,4)Sachin Bhat*"Implementation of collision avoidance system for hairpin bends in Ghats using proximity sensors" 1Manipal University, 2Visvesvaraya Technological University, 3Visvesvaraya Technological University, 4Reva University Email: chitransh.email@gmail.com1, acharya.nikhil@icloud.com2, bmfervez@gmail.com3, sachinbhat88@gmail.com4

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OUTCOME

The specific outcome of an accident prevention system at hairpin bend would ideally be a reduction in the number and severity of accidents that occur at that particular location. By providing drivers with clear warnings, guiding them on safe speeds, and implementing physical barriers or safety features, the system aims to improve overall road safety and prevent accidents from happening or minimize their impact if they do occur.

It's important to note that the effectiveness of such systems can vary depending on factors like driver behavior, road conditions, visibility, and adherence to safety guidelines. However, the primary goal is always to enhance safety and reduce the likelihood of accidents at challenging road segments like hairpin bends.