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Accident Prevention on Hilly Road by Using Arduino and IR sensor

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ABSTRACT: Accidents on hilly roads pose significant challenges to road safety due to the unique terrain features and environmental conditions. This thesis presents a novel approach to address this issue by proposing a system for accident prevention in hilly areas utilizing safety sensors integrated with Arduino Uno microcontroller boards. The system aims to detect potential hazards on hilly roads in real-time and trigger timely interventions to mitigate the risk of accidents. Through a comprehensive literature review, various types of accidents and contributing factors in hilly terrains are identified, laying the groundwork for the proposed solution. The research focuses on sensor selection, prototype development, testing, and evaluation of the system's effectiveness. Key components of the system include sensors for obstacle detection (IR sensor). These sensors, coupled with Arduino Uno's capabilities for data processing and control, form the basis of the accident prevention system. A prototype system is developed and tested in simulated and real-world hilly terrain conditions to assess its performance. The results demonstrate the feasibility and effectiveness of the proposed approach in reducing the risk of accidents on hilly roads. This research contributes to the advancement of road safety technology in challenging terrain environments and provides insights for future developments in this field.

I. INTRODUCTION

Road safety in hilly areas presents a complex and pressing challenge due to the unique terrain features and environmental conditions that increase the risk of accidents. Steep slopes, sharp curves, limited visibility, and adverse weather conditions are among the factors contributing to the heightened danger on hilly roads. As populations grow and infrastructure expands into hilly regions, the need for effective accident prevention measures becomes increasingly urgent. Traditional approaches to road safety, such as signage, speed limits, and traffic enforcement, have limitations in hilly terrains where hazards can be unpredictable and dynamic. Technological innovations offer promising solutions to complement existing safety measures and enhance road safety in challenging terrain environments.

This thesis proposes a novel approach to accident prevention in hilly areas by leveraging safety sensors integrated with Arduino Uno microcontroller boards. The system aims to detect potential hazards on hilly roads in real-time and trigger timely interventions to mitigate the risk of accidents. By integrating various sensors capable of detecting obstacles, monitoring road conditions, and assessing vehicle speed and proximity, the proposed system offers a proactive and adaptive approach to road safety. The development of this system builds upon existing research in the fields of sensor technology, microcontroller programming, and road safety engineering. Through a comprehensive review of relevant literature, this thesis identifies the types of accidents commonly occurring in hilly terrains and the factors contributing to their occurrence. This foundational knowledge informs the design and implementation of the proposed accident prevention system.

In summary, this thesis aims to address the pressing issue of road safety in hilly areas by proposing an innovative solution that combines sensor technology with microcontroller programming to detect and prevent accidents in real-time. By enhancing our ability to identify and mitigate hazards on hilly roads, this research seeks to save lives, reduce injuries, and improve the overall safety of transportation networks in hilly terrains.

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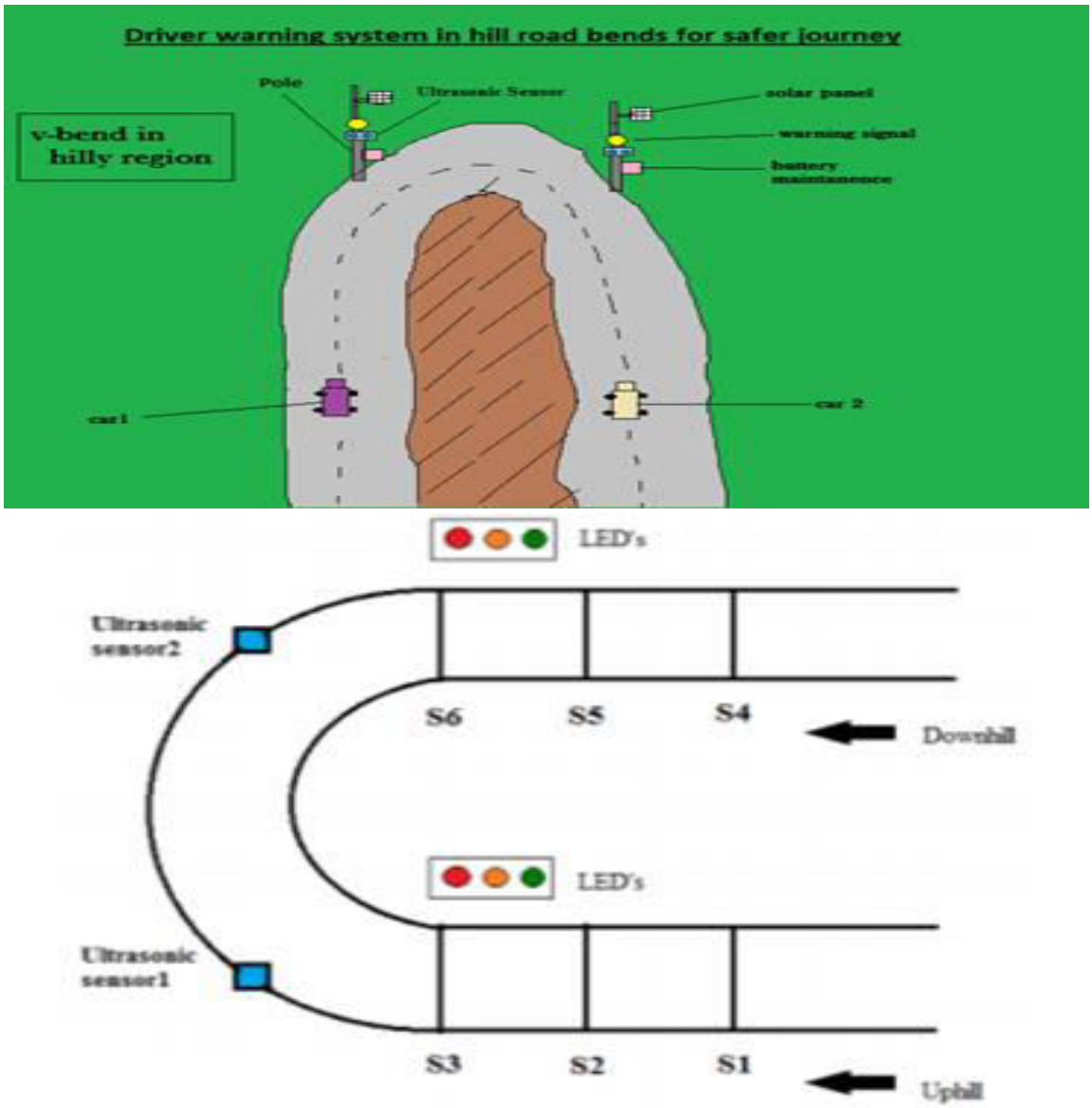

Figure no. 1 System Design

Accident Prevention on Hilly Road by Using Arduino and IR sensor

II. LITRATURE REVIEW

An accidents an unpleasant event that no one ever wants to occur in their life. It ruins the life of many people causing tremendous losing the life of people. Preventing accident (accident prevention) refers to activities designed to foresee and avoid accidents. There has been an increase of 17.4% in the total number of death rate caused by road accidents during the period of 2011-2014.This percentage has raised eyebrows and caught the attention of many to curb the growing rate. It is found that 80% of the times it is the fault of the driver. Much prevention system has been so far suggested and some were successful to a few percentages. But unfortunately still the accident rate remains a mysterious and very serious problem yet to be solved. So we suggest a technique to prevent accident by alcohol sensor since most of the accident occurring today is mainly because of drunk and drive. In order to avoid rash driving we go for a new technique of speed reduction system which uses the INFRARED waves fitted to the vehicle to detect the obstacles and the distance they are apart from which we could reduce the speed of the vehicle automatically if the obstacles are

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present mere closer. Prevention of accidents remains on one side as a huge question mark but rather on the other we look up for something as a life saving measures to safeguard our self in case of occurrence of any accidents. Many lives would have been saved if the emergency service could get the crash information in time.

A study by Virtanen etal. shows that 4.6% of the fatalities in accidents could have been prevented only in Finland if the emergency serviceability provided at the place of accident at the proper time [1].In order to solve the problem of death caused by accident which occur because of the delay in help provided by rescue, can be solved by a new system of accident detection International Journal of Advanced Technology in Engineering and Science www.ijates.com Volume No.02, Issue No. 11, November 2014 ISSN (online): 2348 – 7550 157 | P a g e technique which finds out the occurrence of accident through various sensors and intimate the occurrence of accident to the nearest rescue teams or patrol services by the use of GSM and GPS system. As proposed in the existing system as proposed by Accident Detection and Reporting System using GPS, GPRS and GSM Technology [2],which contains a major advantage in case of accident detection by speed monitoring since this case may fail to provide the required throughput as it is difficult to monitor the speed of the vehicle continuously as it may and also the efficiency of the system is very low when compared to the proposed system.

III. WORKING METHODOLOGY

STEP 1: Coding for micro controller Arduino UNO which consists of set of commands to process the data from sensor and to operate the LED as shown in fig. 2. Fig. 2. Program for micro controller Arduino UNO of sensor-based accident prevention.

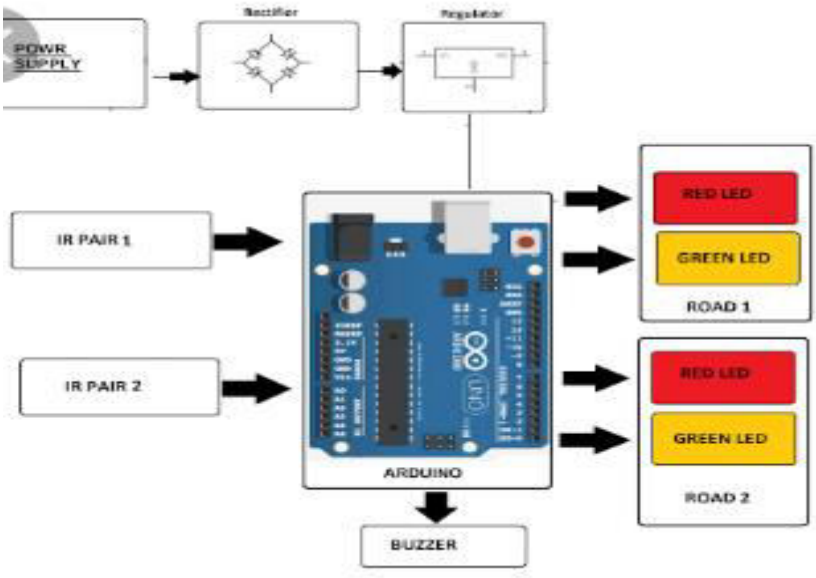

Figure no. 2 Circuit Design

STEP 2: Circuit connection having sensor and micro controller Arduino UNO where the sensor senses the obstacle and the micro controller Arduino UNO processes and operates LED as per the commands as shown in fig.3. Fig. 3. Circuit connections for sensor based accident prevention system.

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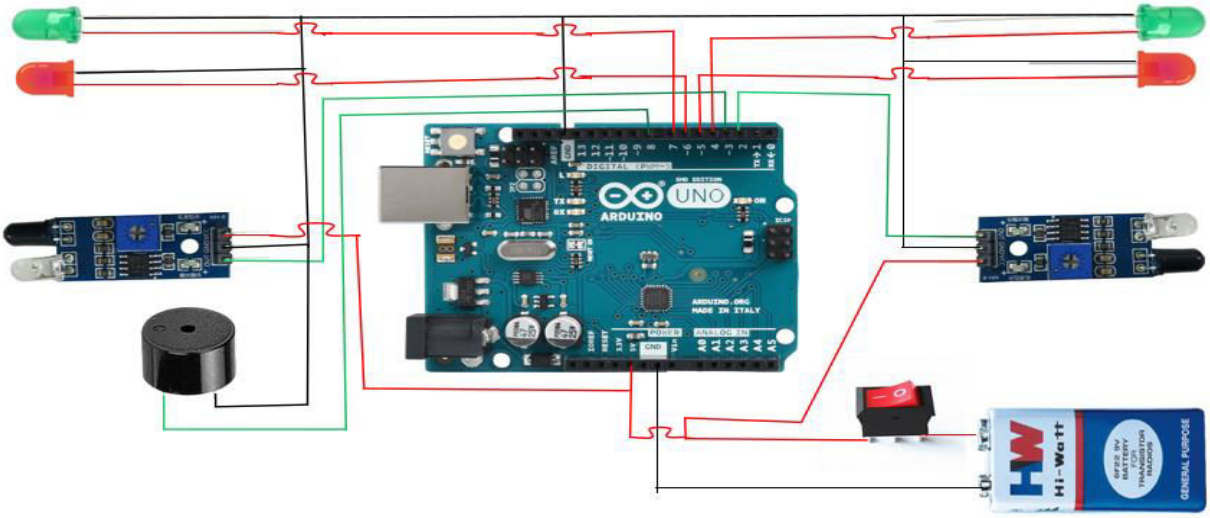

Figure no. 3 : Circuit connection for sensor based accident prevention system

STEP 3: Analysis, debugging and running the program. The program is uploaded to micro controller Arduino UNO. Sensor sends the signal and senses the object and gives the signal information to micro controller Arduino UNO. Micro controller Arduino UNO is powered by using laptop. It possesses and the output is shown in the serial monitor.

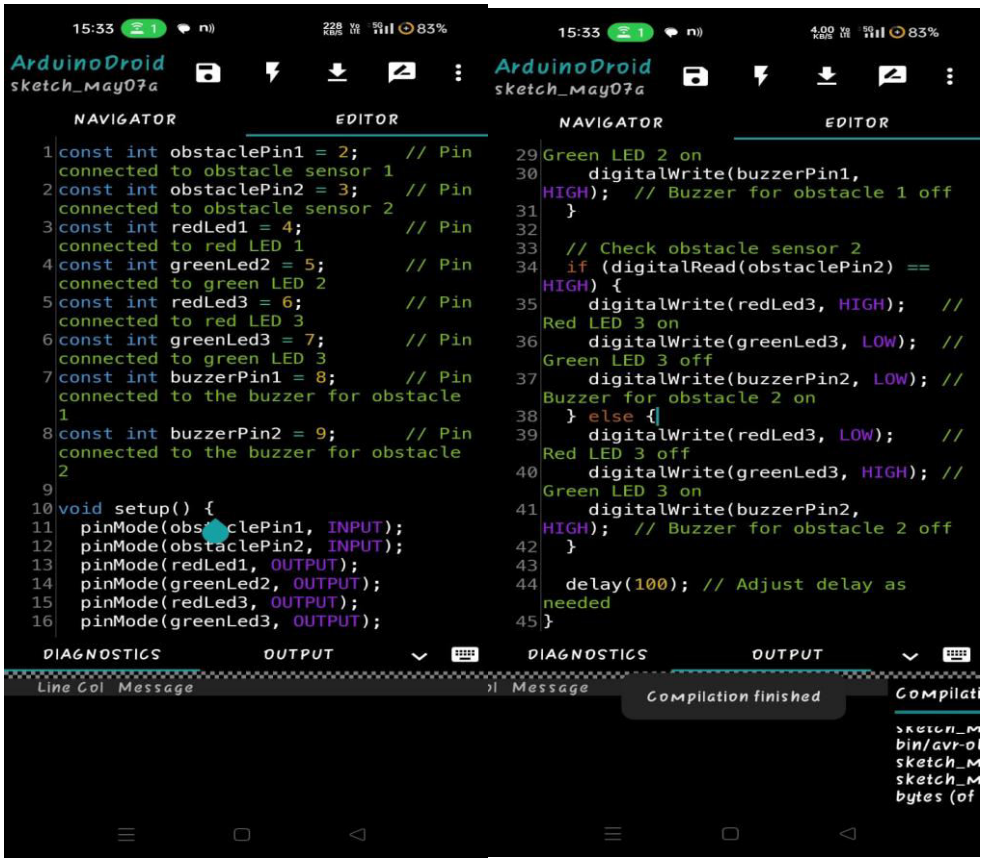

Figure no. 4 Analyzing the output of sensor based accident prevention system

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STEP 4: Fixing the circuit to the model i.e. fixing micro-controller Arduino UNO, INFRARED sensor and LED light to the model of curve road as shown in fig.5. Fig. 5. Circuit fixed to the model of sensor-based accident prevention system.

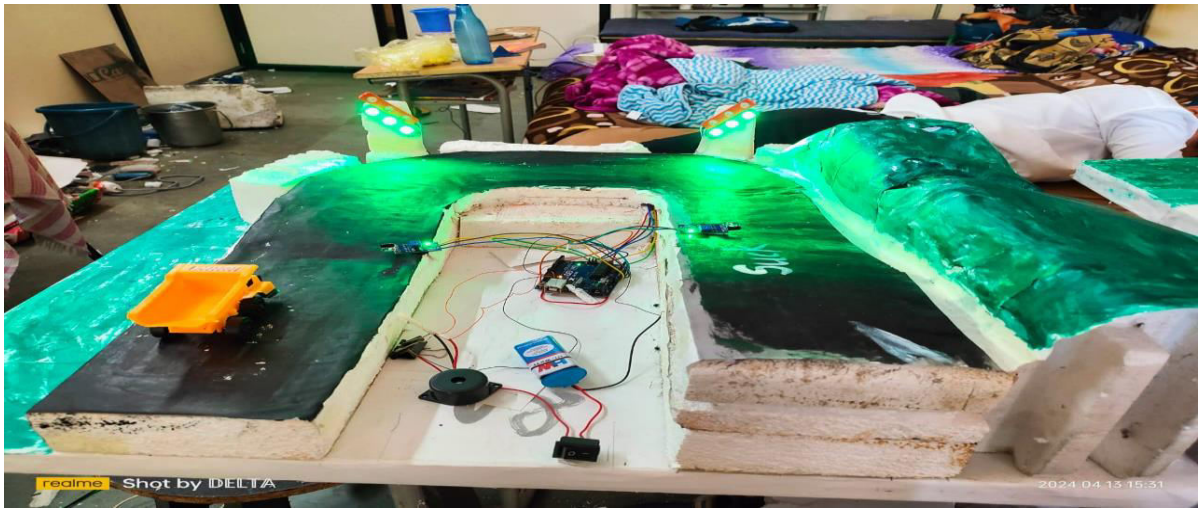

Figure no. 5 Circuit fixed to the model of sensor based accident prevention system

STEP 5: Detection of vehicle by the sensor when vehicle passes through the road. It is the experimental demonstration for this paper. The signal sent by the sensor hits the vehicle and it reflected back to the sensor as shown in fig. 6. Figure 6: Vehicle passing through the road.

Figure no. 6 Vehicle passing through the road

STEP 6: Output is obtained i.e. glowing of LED at the instant when the signal is received by the sensor after hitting the vehicle. As shown in fig. 7. Fig. 7. Final output of sensor-based accident prevention system by glowing of LED light. IV.

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Figure no. 7 Final output of sensor-based accident prevention system by glowing of the LED light

IV. PROJECT OUTPUT

Figure no. 8 Image shows working model of project

V. ADVANTAGES

- **Real-time Hazard Detection**: The system can detect potential hazards such as obstacles, road surface conditions, and excessive speeds in real-time, allowing for timely interventions to prevent accidents.
- **Proactive Safety Measures**: By continuously monitoring road conditions and vehicle movements, the system can proactively identify and address potential safety risks before they escalate into accidents.

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- **Adaptability and Customizability**: Arduino Uno provides a flexible platform for integrating and controlling a wide range of safety sensors, allowing for customization based on specific terrain features and environmental conditions.
- **Cost-effectiveness**: Arduino Uno microcontroller boards are relatively inexpensive and readily available, making them a cost-effective solution for implementing safety sensor systems compared to proprietary hardware or systems.
- **Ease of Prototyping and Development**: Arduino Uno's user-friendly development environment and extensive online resources facilitate rapid prototyping and iterative development of the safety sensor system, reducing time-to-market and development costs.
- **Scalability**: The system can be easily scaled up or down to accommodate different road segments or geographic areas, making it suitable for deployment in various hilly terrain environments.
- **Integration with Existing Infrastructure**: The safety sensor system can be integrated with existing road infrastructure, such as traffic lights, signs, and communication networks, to enhance overall road safety measures.

VI. CONCLUSION

The development and evaluation of a safety sensor system based on Arduino Uno for accident prevention in hilly areas represent a significant step forward in enhancing road safety in challenging terrain environments. This thesis has demonstrated the feasibility and effectiveness of leveraging sensor technology and microcontroller programming to proactively detect and mitigate hazards on hilly roads. Through a comprehensive literature review, the research has identified the key factors contributing to accidents in hilly terrains, including steep gradients, sharp curves, adverse weather conditions, and human factors. Building upon this understanding, the proposed safety sensor system offers a proactive approach to road safety by continuously monitoring road conditions and vehicle movements in real-time.

People have become much more dependent on transportation systems in recent years, transportation systems themselves face not only several opportunities but several challenges as well. Continuous growth of population all over the world creates a great challenge to the transport management systems. The conventional methods are no longer effective enough for solving complex and challenging transportation management problems. Knowledge from different research areas is needed for developing these systems. Very often complex transportation systems require integration of different methods from different branches of science. Our Collision Avoidance System consisting of a Arduino UNO R3, INFRARED sensors, warning LEDs, BUZZER when implemented has proven to be more effective than just a normal traffic mirror setup.

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