

# Smart Roads System

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**Abstract:** Every developing and emerging country is working to make cities that are smart, modern, citizen-friendly, and environmentally friendly. The impact of smart cities on future developments is significant. Roadways are essential for economic progress and the development of our future cities. Roadways systems are continuously changing due to maintenance or accidents. At the moment, the key concern is ensuring the safety of pedestrians and automobiles. Despite of many technological advancements on the road, safety has not received the same level of attention. When it comes to road safety, there are numerous things we can do to improve the driving experience. This paper proposes a strategy where in an arm barrier is used to blocks the way for vehicles at the junction when the traffic signal is red and allows the vehicles to pass when traffic signal turns green thereby providing safety to pedestrians while crossing the road. At the curved roads, infrared sensors are utilized to detect the vehicle and provide a prior intimation to the driver if there is a vehicle heading in opposite curve through LCD display which helps in preventing accidents. Collection of energy from roadways utilizing piezo-electric substance. The movement of vehicles on speed breaker can be effectively utilized to generate electricity.

**Keywords:** Curved paths, infrared sensors, piezo-electric materials, servo motors, speed breaker, zebra crossing

## 1. Introduction

Roadways are the most common mode of transportation and the country's vast configuration. When roads are incorporated with technology, they improve mobility, sustainability, and safety while also assisting in the smarter transformation of cities. Accidents have become the leading cause of death in recent years. This problem claims the lives of thousands of people every year. There are numerous aspects that contribute to accident causes. Most hilly areas have curved paths, and many accidents occur at the curves owing to a various circumstances. The curves will be sharp and the roadways will be narrow on the curved roads. One such cause of a curved route accident is the lack of sufficient vision for the driver of the opposite curved lane, resulting in a vehicle collision, which causes an accident and may result in loss of human life. The demand for vehicles is steadily increasing as the population grows. Crossing roadways has become a tough and time-consuming task at the current situation. Despite the fact that there are enormous rules and regulations, some people violate

them and drive on the zebra crossing mark when the traffic light is red. In certain cases, people will jump the light while pedestrians cross the road, resulting in serious accidents at the junction. Both of these situations are unsafe and harmful. At the present scenario there is an enormous need for electricity. With the ever-increasing demand for energy, new methods and technologies for adapting new energy sources have been a major concern in recent years. This paper proposes few solutions to all of these issues in this study.

## 2. Literature Survey

1. An overview of characteristics of roadways, issues encountered on various types of routes, causes of obstacles, and strategies to overcome such obstacles through the proper application of advancements is listed. Few pictorial representations are included to provide a brief information about them.
2. The piezoelectric sensor is buried on the road before the curve and an LED light is placed after the curve, such that when a vehicle approaches from one end of the curve, the sensor detects it and the LED light illuminates on the other side. The driver can become alerted and slow down the car by looking at the LED light on/off criterion. The sensor's limitation is that it is temperature sensitive, making it unsuitable for all types of weather.
3. Cars are identified using curved mirrors by automobile millimeter wave radar. Through this the driver can know if there is a vehicle approaching in opposite lane in prior. The drawback is that the mirrors must be cleaned frequently, and this method fails to accomplish the purpose in the event of heavy downpour, fog, or mist.
4. For pedestrians on the pathway, a separate lobby has been established. People are detected using ultrasonic sensors, and the lobby gate remains closed until a predetermined number has been reached. When the count hits target, the gate opens, allowing people to safely cross the road. The disadvantage is that the sensors can be cheated and less secured.

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5. Piezoelectric plates are incorporated below the speed breakers. When a piezoelectric material is subjected to mechanical stress (such as vehicle movement), positive and negative charge centre in the material form an electric field. The limitation is that the piezoelectric plates may break due to direct force exertion on the plates.
6. A carriage is located at the end of the zebra line. It functions as a horizontally moving elevator. Within minutes of reaching the predetermined number of pedestrians, the carriage departs from its parked place. Once it crosses the first lane, cars that are parked in front of that zebra line will be allowed to proceed. The drawback is that the proposed work is more expensive, requires maintenance, and must be reinstalled when road repairs or constructions are needed.
7. A predictable AFS that calculates the swivel beam position utilizing current devices such as LDWs (Lane Departure Warning System) is used. The suggested method makes use of data about the front road's pre-estimated curvature, which is calculated using LDWs. The disadvantage is that this technology is only suitable for use at night, thus this work is not suitable for night times.
8. On an L-shaped post overlooking the zebra crossing, two cameras are installed. To provide visibility during the night, near infrared cameras were chosen and near infrared illumination was provided. The system can detect the presence of some pedestrians on the stripes, which is sufficient to flag the crossing as pedestrian-only and thus not open to automobiles. The limitation is that the setup is complicated and requires upkeep.
9. The Speed Breaker is a spring-supported flexible hump that is compressed and released vertically down and up. The rack and pinion is a device that converts linear motion to rotational motion. The springs are pressed when the load acts on the speed breaker, forcing the rack to travel lower and rotate the pinion, converting the vertical movement to rotational action. The rack and pinion system converts the vehicle's movement into rotary motion. Then, with various configurations, it leads to the generation of energy. The drawback is that the setup is complicated and requires upkeep.
10. This presents a brief overview of roadways, challenges experienced on various sorts of routes, sources of impediments, and techniques for overcoming such obstacles through the proper application of advances, sensor technology, and other technological implementations.

### 3. Proposed work

The proposed objectives address the issues that are identified in literature review

#### 1) Curved-road accident avoidance

On the road's pavement, infrared sensors will be installed. When a vehicle is identified on one side of the curve, a

notification appears on the LCD display that is placed on the opposite side of the curve. If there are vehicles on both sides of a curve, a message will be displayed on the LCD display on both sides of the curve, giving the driver advance warning and assisting them in reducing speed and slowing down at the curved paths. Accidents can be avoided and many lives can be saved.

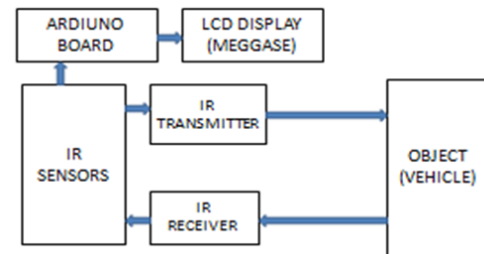


Fig. 1. Functioning of curved road accident avoidance

#### 2) Secured zebra crossing

Arm barrier is used to manage movement of vehicles at the junction with respect to the traffic light. When the traffic light is red, the arm barrier remains closed and prevents vehicles from passing. Pedestrians can safely cross the road at that instant. When the traffic signal becomes green, the arm barrier opens, allowing vehicles to pass, ensuring pedestrian safety and also preventing light jumping at the junction.

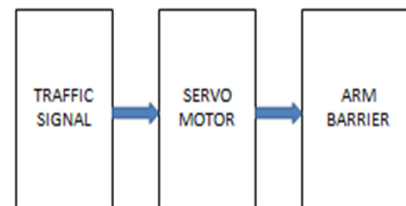


Fig. 2. Functioning of secured zebra crossing

#### 3) Piezo-electric speed breakers to harvest energy

The movement of vehicles on a speed breaker can contribute for the generation of electricity, which can then be used for a variety of applications. Piezo-electric sensors are placed below the speed breaker, with springs between them, to prevent the piezo-electric material from breaking when it is under stress. This will result in indirect stress interaction with the piezo-electric material. When a vehicle passes over these speed-breakers, mechanical stress is exerted to the plates, resulting in the generation of voltage, which is then transferred as an electrical current through a circuit, converting to piezoelectricity.

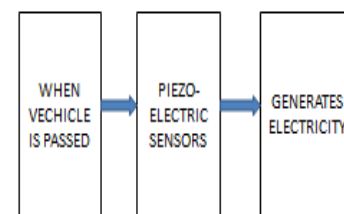


Fig. 3. Functioning of piezo-electric speed breakers

#### 4. Expected Results

This paper proposes few strategies which contribute to the following results:

- Prevention of accidents on curved paths by providing a prior intimation to the driver through LCD display when a vehicle approaches on the other side of lane.
- Ensuring safe and secured zebra crossing for the pedestrians with the help of arm barrier which blocks the way for vehicles when traffic signal is red and allows the vehicles to pass when traffic signal turns green.
- Generation of electricity using the movement of vehicles through piezo-electric materials.

#### 5. Conclusion

This paper proposes few strategies that can be implemented to prevent accidents on curve roads, ensure pedestrian safety while crossing heavy traffic places, and harvest energy from roads. This study offers one of the finest options, which is accomplished by informing the driver via an LCD display message that appears when the car approaches the curve from the other side. Thousands of lives could be saved on curve roads as a result of this. The arm barrier provides a safe move for pedestrians and also inhibits jumping of lights, reducing accidents, therefore the problems and risks associated with road crossing will be eliminated as a result of the implementation of this work. Use of piezo-electric material to generate energy and using it for various applications helps us contribute to the generation of new energy harvesting technique.

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