

Smart Highway System

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Abstract - At present, we are living in an era which is known as “Information and Technology Era”. We can make our existing highways smart by upgrading it by sensors, some electricity generating mechanisms, etc. But, what is the need of doing that? You may have noticed, roads are really dumb right now. They’re expensive to maintain, and generally can’t do much besides allowing above-ground transportation. This project which is named as “Smart Highway System” is basically an integration of two practical aspects which are Energy Generation through Speed Breakers and Accident Prevention on Hairpin Curve Roads. If we observe, whenever a vehicle is passed over a speed breaker a lot of jerking pressure is being exerted between the tyres and speed breaker which is normally wasted. This jerking pressure can be converted to a significant amount of electricity by a Simple Roller Mechanism which is an unconventional and eco friendly source too. And the second aspect deals with the problem faced on Hairpin Curve Roads (U-shaped roads). Whenever two vehicles are moving on either sides of a U-shaped road, they are being unaware of approaching towards each other. This causes a head-on collision between the vehicles at the apex point. So, this situation can be prevented by using a special arrangement of Infrared Sensors making both the vehicles aware of themselves while approaching each other.

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keywords - Smart Highway, Sensors, Information Technology, Roller Mechanism, Energy Generation, Accident Prevention, Hairpin Curve Roads.

I. INTRODUCTION

A Project topic should be such that it provides solution to real-life problems using current trends and techniques in a way that it is hypothetical. Obeying to the above statement, This Project topic i.e., Smart Highway System deals with two of the major real scenario problems which are Electricity production and increasing Accidents. The Project consists of two aspects :- I. Electricity Generation through Speed Breakers II. Accident Prevention using IR sensors The first aspect of the project deals with an eco-friendly and a non-conventional generation of electricity through speed breakers. Whenever a vehicle passes over a speed breaker a jerking pressure is being exerted between the tyres of the vehicle and the surface of speed breaker. This jerking pressure usually gets wasted without any use. But if this jerking pressure is being channelized in a right way by proper arrangement of modern techniques then it can be converted into a significant amount of Electrical Energy. And this can be achieved by a mechanism called Simple Roller Mechanism. In this mechanism, a small rectangular channel section is being made at the apex of the speed breaker and a cylindrical rod of suitable diameter is placed in the section offering a smooth transition between the speed breaker surface and cylindrical rod surface. This cylindrical rod is fitted to a D.C. Generator at its far end. Now whenever a vehicle passes over the speed breaker, the jerking pressure causes the cylindrical tube to rotate which in turn rotates the armature windings of the generator and produces Electrical Energy. This Electrical Energy is stored in a Storage Battery and further used wherever it is required. The second aspect of this project deals with the prevention of accidents occurring on hairpin curve roads. Hairpin Curve Roads are the curve roads with a very tight radius turning approximately about 180°. This name comes as they appear in the shape of a hairpin. They are also known as U-shaped roads. Whenever two or more vehicles passing on either side of the road, the vehicles being unaware of approaching each other end up into an head-on collision. Hence to overcome such dangerous situation, IR (Infrared) sensors are arranged on such roads in a specific manner that whenever a vehicle confronts these sensors on one side, a red signal is being alerted on the other side and vice versa. Hence both the vehicle drivers get aware of themselves being approaching towards each other and a major accident is prevented.

II. PROBLEM STATEMENT

This Project addresses two real problems which are Energy loss through Speed Breakers and Accidents on Hair Pin Curve Roads by providing an effective and sustainable solution.

ENERGY LOSS THROUGH SPEED BREAKERS : Now-a-days, Electricity is the primary need of humans. But, the day by day increasing population of human life has led to an increase in the demand of electricity. Hence, we cannot solely depend on a single source. So, there has to be some other source which is nonconventional and also sustainable. Now, talking about the problem which is highlighted in this project. Everyone is aware of speed breakers on roads. Speed Breakers were invented to regulate road safety by alerting the driver to slowdown their speeds. But the actual problem is whenever a vehicle passes over a speed breaker, a jerking pressure is being exerted between the tyres of the vehicle and the surface of speed breaker. This jerking pressure normally gets wasted and is of no use. Hence, a suitable mechanism has to be used with the speed breaker so that the jerking pressure can be converted into a significant amount of electricity.

ACCIDENTS ON HAIR PIN CURVE ROADS : Hair Pin Curve Roads are the roads with a very tight radius turning approximately about 180°. They are named so because they appear in the shape of a hair pin. They are also called as “Road of Death” because the problem associated with these kind of roads is a threat to the life of a person driving on such roads. So, the problem associated with such roads is whenever two vehicles are moving in a direction towards each other but from different legs of the Curve. In such scenarios, both the vehicle drivers are unaware of the fact that they are approaching towards each other. This unawareness leads to an head-on collision between them at the apex of the hair pin curve.

III. LITERATURE SURVEY

Existing Systems and their Limitations:

Energy is the primary need for survival of all organisms in the universe. Everything that happens in the surrounding is just the expression of flow of energy from one form to the other. But in this rapidly moving world population is increasing day by day leading to an increase in the need of energy. Due to which the conventional sources of energy are depleting. Hence, in order to overcome this problem we need to implement new techniques to conserve energy as much as possible. This led to the development of new mechanisms by which electricity is generated from the movement of vehicles over speed breakers. Driving in hilly areas is a very difficult task. Drivers have to be alert all the time while driving in such regions especially hairpin curve roads.

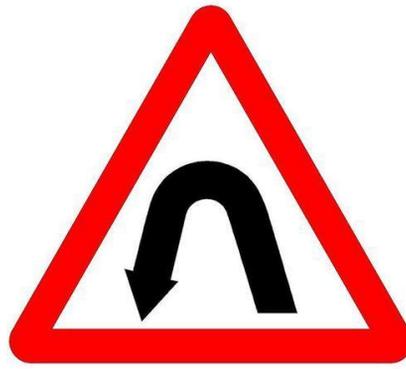
The major cause of accidents in hairpin curve roads is the drivers being unaware of another vehicle approaching them from opposite side. To prevent this situation there are many traditional accident alert and avoidance system which includes the following :-

Convex Mirror : This setup is used at some areas to give a glimpse of any vehicle approaching from the opposite side. But this method is not much effective as the mirror needs to be kept clean all the time which is very difficult in such hilly areas due to the presence of fog and moist in the atmosphere. Hence, this reduces the visibility. Also the time taken for the driver to view the mirror and react is high resulting in a poor judgement.



CONVEX MIRROR

SIGNBOARDS : Signboards for hairpin bends and curves are installed on hilly regions. But that's not enough because it doesn't provide any detail about a vehicle approaching from opposite side whereas people usually don't bother on such signboards and think they can surpass the hairpin bend safely.



SIGNBOARD

Vehicle Horn : This is one of the traditional ways to negotiate a hairpin bend. The drivers on both sides judge the distance of one another based on the intensities of the sound from their respective horns. This method although being the simplest poses to be highly inefficient and also causes a lot of confusion between the drivers.



VEHICLE HORN

Vehicle Headlights : Flashing Headlights during the night works similar to the vehicle horn making it yet another inefficient method. Also this method is completely ineffective in daylight conditions.



VEHICLE HEADLIGHTS

CCTV Camera and LCD Display : In this system, a CCTV Camera on one side captures the vehicle and displays it to the opposite side on the LCD Display. The main issue in this system is it must be installed at correct angle and if anything falls on the lens of the camera, then it will not provide a clear vision to the drivers. This may cause confusion to the drivers.



CCTV

IV. METHODOLOGY

1. SIMPLE ROLLER MECHANISM:

Simple Roller Mechanism is the method which is used for the first aspect of this project, i.e. Energy Generation through Speed Breakers. The method basically aims to convert the wasted jerking pressure (which is created between the vehicle tyres and speed breaker) into a significant amount of electrical energy. It is named with the prefix “Simple” because its very easy to understand and implement as well. On the other hand, it is also cost effective as compared to other Mechanisms. It is actually a combined arrangement of speed breaker, DC Motor/Generator and a cylindrical shaft. So, for the arrangement first we cut a cuboidal section at the apex of the speed breaker. Now, the cylindrical shaft connecting motors on either end is fitted into this cuboidal section such that there is a smooth transition between the surface of the speed breaker and the cylindrical shaft. After this, the arrangement is complete and ready for the desired work. Whenever a vehicle passes over this arrangement, the cylindrical shaft rotates thereby rotating the axles of motor/generator connected on either ends. The rotation of axles generates electrical energy which can be stored in a storage battery so that it can be used for any further purposes or for lighting up street lights.

2. ACCIDENT PREVENTION MECHANISM:

This method is used for the second aspect of this project, i.e. Accident Prevention on Hairpin Curve Roads. It basically aims to prevent accidents caused due to the unawareness between two vehicles approaching each other from opposite legs of the hair pin curve road. All the other methods which are being currently used on hairpin curve roads to prevent accidents are not doing much better. Hence, this method would be very much convenient and effective. It is basically an arrangement of IR sensors and signal poles on the hairpin curve in such a way that both the vehicles are alerted way before reaching the apex of the curve. So, initially two IR sensors are fitted on the either sides of the hairpin curve as shown in the Chapter 3.2 of this report. This IR sensors are connected to signal poles of the opposite sides. So, now whenever a vehicle on one side comes in front of these sensor, a signal is alerted on the other side and vice versa. This is how, both the vehicle drivers are alerted and a major accident is being prevented.

V. CALCULATIONS

Design Details and Calculation:- POWER GENERATED BY SIMPLE ROLLER MECHANISM:

We know that, Power = workdone/time = force * distance/time

Here, Force = Weight of the Vehicle = Mass of the Vehicle * Acceleration due to gravity
&

Distance = Radius of Cylindrical Shaft

Now, Assuming Weight of the Vehicle = 1000 kg (average) and Radius of Cylindrical Shaft = 16 mm where, acceleration due to gravity = 9.81 m/ s²

∴ Force = 1000 * 9.81 = 9810 N

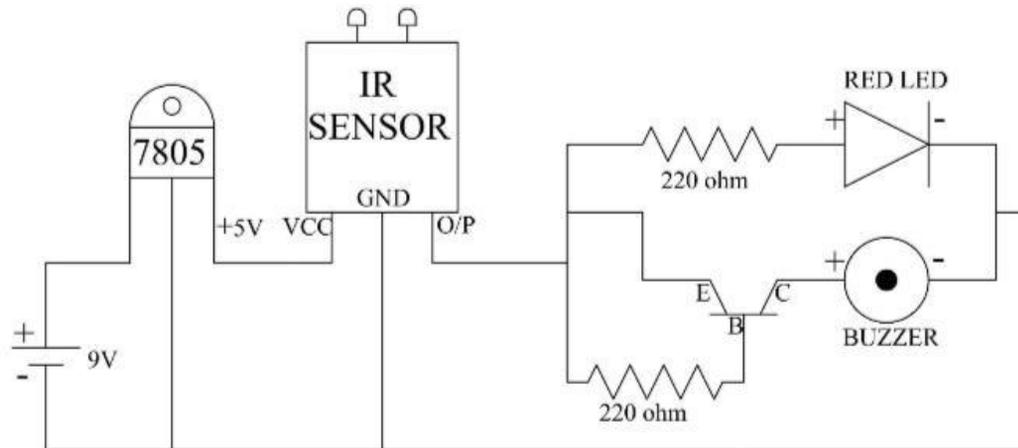
So, Output Power developed for vehicles passing over the simple roller mechanism for one minute is given by :- Power = 9810 * 16 * 10⁻³/ 60 = 2.616 watt

where, Time = 60 sec Power developed for one hour :- Power = 2.616 * 60 = 156.96 watt

Power developed for one day :- Power = 156.96 * 60 = 9417.6 watt

VI. CIRCUIT LAYOUT

CIRCUIT DIAGRAM FOR ACCIDENT PREVENTION ON HAIR PIN CURVE ROADS:



VII. FUTURE SCOPE

The First aspect of this project shows the generation of electricity by a non-conventional method without using natural resources and keeping up with the sustainability criteria. As it is known that utilization of energy indicates growth of a nation, so this represents a country's technological advancement also. In the near future, due to the rapid increase in population of human life, the rate of electricity demand will also increase in developing countries like India. Hence, this project can be a great boon not only for India but also for other countries of the world. It can capture a significant amount of electrical energy from the wasted energy which can be stored in a storage battery and can be further used for lighting up street lights or for any other purposes.

This project indicates that the amount of electrical energy generated depends upon the number of vehicles passing over the speed breaker. And we know how the rate of vehicles moving on roads and highways are increasing day-by-day. So, the first aspect of this project can act as a mini power plant system which is very beneficial for the country in order to meet future electricity demand. The

Second aspect of this project deals with the accidents occurring on hair pin curve roads. It will upgrade the quality of transport system one notch higher than the existing system. And this aspect also has a plus point in future scope because all the other existing methodologies which are currently used are proved to be ineffective. Hence, such a system which is completely sustainable and saving lives of thousands of people in such accidents has a higher probability of acceptance in the near future.

VIII. CONCLUSION

“Electricity plays a very important role in our life”. In the near future, due to population explosion, the current power generation will become insufficient to fulfill our requirements. In this project, we have discovered this technology to generate electricity from speed breakers in which the mechanism used is reliable and also this technology will help in conserving our natural resources. In the near future, this technology will prove to be a great boon to the world. It will save a lot of electricity of power plants that gets wasted in illuminating the street lights and it can also be used for other purposes. As the conventional sources are depleting very fast, its high time to think for an alternative source which is non-conventional and at the same time sustainable. We got to save the power from the conventional sources for efficient use. So, this idea not only provides an alternative but also adds to the economy of the country. There is one thing which cannot be regained after it is lost and that's “LIFE”. Life is more important than any other thing. We have discussed about the hairpin curve roads on the ghats and hilly regions. Hence, we know that hairpin curve roads are a big threat to the life of the ones who are driving on such roads. So, to save this valuable life we have introduced a technology in the second aspect of this project. The aspect works on a specific arrangement of IR sensors and signal poles which alerts both the drivers approaching towards each other before they reach the apex of the hairpin curve. This method can prove to be very effective as the other currently existing methods like convex mirrors, LCD display, sign boards, etc. are not proving to be effective. Hence, this simple yet effective method will enable the drive to have better judgement so that the road accidents on hairpin curve roads are drastically reduced. REFERENCES

IX. REFERENCES

- [1] "Electricity Generation from Speed Breakers" by Aniket Mishra, Pratik Kale and Atul Kamble, International Journal of Engineering and Science (IJES) Volume 2, Issue 11, 2013, ISSN(e): 2319-1813, ISSN(p): 2319-1805.
- [2] "Design of Power Generation Unit Using Roller Mechanism" by B. Santosh Sarma, V. Jyothi, D. Sudhir, IOSR Journal of Electrical and Electronics Engineering (IOSRJEEE) e-ISSN: 2278- 1676, p-ISSN: 2320-3331, Volume 9, Issue 3 Ver. 1 (May/June,2014), PP 55-60.
- [3] "Efficient Method of Energy Regeneration through Speed Breakers" by Manoj Kumar, K.N.S. Rahul, Smt Malathi Narra, B. Pandu RangaRao, International Journal of Innovative Technology and Exploring Engineering(IJITEE), ISSN: 2278-3075, Volume-9 Issue-3S2, January 2020.
- [4] "Electric Power Generation By Roller Mechanism" by Kavar Nirav S, Hemant Singh, Modi Happy D, Badval Navdipsing J, Nayak Jaynish, Prof. Chintan D. Patel, International Journal of Applied Research in Science and Engineering (IJARSE) Volume 2, Issue 1
- [5] "Speed Breaker Power Generation" by Laukik Kharche, Kalpesh Jadhav, Pranay Gawas, Chaitali Gharat, International Research Journal of Engineering and Technology (IRJET) Volume: 06, Issue: 02 | April 2019, e-ISSN: 2395-0056, p-ISSN: 2395-0072.
- [6] "Implementation of Collision Avoidance System for Hairpin Bends in Ghats Using Proximity Sensors" by Chitransh Srivastava, Nikhil Acharya, Fervez Jaffer B.M., Sachin Bhat, International Journal of Current Engineering and Scientific Research (IJCESR), ISSN (PRINT): 2393-8374, (ONLINE): 2394-0697, VOLUME-3, ISSUE11, 2016. 17
- [7] "Advance Road Safety for Ghat Road's at Hairpin Bend" by Harshada Targe, Anushka Mahajan, Mohit Patil, Yogesh Lilake, Vijay Sonawane, International Research Journal of Engineering and Technology (IRJET), Volume: 05 Issue: 01 | Jan-2018, e-ISSN: 2395-0056, p-ISSN: 2395-0072.
- [8] "Accident Prevention and Traffic Pattern Analysis System for Hilly Regions" by V. Ramachandran, R. Ramalakshmi, K. Mathankumar, International Journal of Innovative Technology and Exploring Engineering (IJITEE), ISSN: 2278-3075, Volume-9, Issue2S2, December-2019.

