

Road Safety at Dive Ghat and Electricity Generation using Advanced Techniques

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Abstract: “Speed Kills”, but still people don’t care enough to act safe while driving on road. Road traffic accidents and deaths caused by them are most critical issues now a days which is also impacting adversely on the country’s economy. Research in this paper includes important issues like road accident, their impacts, causes of these accidents, effects of accidents, prevention and control measures that can improve this situation.

Now a days, while driving through the ghat section during long journey, percentage of accident in ghat area is increasing at an alarming rate, and the severity of these accidents is non-reparable. Due to unavailability of street lights in ghats especially while turning, it becomes more difficult to make turn. Vehicles coming from another side of road are not visible due to obstructions and darkness. In this paper we are trying to put a valid effort to reduce the rate of accidents causing death due to lack of signal system and proper safety guidelines in ghat section. We are suggesting to use smart signal system fabricated by us which can be replaced by traditional speed breaking system. Our smart signal system is capable of both reducing the speed of vehicles and producing the electricity simultaneously. The system includes rollers, generator, IR sensors and LEDs. The working of the system is as the vehicles moving in both lanes come in contact with rollers which are fixed to a steel ramp, vehicle passes over it will start moving a pulley drive mechanism provided which will transfer the motion to a DC motor/generator for electricity generation. This method provides an efficient way to generate electricity from the kinetic energy of moving vehicles on roads, highways, parking lots etc. The cost of fabrication of the model is less which provides a boost in application of this system at above mention sites.

Keywords: IR sensor, LEDs, road safety

1. Introduction

Mostly, in the hilly areas of *Dive Ghat*, Pune-Pandharpur highway, Maharashtra accidents occurs due to poor development of likely national highways and hazard zones. In India the rate of accidents in ghat section is increasing day by day. To reduce the rate of the accidents in this zone we have to suggested the provision of road safety management system which includes the study of

1. Traffic survey
2. Engineering Measures
3. Preventive measures
4. Educating the public with traffic rules and regulations

Traffic survey includes finding the number of vehicles

passing through the ghat section in the both Peak and Slag hours. Engineering measures includes study on road designing, road lightning, provision of traffic controls, facilities supervision and monitoring centers all these will lead to decrease in the rate of the accidents. Educating public is necessary to provide information and education about traffic laws and regulations, safety precautions while driving through ghat section.

Energy generation using roller speed breakers can provide a secondary source which is promising enough to provide early signal system at ghat section. The application of roller speed breaker becomes easy as its fabrication cost is low and it does not need any sufficient efforts. It can be widely accepted at both individual and community levels. The system works as the rollers rotate as soon as they come in contact with moving vehicles which will charge the piezoelectric crystal present in the generator and convert the mechanical pressure moment into electricity, ultimately giving an output of electric current which is supplied to the IR sensors and LEDs placed at both sides of the road providing an early signal to the vehicles moving on both sides of *Dive Ghat*.

2. Theory and concepts

A. Ease of use

The unit used for power generation from speed breaker is small as compared to other power generation units like wind mill, power plants and other such units. Thus, it provides ease in employing the unit wherever it is required and also it is economical. Once it has been employed it only then after requires periodic maintenance which further adds ease of use of it.

B. Working principle

This project explains the mechanism of electricity generation from speed breakers. The friction force due to vehicle movement acted upon the speed breaker system is transmitted to pulley mechanism arrangements. The pulley arrangement is made of two pulleys, one of the pulley is larger in diameter than the other pulley. Both the pulleys are connected with belt which transmits the power from the larger pulley to the smaller pulley.

As the power is transmitted from the larger pulley to the smaller pulley, the speed that is available at the larger pulley is relatively multiplied at the rotation of the smaller pulley. The axis of the smaller pulley is coupled to a gear arrangement. Here we have two gears with different dimensions. The gear wheel with the larger diameter is coupled to the axis of the smaller pulley. Hence, the speed that has been increased at the smaller pulley wheel is passed on to this gear wheel of larger diameter. The smaller gear is coupled to the larger gear. Therefore, as the larger gear rotates it increases the speed of the smaller gear which is following the larger gear and multiplies the speed to more intensity. Though the speed due to the rotary motion achieved at the larger pulley wheel is less, as the power is transmitted to gears, the final speed achieved is high. This speed is sufficient to rotate the rotor of a generator and is fed into the rotor of a generator. The rotor which rotates within a static magnetic stator cuts the magnetic flux surrounding it, thus producing the electro motive force (emf). This generated emf is then sent to a battery, where the generated emf is regulated. This regulated emf is now sent to the storage battery where it is stored during the day and night time and can be used for the IR sensors and LEDs placed at both sides of the road providing an early signal to the vehicles moving on both sides of *Dive Ghat*.

C. Components required

1) Pulley and belt

Pulleys are used to change the speed, direction of rotation, or turning force or torque. A pulley system consists of two pulley wheels each on a shaft, connected by a belt. This transmits rotary motion and force from the input, or driver shaft, to the output, or driven shaft. A belt and pulley system is characterized by two or more pulleys in common to a belt. This allows for mechanical power, torque, and speed to be transmitted across axles. If the pulleys are of differing diameters, a mechanical advantage is realized.



Fig. 1. Pulley and belt

2) Shafts

A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power. The various members such as pulleys and gears are mounted on it.



Fig. 2. Shafts

3) Dynamo

It is a device, which converts mechanical energy into electrical energy. The dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current through “Faraday’s Law of Electromagnetic Induction”. A dynamo machine consists of a stationary structure, called stator, which provides a constant magnetic field, and a set of rotating winding called the armature which turns within that field.



Fig. 3. Dynamo

4) Battery

A rechargeable battery, storage battery, secondary cell, or accumulator is a type of electrical battery which can be charged, discharged into a load, and recharged many times, as opposed to a disposable or primary battery, which is supplied fully charged and discarded after use.



Fig. 4. Battery

Color/Grayscale figures

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence and the colour of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm to 2 mm) and integrated optical components may be used to shape the radiation pattern.



Fig. 5. LED

5) Infrared Sensor (I. R. Sensor)

IR sensor is a simple electronic device which emits and

detects IR radiation in order to find out certain objects/obstacles in its range. Some of its features are heat and motion sensing. IR sensors use infrared radiation of wavelength between 0.75 to 1000µm which falls between visible and microwave regions of electromagnetic spectrum. IR region is not visible to human eyes. Infrared spectrum is categorized into three regions based on its wavelength i.e. Near Infrared, Mid Infrared, Far Infrared.

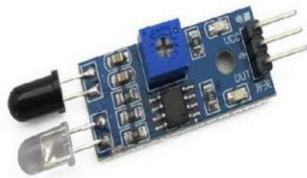


Fig. 6. Infrared sensor

D. Problem statement

To reduce the accidents at hair pin curves in Ghat section by application of LED Signals.

E. Objective

Our objective behind this project is to make a unit which can solve the problem of accidents in *DIVE GHAT* by using IR-sensors and smart signaling system designed by us. On the other hand, to generate electricity from the same smart signaling system by using the traffic moving in Dive Ghat.

F. Advantages

- To reduced rate and number of accidents.
- Proper designing of roads and providing proper safety indicators to the drivers which will reduce the faults of drivers and eventually reduce the rate of accidents.
- Ease in implementing because of simple assembly.
- Cost of unit is comparatively low.
- Maintenances is comparatively low.
- It is non-conventional source of energy.
- Simple model can generate electricity upto 60 watt.
- Model size is small; thus it requires less floor area which is of great importance in metro cities where less area is available.

G. Disadvantages

- The system after installing will require continues monitoring as it consist some complex microchips and sensors fitted under the plates.
- Only skilled expert can handle the maintenance work.
- Continues monitoring is required for the system during heavy rainfall days.
- Load carrying capacity i.e capacity of vehicle passing over it is low.
- Though it requires periodic maintenance, still its maintenance is difficult.
- Its maintenance requires seizing of road causing many traffic problems.

3. Traffic survey

Number of vehicles crossing a particular section at road in per unit time is called as Traffic Volume. Traffic data are needed in research, planning, designing and regulation phases of traffic engineering and are also used in establishing priorities and schedules of traffic improvements. The traffic engineer must acquire general knowledge of traffic volume characteristics in order to measure and understand the magnitude, composition, and time and route distribution of volume for each area under his jurisdiction.

The traffic volume count survey was conducted at the *DIVE GHAT*, Pune – Pandharpur Highway, Maharashtra intersection spanning for 4 hours in the morning and 4 hours in the evening. The peak hour flows are estimated in terms of vehicles/hour and converted to Passenger Car Units / hour (PCU/hr) and thereafter the collected traffic volume data (15-minute interval) was analysed hourly. The traffic flow diagram was plotted for the intersection for various days to understand the turning flows. The hourly variation of traffic volume and traffic composition at the intersection observed for seven days continuously. The typical data collected analysed for the Bypass Intersection is given in Table 1.

Table 1
Bypass Intersection data

Day	Vehicles	Approach	
		Pune – Saswad	Saswad – Pune
29/03/2019	Two Wheelers	4201	4446
	Four Wheelers	2223	2381
	Buses	235	261
	Trucks	271	263

4. Design of electricity generation

$$M = 800(60-20)/8 = 4000 \text{ kg}$$

Where,

800 = Mass of vehicle

60 = Initial speed of vehicle

20 = Final speed of vehicle

08 = Time required for apply break

$$F = M * g$$

$$= 4000 * 9.81$$

$$= 39240 \text{ N}$$

$$\text{Radius of Shaft} = (r) = 60 \text{ mm} = 0.06 \text{ m}$$

$$T = r * F$$

$$T = 0.06 * 39240$$

$$T = 2354.4 \text{ N.m}$$

Electricity Generation for Pune – Saswad Road

$$\text{Total Number of vehicle in one day} = (N) = 6930$$

$$\begin{aligned}
 P &= T * W \\
 &= T * (2\pi N/60 * 60) \\
 &= 2354.4 * (2 * \pi * 6930/60 * 60) \\
 &= 28476.77 \text{ watt}
 \end{aligned}$$

Electricity Generation for Saswad - Pune Road

$$\text{Total Number of vehicle in one day} = (N) = 7357$$

$$\begin{aligned}
 P &= T * W \\
 &= T * (2\pi N/60 * 60) \\
 &= 2354.4 * (2 * \pi * 7357/60 * 60) \\
 &= 30206.75 \text{ watt}
 \end{aligned}$$

Table 2
Result

Day	Electricity Generated		Total Electricity Generated
	Pune - Saswad	Saswad - Pune	
29/03/2019 (For One Day)	28476.77 Watt/Day	30206.75 Watt/Day	58683.52 Watt/Day
(For Seven Day)	199337.39 Watt/Week	211447.25 Watt/Week	410784.64 Watt/Week

5. Conclusion

"Electricity plays a very important role in our life". Due to population explosion, the current power generation has become insufficient to fulfill our requirements. We have discovered technology to generate electricity from speed breakers in which the system used is reliable and this technique will help conserve

our natural resources. In coming days, this will prove a great boon to the world, since it will save a lot of electricity generated from power plants that gets wasted in illuminating the street lights. As the conventional sources are depleting very fast, it's high time to think of alternative resources. We got to save the power gained from the conventional sources for efficient use. So this idea not only provides alternative but also adds to the economy of the country. Also the generated energy play an important role to provide energy to the smart signaling system and LEDs lights which are the part of entire setup. This signal system will slowly but surely play an important role in reducing the rate as well as number of accidents of ghat sections without external power sources.

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