SMART HIGHWAY UTILIZING GREEN ENERGY

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ABSTRACT

India is home to world’s most complex road networks. Road development is one of the most important part of the Indian Infrastructure. Considering the global energy ad climate crisis it is important to make use of environmental friendly energy sources also called as Green energy. This report aims to assess the functionality of piezoelectricity in roads to utilize energy executed from the moving vehicles. The energy converted into electrical energy using piezoelectric technology to replace fossil fuel in street light applications. The vitality of this technology arises as fossil fuels is being over consumed which makes it challenging to provide sufficient power in the next era as an effect of growing population. Being dependent on renewable energy to account for a greater global consumption level is essential to overcome the risks associated with fossil fuels. Piezoelectric road is a new energy evolution to provide a sustainable solution in terms of environment, economy, and social needs.


1. INTRODUCTION

The road development is the one of the major part of infrastructure which include projects such as highway, railway, water reservoirs, reclamation etc. The construction of road is of major concern as considering growing urbanization. Providing good road network is very essential for the development of any country. Highway from the name it is very clear that any public street or other public path on land. It is mainly used for major roads but also includes public ways and public routes. Indian road network of 33lakh kilo meters is second largest in world and consist of:

<table>
<thead>
<tr>
<th>HIGHWAY</th>
<th>LENGTH (in km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressways</td>
<td>200</td>
</tr>
<tr>
<td>National highways</td>
<td>96,260.72</td>
</tr>
<tr>
<td>State highways</td>
<td>1,31,899</td>
</tr>
<tr>
<td>Major district</td>
<td>4,67,763</td>
</tr>
<tr>
<td>Rural and other</td>
<td>26,50,000</td>
</tr>
<tr>
<td>TOTAL LENGTH</td>
<td>33LAKH (approx.)</td>
</tr>
</tbody>
</table>

In India, There are more than 6 lakh villages located in different terrain conditions. The climatic condition also varies from place to place to a great extent. Social, economic and educational development of these villages greatly depends on accessibility. The large numbers of villages in the rural India are still not connected with all-weather roads. It has now been realized that for the development of rural areas, proper communication system must be the priority. About 65% of freight and 80% passenger traffic is carried by roads. National highway constitute only about 1.7% of the road network but carry about 40% of total road traffic. Number of vehicles has been growing at an average of 10.16% per annum over the last five years. We will try to discuss various methods which will ultimately give us electrical energy by harvesting green energy on highways. In this project we will talk over various productive strategies to transform green energy into electric energy and by using it making smart highways.

2. SOURCES

2.1. Piezoelectric

Redirecting routes to integrate the principle of piezoelectric devices to urban roads is significant at this stage. Focusing on the transition of energy to piezoelectric integrated roads, a renewable energy harvesting method, will lead the next power generation into a feasible and more reliable source of energy. The term Energy Harvesting or Renewable Energy, such as solar panels or wind turbine, is a method of producing electrical energy by utilizing the energy surrounding the environment from the sun and wind, for example. However, energy formed from various vibration machines, objects in motion, or any other source
of mechanical energy is not being captured. Therefore this source of energy is dispersed and thus wasted.

2.2. Solar road panels

The principal idea of solar road panels is to utilize the space occupied by roads to generate electricity via photo-voltaic panels installed in place of a conventional concrete or asphalt road surface.

Other functions for solar road panels have been proposed, including the following:

- The panels could include LED lights for creating dynamic road markings, e.g., lane markings, or warning messages such as “Reduce Speed”.
- The panels could include heating elements that produce sufficient energy to clear ice and snow from roadways.
- The panels could include wireless charging technology to recharge the batteries of electric vehicles that drive over the panels.

2.3. Speed Breaker

In the present day scenario power has become the major need for human life. Energy is an important input in all the sectors of any countries economy. The day-to-day increasing population and decreasing conventional sources for power generation, provides a need to think on non-conventional energy resources. Here in this paper we are looking forward to conserve the kinetic energy that gone wasted, while vehicles move. The number of vehicles passing over speed breaker on road is increasing day by day.

Beneath speed breaker, setting up an electro-mechanical unit known piston/water tank assembly could help us conserving this energy and use it for power generation. This generated power can be stored, by using different electrical devices. We can supply this energy to street lights, traffic lights, and nearby areas, and thus helps in country’s economy. This is a design of such a type that there will not be any problem to drive the vehicle over it. From cycle and motorcycle to L.C.V. or M.C.V. or all types of heavy vehicles can pass through this system.

This mechanism of generating of electricity can be placed on the actual speed breaker of the roads. The power is generated when the vehicles pass through it. Which in can be stored in the battery. This power can be used in many places after using the inverter, which enhances in the voltage from 12 volts to 230 volts. This power can be used in the following:

1. Street Lights.
2. Road Signals.
3. Sign boards on the roads.
4. Lighting of the bus stops.
5. Lighting of the check post on the highways etc.

2.4. Wind Turbine

The strong south-west summer monsoon, which starts in May-June, influences the wind energy in India. In this time cool, humid air moves towards the land in October the north east winter monsoon starts, when the cool, dry air moves towards the ocean. In the months march to August, the winds are uniformly strong over the whole Indian Peninsula region but it except the eastern peninsular coast. Wind speeds in month November to March are relatively weak though higher speed winds.

The capacity of wind power has increased from 4.8 MW in 1995 to more than 239 GW in 2011. Today, each wind turbine could generate as much electricity as a conventional power plant. Wind energy has made its most significant contributions in China, the US and Germany, where the cumulative installed capacities are 62, 47 and 29 GW, respectively. Figure (3) shows the worldwide wind installation capacity.

3. SENSOR NETWORK FOR SMART HIGHWAY

3.1. LDR Sensor
A photoresistor is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor can be applied in light-sensitive detector circuits, and light-activated and dark-activated switching circuits.

3.2. IR Sensor

An infrared sensor is an electronic device, which 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 than emitting it that is called as a passive IR sensor.

4. RESULT

- Solar receives 4 – 7 kWh of solar radiation per square meter.
- They generate energy from the wind itself. One turbine can reportedly produce near about 1 kilowatt per hour, which is the equivalent of the hourly electricity needs of two households.
- The use of sensors on the street lights reduces loss of electricity.
- Use of green energy gives less production cost of electricity.
- Using solar panels which will be laid parallel to the road and will be used to charge the battery. And the same battery will be used for the power supply for the equipment’s of the toll plaza.
- The proposed method of digital transactions will make flow of traffic from toll plaza much easier.
- The Highways makes Smart.

5. CONCLUSION

By conducting different tests and from the obtained results and also from observation & study; we come to the conclusion that,

- The unlimited energy use for the generation of electricity.
- Renewable energy production and supply is continuously increasing on the global level.
- The use of sensors on the street lights reduces loss of electricity.
- Use of green energy gives less production cost of electricity.
- The Highways makes Smarter.
- Electric vehicles have the potential to be used for both power generation and storage

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