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Utilizing Modern Technology to create Smart Highway Systems

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ABSTRACT: India is a developing country, infrastructure development is need of any nation to become a developed country, The whole efforts of the Indian government are into the mark to make most of cities in India to be smart. For making any city smart, it is essential to make transportation system connecting that city of a good caliber because the transportation is key for growth of any country since it is the very important aspect of movement, intercommunication of persons, goods or other things from one place to another, A smart city must have a network of smart transportation modes viz. airways, highways, railways etc. Nowadays safety on road has become an important factor in our life because there is an increasing amount of accidents on the road and there are some places where accident occurs frequently such as crossings, turns. As per the road accident statistic of India - 2014, average deaths caused by road accidents that take place in India is 382 Persons/Day i.e. about 1,40,000 persons per year which is more than total sum of people died in all wars of India up to the date. So, road safety or immunity is very essential aspect for any highway to be smart. Along with safety, comfort, convenience, mobility are also important aspects for highway to be called smart.

KEYWORDS: Modern Technology, Smart Technology, Advance Highway System

I. INTRODUCTION

Ideal highway system can be said to that highway system which is safe in transport, convenient for travelling provides comfort to users during travel, and provides assurance of incident management by the adoption of proper traffic management unit keeping surveillance over road, sensors sensing and transmitting data, GIS and other Intelligent Transportation Systems (ITS). The conventional highway systems that are used in India at present times are very simple in character: There are no arrangements in vehicles which will prevent accident resulting into frequent incidents of colliding vehicles. Traffic congestions on roads is high. If any disaster take place, it takes considerably more time to even out the situation, as there are no traffic controlling or managing units present. Though at some places there are traffic management centre, due to lack of intelligent communication and conveying systems, the quick information is not conveyed to such centres. Therefore, use of prevalent Intelligent Transportation Systems becomes necessary. Speed breakers are most commonly used mediums for controlling vehicles at intersections. But most of the times they result into headache to drivers and road users. Sometimes their existence is unnecessary. Other substitute method should be adopted instead of speed breakers. So adoption of smart highway systems seems to be very substantial need of present scenario.

II. PROPOSED MODEL

There are four systems adopted in the model viz. 1. Obstacle Detecting System 2. Accident Location Informing System 3. Cross-Signals and 4. Solar panels for street lights.

A. Obstacle Detecting System (ODS)

As discussed earlier, number of road accidents occurring in India is very large. Most of the accidents are due to collision of vehicle to vehicle or vehicle to other obstacles. Weather conditions may be the reason at maximum times or any other reasons for vision of the obstacles, but accident due to such conditions are very severe in nature. To overcome such conditions the system used in the model is obstacle detector system.

Working:

The system consists of the mainly four components viz. sensors, microcontroller, relay and motor all are fitted in vehicle. Sensors used are of ultrasonic type of sensors. When any obstacle comes in the route of vehicle, the ultrasonic sensors will detect it and will give signal to the microcontroller. Microcontroller will guide the operation and will stop



the motor of the vehicle with the help of relay. Similarly if any deep pothole is detected, the same working will happen and vehicle will be stopped. In this way, the chances of collision between vehicles or vehicles and obstacles may be reduced.

B. Accident Location Informing System (ALIS):

Fatality in accidents is severe problem, but most of the fatalities are due to delay in medical helps provided at the accident location. Since no information about the mishap is received by service providers like ambulance, cranes, etc, the service on the location of the accident may not be provided. To overcome this setback, there is provision of the system in model which will give the location information to traffic control unit which in return will provide services like ambulance to the accident location and hence fatality may be minimized.

Working:

The system works on the combination of components viz. sensors, GSM, GPS, traffic control unit. There is use of ultrasonic type of sensors in model which is assembled in vehicle and works on the basis of three axis method. They detect the vibrations and provide signal to transducer. When any accident will occur with vehicle, due to vibrations and jerks the axis of the ultrasonic sensors will get affected and the signal will be sent to microcontroller and at the same time a message will be passed to traffic control unit which is observing the movement of all vehicles on that route with the help of GSM. The traffic control unit will detect the location of the vehicle affected by accident with the help of GPS. All these procedures can happen within 10 seconds resulting into quick information to service providers and immediate help will be provided to the accident location. In this way delay in providing help will be reduced.

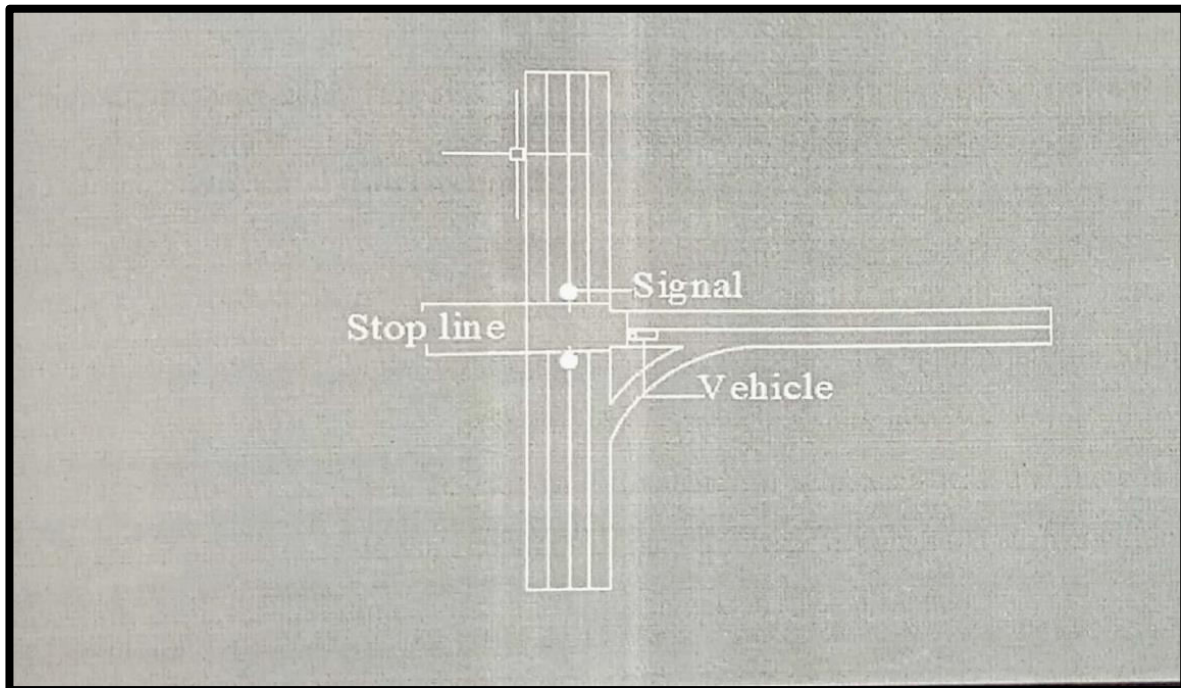
C. Cross-Signals at T-Intersection

In India, speed breakers are used as most common medium for controlling the speed of vehicles at most of the intersections. But speed breakers are not appropriate for all the situations. Speed breakers gives jerks to vehicles which results into discomfort to road users. Also many times at T-intersections, if frequency of such vehicles is less, and there is no vehicle crossing the road, slowing down of all the vehicles is needless. At conditions where flow from the sub route is less, the cross signals may be provided. Cross signal is the signal whose working depends on the intersecting traffic route unlike normal signals which works on all relevant traffic from all directions. By these signals, vehicles from main route of highway will stop only if there is any vehicle from branch line which needs to cross the road.

Working:

This system consists of sensors, microcontroller, relays and signal. Sensors used are object sensors. When any vehicle from branch route of T-intersection will come at intersection. it will stop at stop line.

As it will come at stop line, object sensor fitted at road intersection will sense the vehicle and will provide the information to microcontrollers. Microcontrollers will turn on the signal with the help of relay. A red signal will be turned ON at both directions of main routes to stop the vehicles at main route for 15 seconds. As the signal is turned on, the vehicles at main route will stop at the Stop Line. Within those 15 seconds vehicle from the branch route will cross the road and merge into the main route. After 15 seconds, the signal will automatically turn off and vehicles from main route will move further. In this way the traffic from main route will be disturbed or slowed down if and only if there are any chances of the vehicle crossing.



D. Solar panels for streetlight

Energy Consumption of a high-pressure sodium street lamp which is generally used in India is up to 1000 watts LED street lights requires only up to 75 watts Sun is unlimited and boundless source of energy, Solar energy may be utilised as a source of electricity with the help of solar panels.

In this model, a system is made as a representative for the solar system for street lamps By using solar panels, solar energy is converted into electric energy. A solar panel, is a series of interconnected silicon cells joined together to form a circuit. Power is produced by these interconnected cells using as an electricity production system. By adopting this method energy saving may be acquired at large extent.

III. RESULT AND CONCLUSION

The model was tested for various conditions. The table showing results after testing of model.

Table-1

No	System Used	Result
1	Obstacle Detecting System	Obstacle and deep potholes are detected and vehicle stops within 5 seconds
2	Accident Location Informing System	Information and location of the accident is tracked within 10 seconds
3	Cross-Signals at T- Intersection	Average delay at one intersection is reduced to 10 seconds per T- intersection
4	Solar panels for streetlight	Energy consumption per street lamp is reduced by 975 watt



III. CONCLUSION

In the research, we have worked on the setbacks of various traffic incidents. The model made is a good representative of the highway system that can be adopted in future to minimise the road accidents and fatalities. By studying and testing of the model following things may be concluded.

- The obstacle detecting system if adopted in all vehicles, might be very useful in order to lessen India's one of the most severe problems of road accidents-vehicle collisions.
- Conveying message of road incidents to the service providers may become easy and nippy by the accident location informing system.
- The cross signals may provide quite comfortable and convenient crossing at intersections. Also will give some relief from the jerks and discomfort occurred by the speed breakers
- Use of solar energy is need of present as well as in future condition. Using solar panels as energy source for streetlamps may be the beginning of the same

However, the methods adopted in the models are quite expensive. And their application in realistic conditions requires more precious and accuracy in development.

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