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Smart and Innovative Techniques for Safe and Smooth Road Transport System for Pune City

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Abstract— This technical work describe infrastructure requirement and also the working principles and procedures involved in operation of a wise Road. a wise Road is comparable to a traditional highway but the difference is, it's equipped with the electronic gadgets required to capture static and dynamic physical entities occupied on the road at a given time and location. Now a day's traffic safety and highway congestion has become a heavy concern to the authorities and it required to be managed them within the available resources. Also it's unimaginable to extend the capacity of highway infrastructure to compete with increase in traffic. In cities on transit, great deal of traffic data being generated and an integrated approach is required for the efficient management installation. Smart Road is an innovative approach wherein Information Communication Technologies (ICT) is merged with traditional infrastructure and integrated with digital technologies. Critical examination of literature review reveals that several technologies are available for data capturing and management. Notable among them are by using ultrasonic sensors, light sensors, motion sensors, camera and IOT devices. the info collected by the devices would be managed through cloud computing and massive data analytic methods. To assess this traffic situation spot speeds and traffic volumes are captured for peak and non-peak on the Express Highway and from the info captured 85th percentile speed. Smart road technology is discussed for transportation management.

Keywords— Smart Roads Traffic Congestion, IOT devices, Traffic Management.

I. INTRODUCTION

Increasing traffic is of significant concern to the authorities in every city round the world. Muscat the capital city in Oman is suffering with varied traffic problems. the priority issues are speeding from cars, increasing personalized vehicles and therefore the big personal cars with low percentage. the issues arising out of increased traffic are: increased congestion levels, over speeding of private cars, travel delay times, loss to human life and property, increased pollution levels and retarded economic development. There's must manage all the traffic related concerns in an exceedingly smart way. To address all the listed problems and to search out solutions a wise Road using intelligent transit (ITS) is latest development and being adopted for arterial and sub arterial roads in cities across the globe. Smart road could be a road, wherein a normal road is supplied with kind of sensors and electronic gadgets which help in detecting the relevant problems and find feasible solutions to enhance the operational efficiency of the system.

Aim of the study is to assess the infrastructure required for the conversion an urban highway with state Art Technology as a sensible Road. For this, a road segment of an existing urban main road is taken and demonstrated through a case study.

The specific objectives of the study would include:

- To review the working mechanism-principle involved within the operations of smart road.
- To estimate the infrastructure required for the conversion of a standard road to smart road.
- To assess this traffic situation on a main road and suggest smart road technology.
- To gauge the advantages of smart road quantitatively and qualitatively.

II. METHODOLOGY

Following steps are followed for the fulfillment of the objectives of the study.

- Collection of data, literature and case studies on smart road.
- Selection of a primary road stretch, after having discussions with the ROP and ministry of Transport officials.
- Conducting spot speed studies for the quantification of 80-85th percentile speeds.
- Finally Assessment of requirement of IT infrastructure for the given selected segment of road to convert into a smart road.

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III. TRAFFIC PROBLEMS IN PUNE

After the discussion with some citizen, Road users likewise as traffic controlling police we try and understand the actual problems in Pune. Also we study some previous road traffic data and understand some problems, they're as follow;

1. Inefficient Road Network
2. Inappropriate Traffic Management:
3. Inefficient Inter-City Bus Transport:
4. Traffic Rule Violation:

5 Inadequate Infrastructural Facilities:

6. Inappropriate Constructions & maintenances work:

Sr. No.	Reasons	No of respondants
1	Road Condition	23
2	Undiciplined parking	37
3	Undiciplined Driving	37
4	Excessive number of vehicles on road	11
5	Narrow road	8
6	Bad planning	34
	Total	**150**

Table 1: Result of Respondents

These are the some major problems in Pune city, and in our work we try to suggest the some smart techniques to overcome this problem.

(A)

(B)

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(C) **(D)**

Fig.1: Traffic Problems in Pune (A,B,C,D)

IV. WORKING PRINCIPLE OF SMART TECHNIQUES

Numerous street mishaps happen each year since drivers are occupied from the street or nod off. Rumble strip innovations take care of this issue and fundamentally lessen the quantity of mishap. These wrinkles out and about are situated on the partitioning strips and shoulder line of the streets. The profundity of these scores just as the distance between them are changed so that the passing vehicles wheels vibrate and created boisterous sound as a notice to a drivers.

Nations having cold environment condition dealing with an immense issue of snow on streets. The stored snow on the street goes looses the friction between tire and road surface and increases the chances of accident.

In the event that speed of passing vehicles is low, the fillings of Non-Newtonian Material stay fluid and goes somewhere near the weight of the vehicle without giving any jerk to the vehicle. Nonetheless the speed of passing vehicles is considerably more then, at that point the material becomes solidify and go about as speed obstruction.

A rotating road barrier is developed to solve this problem. They convert the impact energy of accident into the rotational energy with the help of rotating barrel and prevent the vehicles from driving off.

Dedicated Electric Lane is the one lane of road build with the help of magnetic field where the user of electric vehicles can recharge up their vehicles' battery by just driving their vehicles on that lane.

In low visibility the sensor can detect the hazards vehicles on the road and alert the coming drivers with the blinking red signal light before that spot.

When drivers in nearby area search for empty parking space in their smart navigation system, this system is inform them about empty available space. So users can easily find Parking space and park their vehicles.

A smart traffic management system informs the drivers about upcoming situation of road condition. Due to that pre alert the driver can avoid the problematic route and select alternative route. This system gives the information about traffic intensity, temporary closed routes, ongoing maintains work, condition of roads, etc. on the electric information board which is placed on signal poles. This system analyzed traffic density by magnetic sensor and sends this data to the controller which shows it on information display. It also controlled from the central traffic management station and also can set the particular message for display on board. After reading that message drivers can decide about taking of route for reach the destination.

V. PROBABLE SOLUTIONS

After all the problems and the techniques for that particular problem as well as all the feasibilities studies we suggest the following smart techniques to overcome these traffic problems.

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LOCATION	PROBLEMS	SOLUTION
Swargate PMPML stop	Required lot of electrical energy and it is possible to generate renewable energy.	Providing electro power generating system.
Swargate ST stop		
Shivajinagar ST stand		
Pune Station PMPML stop		
Swargate – Katraj BRT road	There is no electric lane for electric buses	Providing dedicated electric lane
Katraj- Handewadi road		
Nagar road		
Bopdev Ghat	Approaching vehicles not visible	Install vehicles detection system
Dive Ghat		
Hadapsar Gadital	Parking space is negligible	Construct smart parking hubs.
Swargate		
Hinjewadi		
Appa balwant chowk		
Hinjewadi	Lack number of electric charging stations.	Provide electric charging stations.
Swargate		
Pune Station		
Katraj		
Pune stations		
Pune Univercity circle	Meet roads more than 4 direction, there is lack of Parking detection and information system	Provide Parking detection and information system
Shivajinagar		
Katraj		
swargate		
Hadpasar		
Chandni chowk		
Katraj – saswad road	Road marking is not visible due to low light.	Provide glowing rumble strips.
Hadapsar – saswad road		
Wagholi – mundhwa road		
Mantarwadi pahata- khadi machine chowk road		

Table 2: Probable solutions for traffic problems

VI. COST AND FUNDING

In the cost of project the following parameters are includes;

- Capital cost
- Maintenance cost
- Operation cost
- Other costs

The cost requirements and the details of cost analysis as follows;

TECHNIQUES	INITIAL COST (RUPEES)	MAINTENANCE COST (RUPEES)	OPREATING COST(RUPEES)	SCRAP COST (RUPEES)
AUTOMATIC TRAFFIC SIGNALS	2,50,000 to 3,00,000 per unit.	15,000 to 30,000 per unit	300 to 500 per unit	30,000 per unit
DEDICATED ELETRIFYING LANE	2.5 core to 3 core per km	1,00,000 to 1,50,000 per km	40,000 to 50,000 per km	30,000 to 40,000 per km
WEATHER DETECTION SENSOR	1,25,000 to 2,00,000 per unit	00	10,000 per unit	00
SMART STREET POLE	2,00,000 to 3,00,000 per unit	10,000 per unit	15,000 per unit	2000 to 5000 per unit

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GLOWING ROADWAY LINE PAINT	6000 to 8000 per lit.	800 to 1000 per km	00	00
LED SCREENS	4000 to 8000 per sq. ft.	1000 to 1500 per unit	500 to 1000 per unit	100 to 1000 per unit
PARKING MANAGEMENT SYSTEM	1,00,000 to 2,00,000 per unit	5000 to 10000 per unit	4000 to 5000 per unit	10000 to 20000 per unit
CHARGING STATION FOR CAR	30,00,000 per unit	1,80,000 per unit	25,000 per unit	50,000 per unit.

Table 3: Life Cycle Cost Analysis of Smart Techniques

With the recognition of the high Capital Cost of Smart techniques, the city decision makers would know it is not easy to build smart road projects without reliable financing sources. There are common funding sources for projects are,

i. Government-level funding
ii. Local-Level Funding
iii. Community-Focused Funding
iv. Public-Private Partnerships (PPPs)
v. Loans and Municipal Bonds
vi. Private Funding
vii. User Charges and Pay for Performance
viii. Competitions

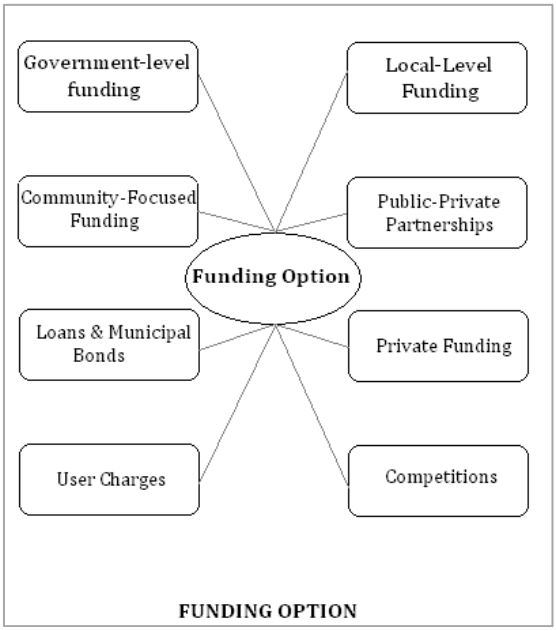

Fig.2: Potential Funding Option

VII. BENEFITS OF SMART, INNOVATIVE ROAD TECHNIQUES

As we can see the Road network system of country is mostly responsible to the development of that country. So the main benefit of This Smart, Innovative Roadways Technique is too increased in the growth and development rate of country by providing smooth, safe, efficient road network system. In addition to this there are more benefits of these smart techniques, they are as follows,

1) Reduce Road Crashes and Accidents:
2) Reduce rate of pollution:
3) Improved Travel Quality:
4) Safety and Security:
5) Improve Transportation Efficiency:
6) Reduce consumption of conventional energy:

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VIII. CONCLUSION

In this technical paper current issues in traffic with respect to safety and level of service are evaluated on the city roads and the concerns are highlighted. Role of Smart Road technologies as an effective way of finding the cost effective solutions to the current traffic problems is emphasized. Working principles of smart road are discussed. To convert the Express Highway into a smart road, IT infrastructure requirement is arrived at. This technical paper is intended for demonstration only, for which a stretch of about 10Km is examined for demonstrative purposes. A detailed study need to be carried for the complete assessment of IT infrastructure and for the conversion of express highway network into a smart road system.

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