Nashik Smart City: Use of ICT components for Smart Road

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Abstract - Development of 100 cities into Smart Cities is one of the biggest upcoming projects undertaken by the Government of India. Solapur, Nashik, Aurangabad, Pune, Moradabad, Aligarh etc. have been a part of this initiative out of which we have chosen Nashik city as our study area. Nashik city faces issues like traffic congestion, insufficient road width, inflexible road, illegal parking of vehicles, women security etc. Construction of smart road on existing road has been proposed in order to solve majority of the issues faced by the city has been proposed by the Nashik Municipal Corporation. Dedicated parking lanes, cycle ways, wide pavement surfaces, are planned to be used in the smart road. Modern day ICT (Information and Communication Technologies) components like 3D speed breakers, E-Toilets, E-Challan system, Intelligent Traffic Management systems, adaptive signaling, Emergency Call Boxes, Panic Buttons, Variable Message Display, CCTV Surveillance, Smart Poles with Smart LEDs have been discussed in this paper in accordance with the chosen area of study.

Key Words: adaptive signaling, traffic congestion, smart road.

1. INTRODUCTION

The Government of India has initiated the development of 100 cities into Smart Cities. A fund of 98,000 crore rupees has been sanctioned for this project. Nashik city is one of the cities in the state of Maharashtra which has been chosen for development. A road which provides flexibility to the users, is multi-purpose in nature and involves the use of ICT components in order to solve the issues related to transportation can be termed as smart road [3]. As the city of Nashik faces traffic congestion issues, illegal parking issues, the Nashik Municipal Corporation has planned to construct a smart road on the existing road passing through the central region of the city. Majority of the problems related to transportation and security faced by the city of Nashik can be solved using the modern day information and communication technologies like Intelligent Traffic Management Systems, Emergency Call boxes, etc. In this paper, the details about some of the ICT components which can be used to solve the issues faced by the city have been discussed.

2. DESCRIPTION OF THE SITE CHOSEN

In the proposed Nashik Smart City project, we have chosen the central road of the city as our study area. The central road of Nashik city runs from Ashok Stambh to Mumbai Naka. The distance between Ashok Stambh and Mumbai Naka is 1.1 km. The existing road is a two-way road and its width of the is 24 metres. This road is in the central part of the city with collector’s office, high schools, district and sessions court and other infrastructure of the city adjacent to this road. This road is called as the busiest road of Nashik city. The figure 2.1 shows the stretch of the road chosen.
2.1 Necessity of Smart Road
The width of the existing road has been reduced due to illegal parking of vehicles on the road, extension of the compound wall of buildings by residents and encroachment of street hawkers on the pedestrian walkway [5]. The electric lines, manholes etc. are all present on the surface of the road which makes the road inflexible for use. This road has been defined as the busiest road as it connects the city to the highway and is frequently used. Looking at the current scenario of the city of Nashik, construction of smart road is the need of the hour. Smart road provides the required flexibility, ease of transportation and provisions for parking as well [2]. It will solve the traffic congestion issues to a great extent.

2.2 Description about the Proposed Smart Road
- The length of the smart road is 1.1 km which is from Ashok Stambh to Mumbai Naka which has 3 roundabouts in between them.
- The smart road will be a (4+4) lane road and the width of the road is 24 metres.
- The carriage way of the road has been proposed to be 7.5 metres in width on both sides. The carriage way will also include a 1.5 metres dedicated cycle way of on both sides of the road for the people travelling via cycles [6].
- There is a median of 1metre width at the center of the carriage way.

Fig 2.1 Stretch of the proposed Smart Road
- Pedestrian walkway of 2 metres has been proposed to be constructed on both sides of the road.
- Finally, there will be a dedicated parking lane of 2 metres provided on both the sides so that the issue of illegal parking is solved.

3. COMPONENTS OF ICT PROPOSED FOR THE SMART ROAD

The chart 3.1 shows the components of the ICT to be used for the smart road.

### Chart 3.1

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3.1 Use of 3D Speed Breakers

The traditional speed breakers which have been incorporated over the years have one of the disadvantages that they require a lot of materials and maintenance. The height of some of the traditional bumpers is so tall that vehicles and the drivers face discomfort in passing through them. Nowadays, the latest innovation to replace the traditional speed breakers are the 3D speed breakers [4]. This is a relatively new concept which aims at decreasing the original height of the speed breaker and providing an illusion by creating a virtual image by painting on the road surface. This projected image is seen by the driver from long distances and speed of vehicles reduces and the vehicles passes through the breaker without any jerk. The main issue that arises is that the frequent road users who become familiar with the concept and do not reduce the speed at the breaker. In order to solve this issue, the latest method is to reduce the height of the existing speed breaker and then use 3D paint to create a virtual image by which the height of the breaker is visible from long distances. The use of thermoplastic paint should be replaced by fluorescent paint which glows when the light of vehicles reflects on it at night. The driver of the vehicle can view this image from long distance and will have to reduce the speed of the vehicle. This will not only reduce the jerks which occur due to application of sudden breaks but will also reduce the number of accidents to a great extent.

3.2 Smart Poles with Smart LEDs

The ordinary poles on street have lights which have been used over the years at night, have high intensity light bulbs. This high intensity light gets reflected in the eyes of the driver which causes discomfort and increases the chances of accident. Smart poles are the ones which have components such as LED display, Smart LEDs, light intensity sensors, Wifi, Telecom carriers, ECBs etc. Ordinary poles need recharging of the batteries frequently but smart poles have their own power chargers situated on them. These power chargers store the solar energy and then use this solar energy to charge the LED lights. Smart LEDs adapt to the level of luminance signaled by the luminance sensors and they go on and off based on the sunlight availability. The primary advantage of using Smart LEDs are that they do not get reflected in the eyes of the driver. This prevents accidents which occur due to the distraction cause to the driver because of the intensity of light.
principle of self-charging using its own power bank also lessens the use of electricity from other external sources. Figure 3.2.1 shows typical smart pole.

![Smart Pole](image)

**Figure 3.2.1 Smart Pole**

### 3.3 Installation of CCTV Surveillance

Twenty-four hours monitoring of the city is the need of the hour as the road chosen to develop is the busiest road of Nashik city. Since the road is connected to the highway and has lot of important buildings (hospitals, schools, sessions court etc.) adjacent to it. Due to these reasons, there is frequent traffic congestion not only during peak hours but also at other times of the day [7]. Women security issues all over the country need to be dealt carefully and installation of CCTV is one step towards this. In case of an accident on the road, CCTV footage can help the person sitting in the control room to alert the medical help within a short duration of time. Traffic offenders, speed limit violators can all be monitored using the CCTV surveillance. These CCTVs can be installed on the Smart Poles in order to get the entire view of the road. Traffic congestion in a particular area of the city can also be monitored and adequate steps can be taken in order to decongest the area.

### 3.4 ECBs and Panic Buttons

Emergency Call Boxes (ECBs) can be used on the road in order to make the communication between the people (motorists, pedestrians) and the authorities (police stations, hospitals etc.) better. For instance, if there is an accident on the street, then people need not waste time in searching for the contact details of medical help. The ECBs already have all the required contact details which can be activated using codes mentioned on the instruction plate of the ECB. Using ECBs, the person who has been injured can receive medical help much quicker than expected. Moreover, ECBs and CCTV surveillance can be interlinked together. Interlinking of ECBs with CCTVs is a modern day idea of making women security even more stronger. Modern day call boxes have sensors which are programmed using software which detects sound. Certain words like “HELP” said at certain decibels by the person in trouble are detected by the sensors and the alarms get initiated. The nearby police stations or even the nearby residents can reach the spot to save the person’s life [1]. Even if the culprit tries to escape spot, he can still be captured on the CCTV surveillance due to the interlinking between ECBs and CCTVs. Theses ECBs can be installed on the Smart Poles or can be accommodated separately on the road. Panic Buttons can be installed on the Smart Poles. Either ECBs or Panic Buttons or both can be installed together. In panic buttons, the person just has to push the button which will initiate the alarm to the nearby police stations. One of the drawbacks is that people might try to create
false alarms by pushing the button repeatedly. But interlinking of the button with the CCTV surveillance solves that issue as well.

### 3.5 Adaptive Signaling and E-Challans

The road chosen to be developed connects the main city to the highway and faces a problem of traffic congestion. Nashik city as a whole, also experiences a lot of traffic congestion especially during the peak hours. Adaptive signaling is a technique using which the person sitting at one place can monitor the traffic movement in the entire city. For example, if there is traffic congestion at point A and there is no traffic at point B, then the person sitting in the control room can change the red light to green at A till the traffic gets cleared. Simultaneously, he can change green light to red at point B for certain period of time till the traffic at point A gets cleared. In this way, traffic of the entire city can be diverted from one point to the other using adaptive signaling. This can be one of the best solutions in cities where traffic congestion is the biggest problems. Traditionally, ‘challans’ were provided to the traffic violators manually using pen and paper. This consumed a lot of time as well as people learnt how to tackle the traffic police and escape after violating the traffic rules. Electronic Challans (E-Challans) are the modern day solutions to such issues of traffic violation [9]. Whenever there is an instance of traffic rule violation, red light violation, speed violation etc., Automated Number Plate Recognition system (ANPR) can be used. The ANPR system has a camera which captures the image of the offender’s vehicle. It converts the captured image into the car registration number and then by integrating with the RTO (Regional Transport Office) database, sends E-Challan to the person owning the car. This will not only save the time of writing the challan but will also reduce the chance of people escaping after violating the rules of traffic.

### 3.6 Implementing E-Toilets

Improper sanitation and defecating in open increases the risk of groundwater contamination. The toilets which were implemented earlier by the Government lacked sanitation, hygiene, clean water. Moreover, those toilets used water from the water line which was provided for public use. There was no proper disposal site available for those toilets and they lacked proper management. Nowadays, the Government of India has launched several Electronic Toilets (E-Toilets) in order to solve the problem of sanitation. These toilets are self-cleaning toilets which have been provided a proper sewer line. The waste from this toilet passes through the sewer line to the sewage disposal site. These have been proposed to be connected to the public transport systems. The main advantage of using E-toilets are they are sanitized [5], self-cleaning and do not use the water from the line provided to the residents.

### 3.7 Variable Message Displays

There are a lot of upcoming projects in a developing city like Nashik. During these projects, there have to be a lot diversion sign boards for the vehicles to pass safely. There is no advance notice to the drivers of the vehicles to follow the diversion or to change the path due to construction work on the road. This results in traffic congestion at a single point. At such times, Variable Message Display boxes can be used in order to notify the drivers well in advance about the event. These variable message display boxes are boxes which are installed few meters before the event is taking place [8]. They can have commercials, information about events, warnings about danger, information about the construction work going on ahead, etc. So, the traffic congestion which arises due to no prior notice can be avoided using message display boxes. Public Announcement Systems can be installed on the smart road in order to notify the vehicles and pedestrians about any events. If public announcement systems are linked with CCTVs and ECBs, then it can help in the public security as well. It can be used to create an alarm among people whenever an accident has occurred. It can be used to notify the people about any kind of danger which is foreseen.
4. CONCLUSION

Smart city aims to improve the quality of the citizens’ life where the different service providers can work together which otherwise work in silos. Modern day ICT components will solve many issues of Nashik city. Traffic congestion will be reduced at a great extent using adaptive signaling. Repetitive offenders and traffic violators will reduce due to the E-Challan system. The utmost concern regarding the security of women in India will also be solved greatly using CCTV surveillance, panic buttons and Emergency call boxes. The design of smart road will provide much more flexibility to the road and will result in smooth functioning of the road. Since, smart road is a multipurpose road, the issues such as illegal parking of vehicles, encroachments of hawkers etc. will be forbidden with strict norms. This will result in betterment of the transportation of the city. 3D speed breakers will ensure the number of speed violators and number of accidents are reduced. The implementation of smart city project in India will change the standard of living for the people. It will also make sure that Metropolitan cities like Mumbai, Delhi etc. are not overcrowded by constant migration of the people from under developed cities. The development of a smart city will also lead to rapid growth of industrialization.

REFERENCES