Hightech Motorway

Sparsh Gairola[1], Kartik Rana[2], Shubham Lad[3], Prof. Sangeeta Kulkarni[4]

[1,2,3,4]K. J. Somaiya School of Engineering

Abstract

Nowadays, our chosen mode of transportation not only saves from A to B but also makes our lives easier and our journeys more enjoyable. Therefore, our infrastructure needs to help us. There is always room for improvement in communication, communications and vehicle safety. Highways and smart roads are the result of many different proposals to incorporate technology into systems operating in private vehicles, lighting and road monitoring. This new concept creates a great travel experience for riders, cyclists etc. The ideas from this test site become a growing part of our daily environment. Intelligent travel systems often focus on the use of data and correspondence innovation in the field of street transport, including foundation, vehicles, clients, travel management and vehicle management and incorporation with different methods of transport. This clearly shows that the journey can be smarter, more cohesive and sustainable without widening the roads or setting up additional rail connections. It's just a matter of setting priorities. This paper explains the need for smart highways, its benefits over conventional highways, the latest technology and technology used on smart highways and how this leads to a sustainable and attractive environment. It starts with the evils of common highways and how smart roads provide a solution to all problems. Problems such as the need for smart highways and the fact that Indian highways can be smart are also properly addressed. Finally, the paper concludes with the future scope of Smart Highways.

Keywords: Image processing, Machine Learning, Automation of Toll Deduction

1.   Introduction

1.1   Smart Highway concept is a mechanism of advancement in the field of Roadways of a country. The features used in this concept are useful in todays world and leads to automation of things. Ideas used in this concept are helpful in conservation of energy, and auto tolling of vehicles.

1.2   The energy that is conserved today can be beneficial tomorrow. Auto dimming of street lights is another way which is helpful in conservation of energy. In this method, the energy saving is done in such a manner, that the needs get fulfilled in minimum energy consumption. This method use LDR sensors which turn ON the lights in dark and turn back OFF in day time. Also when no vehicle is on road, the lights are ON with 30% intensity only, hence saving 70% of energy. If any vehicle comes, the motion sensors detect the vehicle and changes the intensity of light to 100% only for 5 seconds. In this way, a large amount of energy gets conserved.

1.3   Travelling through roads is a time taking journey, but it becomes more time consuming when there is a long queue of vehicles on the toll plazas. To reduce this toll deduction time period, Smart

highway uses high definition cameras installed on the entry and exit gates of highway. These intelligent cameras use the concepts of machine learning and deep learning, and identifies the vehicle's license number plate at entry as well as exit gate.Based on distance travelled by vehicle, the toll is generated and auto deducted from owner's account as soon the vehicle exits from the highway. The concept is further useful in identifying the authenticity of vehicles that are going to enter over the highway.

2. Literature Review

Indian urban areas and urban areas around the globe are bit by bit advancing. It's anything but an unexpected choice with arranged framework ahead of time. The idea of Smart City has recommended in an arranged interstate, with such effect that every movement completed in the city is regulated and constrained by innovation. Web of things is an arising innovation in the IT world that can be investigated to its peak to accomplish the objective of building a savvy city. Building alone isn't sufficient, yet to keep up and continue their character. The uprightness and genuineness is another errand to be prepared and actualized. As an improvisation to this innovation, some of the advance techniques includes:

2.1 Ravi Kishore kodali and Subbachary Yerroju presented a paper on Energy efficient smart street light. [1]

2.2 Bilam Roy has proposed a street light optimizer [2]

2.3 Prakash developed an Insightful Street Lighting framework for brilliant city based on IoT. [3]

2.4 Dhiraj sunehra has presented an Automatic Street Light Control system using Wireless Sensor Networks. [4]

2.5 Farid et al (2013) introduced a pragmatic arrangement dependent on clever and powerful framework for a field of hyper aridity. The framework comprises of an input FLC that logs key field boundaries through explicit sensors and a Zigbee-GPRS far off observing and information base stage. The framework is sent in existing dribble water system frameworks with no actual alteration. FLC gets information from these sensors and fluffy standards are applied to create proper time and span for irrigation system.[13]

2.6 In the brain research writing, Wilde (1982) takes this contention to an outrageous with his hypothesis of danger ho- meostasis. He contends that people embrace a fixed objective degree of casualty chance and change their driving likewise.[15]

2.7 The Automatic Crash Notification (ACN) framework is a viable innovation to diminish the accident reaction time, improve the degree of post-mishap save and ease the seriousness of wounds. It manages a programmed mishap iden- tification framework including vehicles which sends data about the mishap including the area, the time and point of the mishap to a salvage group like an emergency treatment focus. [17]

2.8 ANPR system in worked on Indian number plates. The paper proposes a method of localization and recognition us- ing MATLAB. Indeed, the proposed programming module begins by dissecting the information picture, at that point recognizing the area of the plate. Segmentation step of the character is then applied to finally recognize characters. A summary of the ANPR systems related works where the

accuracy results were between 85% and 97.19% is de- scribed. But, no results are mentioned for the proposed ANPR systems. [27]

2.9 Kurdi and Elzein introduced an approach of ANPR with neural network optical character recognition (NNOCR). This innovation permits perceiving of Lebanese tags with day and evening time pictures. The proposed technique measures accuracy about 96 % of the system. [29]

3.   Problem Statements

3.1 Electricity wastage during the time of darkness when no vehicles are on the road.

3.2 Fixed toll charge even for the vehicle which has covered very less distance.

4.   Proposed Solution

4.1 Auto dimming system of street lights

Electricity wastage during the time of dark when no vehicles are on road. The problem can be rectified by using the concept of auto dimming. Actually the street lights will glow at 30% intensity all the time. It can be implemented by applying motion sensors on the street light poles. The sensors will detect the approaching vehicle and then accordingly glow the particular street light at 100% intensity for a few seconds. After the vehicle passes away, the lights will again come back to their original level of glow i.e 30%.

4.1.1 Motion Detection: A motion detection sensor will guarantee that the lights possibly light up when movement is distinguished.

4.1.2 Microcontroller: The microcontroller is a processing unit in this case. It performs following functions:

•   Process Data: The data must be processed by it that is coming as input.

•   Control Output: This yield controls the power of the light as indicated by the consequences of infor- mation handling.

4.1.3 Control: Intelligent algorithms will be utilized to adroitly control the lights to react rapidly to the necessities of street clients.

4.1.4 Indeed, even Energy Consumption: Adjusting the light degree of the lights presents the issue of incon- sistent energy utilization that adversely influences the utilization of deliberately anticipated energy or- ganizations. This is essential to deliver the perfect measure of energy, for example, to stay away from over- production or shortage. Our answer intends to react to this by utilizing a calculation that progressively con- trols the organization to keep up force utilization.
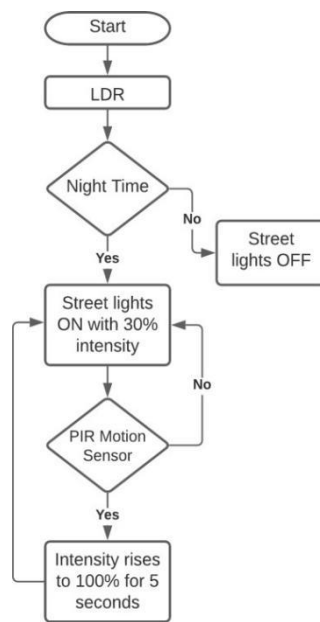
Figure 1: Flow chart for Auto Dimming System
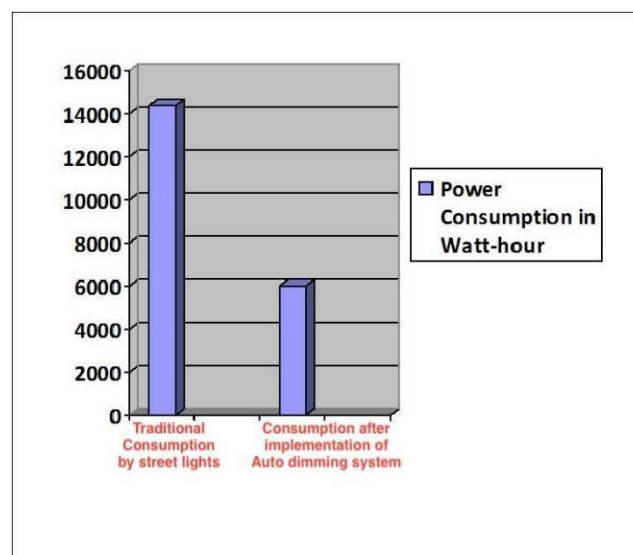
Components Used :

Figure 2: LED

Figure 3: IR Sensor

Fig 4 : Comparision before and after implementation

4.2   Smart Tolling system with Vehicle Identification

The entire ANPR system is based on three main phases. NPL includes image processing and computer vision algorithm to locate and place the license plate. The CS contains a character set on the detected plate. OCR uses the DL method to identify the plate number. The following paragraphs provide details of each step. TheThe proposed NPL algorithm is provided by Fig. 3. It starts with the previous image. Contains a blurry image with a dual filter to remove noise caused by capture or transmission. A comparative study of many other filters was performed prior to the implementation of the selected filters. Using a personal photo database, the two-country filter parameters were adjusted accordingly. The blurry image is gray and measured using OpenCV library functions.

The next step in the proposed algorithm is the detection of a gray image to separate the interest region, which is a license plate. Many filters are used in literature. Some of them have been tested in this work, in order to finally choose a border filtering method because of its simplicity and its effectiveness in this photographic case. The boundary filter consists of replacing each pixel in a gray input image with a black pixel if its size is less than the maximum limit, or a white pixel if the image size is larger than the limit value.

Depending on the choice of the fixed limit value, sudden variations can be detected by the OpenCv function. In fact, the potential for number plates can be determined by looking at the roads found. The remaining areas in the image are filtered. However, not all lines found represent the plate number. Therefore, the proposed algorithm has identified two difficulties in selecting the right cycles and eliminating all false positives. Accepted limits are given for two tests.

Figure 5: (a)

Figure 5 : (b)

Figure 5 : (c)

Figure 5 : (d)

Figure 5: A test image NPL and detection steps: (a) Original image. (b) Gray scaled image with blurred effect. (c) Threshold image. (d) Contours detection.

Fig 6 : Plate extraction and filtering

Components used:

Figure 7 : Camera

Working:

4.2.1 As soon the vehicle enters the highway, the camera installed at the entry gate scans the vehicle's plate.

4.2.2 The licence number plate image is then passes

through the respective machine learning and deep learning algorithms.

4.2.3 This license number is stored in highway's database with the corresponding entry gate name.

4.2.4 Now, as the vehicle exits the highway, it again gets scanned with the gate name from which it exits.

4.2.5 Based upon the distance between entry and exit gate, a toll is autogenerated for that particular vehicle.

Results:
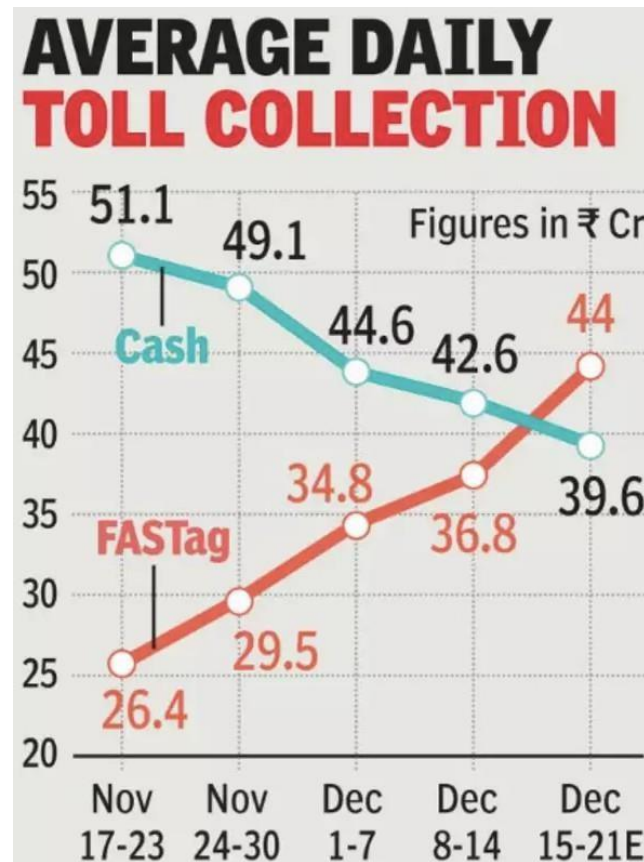
Fig 8: Average toll deduction by conventional as well as RFID based method.

Fig 9: Database maintained based upon the incoming cars scanned at the entry gate

5. Future Implementations:

5.1 Near-Term:

5.1.1 Deploy your system at a small toll booth or university/private road as a pilot.

5.1.2 Send SMS or app notifications when tolls are deducted.

5.1.3 Create daily reports in your Django admin dashboard.

5.2 Mid-Term:

5.2.1 Integrate AI models to classify vehicle types (2-wheeler, 4-wheeler, truck) and charge accordingly.

5.2.2 Link with UPI/Fastag/Bank accounts for seamless deductions.

5.3 Long-Term:

5.3.1 Connect to GPS, IoT sensors, and drones for wider coverage.

5.3.2 Improve cybersecurity to protect user and vehicle data.

5.3.3 Collaborate with government or private highway operators.

6. Conclusion

In this project we made a highway that gives the user a better experience in terms of facilities, safety as well as less time consumption. The features added to this highway are enough smart in themselves for proper functioning of the whole system in a smooth manner. The real time updates of highway to the sever room, helps the authorities to take instant decisions.

7. Acknowledgement

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