Automated Toll Management System

Nimritee Sirsalewala[1], Divya Bhosle[2], Sai Narayan[3], Sumit Jha[4]

[1-4]Computer Department, Watumull Institute of Electronics Engineering andComputer Technology, Ulhasnagar, India

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Abstract - *According to the recent study conducted by The Transport Corporation of India, 27000 crore rupees goes up in fumes due to time wasted at a toll plaza. Excess of fuel consumption is caused due to vehicles having to stop for considerable amount of time waiting for change or due to manned operation at the toll booth creating traffic jams. Automated Toll Management System aims to overcome the massive waste of fuel and time by eliminating the use of barricades which will allow vehicles to pass Toll Pointswithout having to stop at all. Our proposed system keeps track of all the vehicles that pass through, recording the time, vehicle details etc. It also has a Report Generation Module that enables the Tolling Authorities to keep track of the number of transactions. This system also has some other features like notifying Enforcement Authorities about doubtful vehicle behavior. Considering how important it is to ensure a smooth transition from a manned to fully automatic system, our system also provides required features for the same.*

***Key Words*: RFID Tag, Vehicle, FASTag,Electronic Toll Collection, OCR, Number PlateRecognition**

1. INTRODUCTION

Currently, there are a lot of toll plazas currently working manually. This way of collecting toll is time consuming. Where the vehicle owners or the drivers are supposed to stop the car at the Toll Plaza and then pay the amount to the toll collector standing next to the toll booth, after which the barricade is opened either mechanically or electronically for the driver to pass through the toll station. These halts, on well laid highways, bridges with sudden breaks, results in wastage of precious fuel. Another issue is that a team is needed to handle cash and even time is wasted when the driver has to wait for getting the change. After paying the tariff, a receipt is provided and in case of connected highways or return journey one needs to preserve the ticket, which is again very tedious. There is even a possibility that one may escape the toll plaza without paying. Considering a situation where the manual toll collection system is very efficient. Let's assume the time taken by one vehicle to stop and pay the toll is 50 seconds. This 50 second includes where the car stops, pays the toll and then leaves the toll plaza. So, with 50 seconds of an average stop time of 1 vehicle for one day, if the same vehicle travels every day for a month, he spends around 1:40mins x 30 = 50mins just at the toll.

Yearly total time taken=50mins x 12=600mins = 10hrs.

On an average each vehicle that passes through the toll plaza has to wait 10.0hours, keeping their engines turned on. This figure is staggering. Now, if we assume that on an average 200 vehicles pass through the toll plaza each day, then yearly 73000 vehicles pass through the toll plaza. So, each year 73000 vehicles are spending 10.0 hours on toll plaza with their engines on and thereby aiding pollution and wasting fuel and money.

Table -1: Comparison of various system

Factors affecting Toll Plaza				
	Ongoing System	RFID	FastTag	Pay By Phone
Time Consumed	More	Moderate	Moderate	Moderate
Wastage of Fuel	More	Less	Less	Less
Processing	More	Moderate	Moderate	Moderate
Payment Mode	Cash/Card/Wallet	Card/Wallets	Card/Wallets	Card/Wallets

Our application makes use of *RFID chip*. RFID chip is capable of carrying around 2,000 bytes of data. The RFID device behaves in a similar manner to a bar code or a magnetic strip on the back of a credit card or ATM card; it provides a unique identifier for that object. The way barcodes or a magnetic strip is scanned to get the information, in the same manner, the RFID chip is also scanned to retrieve the object's information.

Today, there are several wireless technologies that are being used to build wireless networks. Among them, the 2.4GHz wireless network is most widely used. As the data collected by the RFID readers is accurate and it also does not take more than a few seconds to read a product. This helps to reduce the amount of time taken to count the stock by a large number and can also easily store them at the designated location. The designated location. Advantages of RFID TAGS:

- Saves fuel and time.
- SMS alerts for transactions.
- Online recharge
- No need to carry cash.
- Web portal for customers.

2. PROBLEM STATEMENT

This application targets to solve two biggest shortcomings of the existing Toll Management Systems:

1. Excess of fuel consumption caused due to vehicles having to stop for considerable amount of time waiting for change ordue to slow manned operation at the tool booth.
2. Since the process of generating tickets at the booth is manually done, it opens up windows that allow corporators to not account for all the vehicles that pass through the toll gate.

The problem with the existing TMSs is that in addition to creating jams, it also results in a lot of wastage of fuel. Also, India's toll checkpoints are an open ground for corruption. InMumbai, Thane and Raigad alone, there is a corruption ofRs. 5000 crores at the toll nakas. This number can easily jumpto 10000 crores, and we are not even talking about the wholecountry. This situation has arisen because the TMSs in use right now have so many loopholes that allow for the booth operators to let vehicles pass without having to generate anyreceipt. Our proposed system eliminates any chance of thesame. Both the above-mentioned drawbacks can be overcome by simply automating the process of toll ticket generation.

3. ALGORITHM

3.1 Automated Number Plate Recognition (ANPR) Algorithm:

ANPR is used to store the images and the text from the license plate which are captured by the camera and with some configurations, it can also store the photograph of the driver. The application commonly uses infrared light which allows the camera to take a clear image at any moment of the day. Among those applications, ANPR is one of them. ANPR technology is a region-specific application, because of the plate variation from place to place. ANPR uses Optical Character Recognition (OCR) to convert the images to texts. Some license plates have variations in font sizes and their positioning. ANPR systems must be able to overcome such differences in order to be truly effective. The cameras employed, can contain existing road-rule enforcement or closed-circuit television cameras as well as mobile units, which are usually attached to vehicles. Primarily, there are seven algorithms that the software requires for identifying a license plate:

1. **Plate Localization**: with the help of it we are supposed to find the plate as well as isolate the same.
2. **Plate orientation and sizing**: with the help of it we are supposed to adjust the dimensions to the required size.
3. **Normalization**: with the help of it we are supposed to adjust the brightness and contrast of the image.
4. **Character segmentation**: with the help of it we are supposed to find the individual characters on the plates.
5. **Optical character recognition**: It is responsible to extract text from the recognized number plates and it matches the License Plate Number hence extracted is matched with the License Plate Number obtained from scanning the RFID tag of the vehicle. When these numbers are a match, it is labelled normal.
6. **Syntactical/Geometrical analysis** – Responsible for checking characters and positions against the country specific rules.
7. Taking the average of the recognized value over multiple fields in order to produce a more reliable or confident result. Especially since any single image may contain a reflected light flare, be partially obscured or other temporary effect image may contain a reflected light flare, be partially obscured or other temporary effect. A median filter is also used to reduce the visual noise on the image.
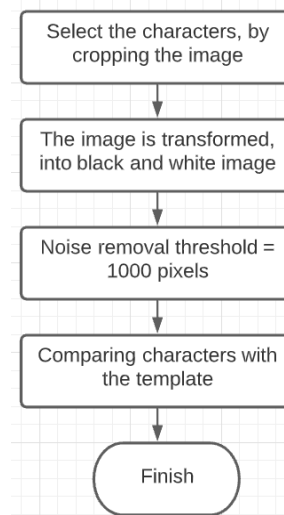

Fig. 2: ANPR Algorithm

3.2 Number Plate Segmentation

Segmentation is the process by which we separate each number or letter on the number plate so as to process them further one by one. There are different methods that can be used for achieving this. One of them is by creating bounding boxes such that the areas containing the connected objects are separated. Since a letter or a number would represent one connected object, a bounding box is created around each object. To Prevent too small or large connected objects in one bounding box, a condition regarding the minimum and the maximum size of a bounding box should be defined. These methods of selecting just the numbers and letters has been found by trial and error method.

4. PROPOSED METHODOLOGY

The system has three major components:

1. **Customer Service Portal**: This is where the Vehicles will be registered, and customers can view their wallet balance, fill their wallet with money. The CSP Systems are set up in till plazas where RFID tags will be generated as soon as the registration process is completed.

2. **Ticket Generation**: This component does not have high UI Requirements; it might as well run without any interface at all. The information received from the other modules is fed into this module after a vehicle passes through the toll gate. Data is then transferred to the database which aid in the report generation method, and then also used in the payment gateway.

3. **Report Generation**: Since every toll both has to maintain records of the vehicles that pass through them for accounting, and security purposes, Report Generation is an important component. This module provides well compiled reports based on number of vehicles that pass through the toll gate every day, Classes of Vehicles. This is where the toll prices are set and vehicle class management is done.

Fig -3: Proposed System Architecture

5. CONCLUSION

Realizing the importance of resources like fuel, time and money and considering how other countries manage their tolling systems, it is inevitable for TMSs in India to adapt to changing times. With the technology available to us, it is easy, necessary and definitely possible to upgrade our functioning TMSs. This system is a giant leap since the deduction of money is automatic, every vehicle that passes through must be registered and if not, the system will flag all such vehicles and they will have to pay later on. If a user fails to get himself registered for a long time, they will be sent a warning letter by details registered through a centralized website, that notifies the authorities who either send the generated RFID tags to the user or the user collects them from the toll plaza. As mentioned earlier, since this system is a huge leap from the existing System, the transition period is very crucial. Necessary measure must be taken to ensure speedy acquisition of RFID tags and dealing with defaulters. Once the initial period passes, it's going to be a smooth ride ahead. Since the database will be centralized for all the Toll Gates, multiple registrations are not required.

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