Automated Toll Payment using Android Phone

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Abstract: *Heavy traffic congestion occurs on almost all toll plazas leading to a waste of resources of fuel, energy and time. This waste can be easily avoided by paying toll in advance using an android application for toll payment. People can select the route in advance even before starting their journey and the toll plazas on the route will be automatically detected. A confirmation message will be sent via short message service (SMS) to the mobile number linked with the vehicle number. The cameras at the toll booth will capture images of license plates and a license plate reader system will recode photographs and the license plate numbers of all vehicles. Thus, the vehicles won't have to stop at all for toll payment which would greatly save time and effort.*

I. Introduction

The main issue in toll plazas is the unending queue and the resultant traffic congestion. This queue occurs mainly because the arriving rate of vehicles is much higher than the servicing rate. The congestion is caused due to the vehicles stopping completely at toll booths for toll payment. This leads to an inane waste of time, easily avoidable fuel consumption and air pollution caused by the vehicle exhausts. Using an app to pay in advance for the toll offers to ease up these issues as the vehicles will not stop completely. The worst case scenario would be slowing down of the vehicle, and not a complete stop. This will also stop the excessive fuel consumption caused by waiting in unending lines and reduce the consequent air pollution. In case a vehicle passes by without paying first, a receipt similar to the one which is generated on flouting of traffic rules will be sent to the user's mobile number associated with the vehicle.

II. Material And Methods

Product requirements:
1. Making toll payment online
2. Paying toll before commencing the journey or while traveling
3. Secure payment gateway

Features:
1. Easy navigation
2. Uncluttered appearance
3. Real time detection of toll booth/s in the chosen route

Limitations:
1.In order to avoid surveillance or penalty charges, there could be an upsurge in car cloning. This is usually achieved by copying registration plates from another car of a similar model and age. This can be difficult to detect, especially as cloners may change the registration plates and travel behavior to hinder investigations.
2. Near infrared light could be used to make the license plate unreadable to license plate recognition systems.
3. The storage of information that could be used to identify people and store details about their driving habits and daily life. It could be misused to monitor people's habits and create an opportunity to arrest them.
4. The safety of the equipment, i.e., the ALPR camera cannot be guaranteed considering the prevalent disregard for discipline. Hence, efficiency of the system can be drastically hampered.

Feasibility study:
1. Technical Feasibility - This project is technically feasible as the technical resources meet capacity and the technical team is capable of converting the ideas into working systems. The hardware, software and other technology requirements of the proposed system are fairly easy to obtain.
2. Legal Feasibility - The project may have conflicts with legal requirements like data protection acts if there is no stringent security in place.
3. Scheduling Feasibility - The project is going according to the planned schedule.

Hardware requirements:
1.Android Phone
2. ALPR Camera

Software requirements:
1.SMS and Payment Gateway
2. SQL Database

Procedure methodology

Paying toll has always been a cumbersome process resulting in long queues. Using this user-friendly app, commuters can pay toll without having to wait in queue at the toll plazas. To avail the app facility, commuters will have to first download and install the application on their phones or tablets. Thenthey have to enter the travel details which include the source, destination, and date of journey and the vehicle license plate number.The vehicle license plate number is used as the commuter's unique id. This helps to maintain clear information about the travel details of the user. Payment can be done via credit cards, debit cards or net banking. Once this information is submitted, it gets stored in the toll database. When the user approaches the toll booth, the ALPR camera will recognize the license plate and check its details automatically. The details about all the vehicles passing through the toll booth will be stored in the database.When the database details don't match with the vehicle recognized by the ALPR camera, the commuter will get an SMS for toll penalty on the mobile number registered with the vehicle license. Thus, when this occurs, the registered user will get a notification about their vehicle passing through the toll plaza. This will drastically improve security as the police can be notified if the said vehicle has been involved in any malpractices.

III. Result

Project design:
Application creation:
1.User downloads and installs the application.
2. User inputs information such as registered mobile number, name, vehicle number, vehicle type, type of journey and location.
3. Depending upon the source and destination of the user, the cost for passing all the toll plazas present on that route will be displayed.

Diagram no. 1: Vehicle Details[7], [8]

Payment session:
1. The total calculated amount from the source to the destination is displayed.
2. The amount can be paid through debit or credit card, net banking or any other online mode of payment.

Diagram no. 2: Source and Destination[7], [8]

Diagram no. 3: Payment Session[7], [8]

Confirmation of payment and validation:

1.After confirming payment, an SMS will be sent to the registered mobile number.

2. The vehicle information given by user is validated for toll booth process.

3. Thus, when a vehicle passes through the toll booth, the ALPR camera recognizes the license plate and validates whether the payment transaction has been completed.

4. If a vehicle has not paid the toll and still passes through the toll booth, then an SMS of penalty will be sent to the registered mobile number.
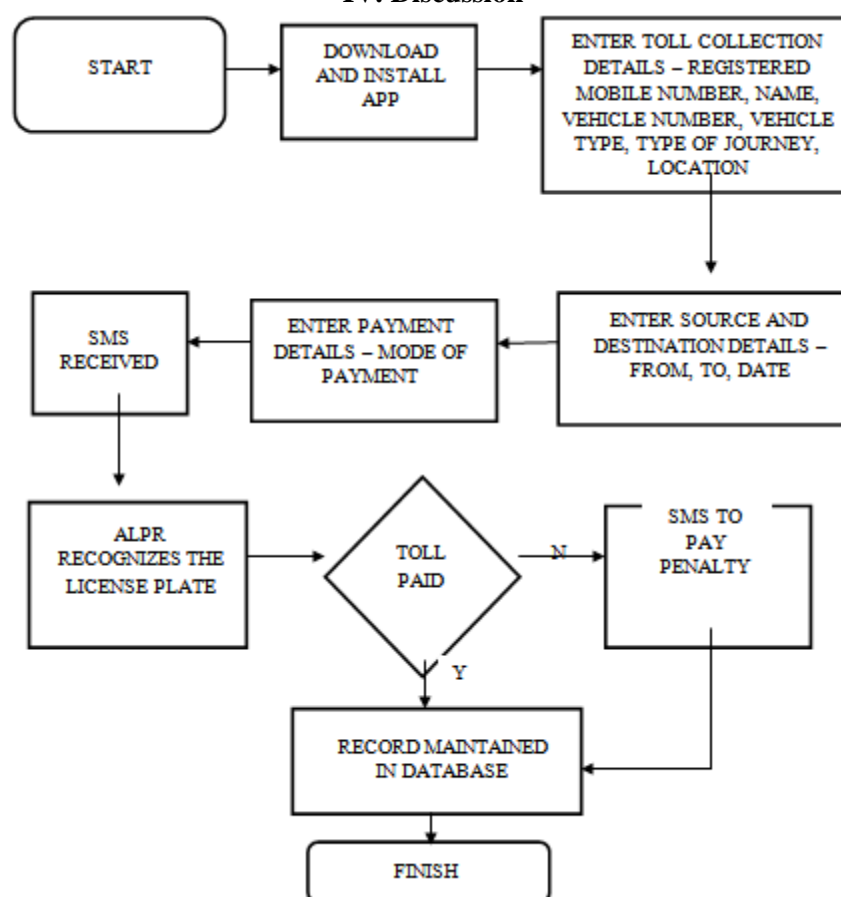
IV. Discussion

Diagram no. 4: Work flow of the application

V. Conclusion

The proposed system uses less cost to implement and requires fewer changes to the current system. It provides the tracking system for theft vehicle which is secured and highly reliable. This system can help to achieve proper traffic management, appropriate toll collection and improve security. Thus a system used as an Automated Toll collection booth, based on payment through Android application saves time at toll booth and minimizes the fuel consumption of the vehicle. Thus, it is also more environmental friendly. This system can also detect vehicle theft which increases security and provides high reliability. It can be used to overcome all drawbacks with the current system such as excessive time consumption and human efforts.

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