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A Survey on Smart Toll Collection Management System with Security

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Abstract: Internet of things aids in exchanging data between two or more physical objects using sensors, softwares, electronics and connectivity. There is an increase in the number of toll plaza with the significant development in highways. In this survey, we address the complications faced in toll plaza through automatic electronic toll collection. This enhancement allows vehicles to pass through the tolls thus eliminating the need to wait. In addition also elaborates the security issues and their possible solutions.
Keyword: RFID, Electronic toll collection (ETC), Automated vehicle identification(AVI), Security, Global Positioning system(GSM), GPS.

I. INTRODUCTION

India still follows manual collection of tolls leading to traffic congestion and waste of time and fuel. To overcome this issue, an electronic collection of tolls has been introduced, which is currently followed by several countries around the world. Electronic toll collection (ETC) is a technology that enables automatic toll collection. Automated vehicle identification (AVI) is the process of determining the identity of a toll-prone vehicle. Most current AVI systems rely on radio frequency identification where an antenna at the toll gate communicates via Dedicated Short Range Communications (DSRC) with a transponder on the vehicle. RFID tags proved to be extremely precise and can be read at highway speeds. An alternative to RFID can be Global Positioning System(GPS). Instead, the system uses the location information of the Global Positioning System to identify the location of a vehicle on a tolled motorway. The implementation of this system proved to be much longer and more expensive than expected. This survey paper mainly exchange views on security related issues faced in toll ways and provide possible solutions to overcome the situation.

II. RELATED WORKS

A. High Security Electronic Toll And Traffic Management And Road Pricing System Using Encrypted Messages And Personal Identity Number.

Cryptographic techniques and personal identity numbers (PIN) features to ensure complete privacy, security and applicability to both open and closed toll systems and prepaid/postpaid transactions. Traffic congestion on Japan's motorways has caused a number of major social problems, which have disturbed the vital economy, caused air pollution, and so on. The ETC systems are expected to provide a solution. Mitsubishi Corporation and Amtech Corporation of the United States have jointly developed the next generation automatic ETC system, which we call Dynicash, to meet critical social needs. The Roadside Charging Station (RCS) consists of a single enclosure that fully integrates the antenna, RF module, interrogator, cryptor (cryptographic device) and power supply functions. The IVU (In Vehicle Unit) is a passive two-piece type tag used in this system. It consists of the IVU tag itself and a removable smart card and also a keyboard, buzzer and LED display user interface. Here, a patron can prevent theft by entering a PIN (Personal Identity Number) after each insertion of the card into the tag using these interfaces. In a pre-payment mode, Dynicash does not record or reveal the identity of the tag or card during the payment process. Therefore, the payment history, destination and other related transaction data used in automatic toll communication are not tracked, ensuring full privacy. Security, as implemented in Dynicash with encryption algorithms, guarantees fraud against both toll agencies and employers. Dynicash also affords electronic cash, whose value can be recovered if the card is lost or stolen. This system uses ISO-compatible smart cards for multiple applications that enable the user to use the same smart card and IVU for non-toll applications such as parking, public transport, sales machines, etc. The very fast transaction time allows vehicles to normally pass through toll gates at speeds up to 180 km /h.

B. An Advanced Security System Integrated With RFID Based Automated Toll Collection System.

Many crimes occur on highways and bridges in developing countries. We have introduced a security feature in this paper that can resist these crimes. The RFID reader only detects the RFID card in the existing automated tolling system in order to deduct the toll amount according to the vehicle type. In the proposed system, If the authority wants to block a particular type of vehicle or vehicle,

it can be done in our integrated system at the toll booth area. This is done by sending a code to the system with the help of GSM module and thus the vehicle is blocked by not lifting the barrier even after the amount being deducted from the user's prepaid account. This system would not let the criminals cross through the toll even when the amount is paid. The system basic requirements are RFID and a GSM module and thus to acutate the system, every vehicle should hold a RFID tag. As the purpose of RFID is unique identification, we can register and hold the details in the database, thus the user's are easily identified and the vehicles with duplicate number plate can be ceased. However, a RFID tag or card reader is placed at the highway or bridge toll collection booth that can detect the RFID tag. Whenever the vehicle enters the toll collection area, the reader immediately scans the tag and identifies the vehicle type and deducts the amount of the toll from the prepaid account of the vehicle owner. The vehicle owner will be immediately informed by a confirmation text message of the deduction. After all these steps have been performed, the system will check whether the authority has received any message to stop the vehicle from passing the stand. If so the authority will send a code text which will block the vechile by not lifting the barrier even after the payment. Now, if the police need to block all vehicles in the toll booth area for any type of checking purpose, another code text message can also be used. This paper projects the embedded system to ensure a faster toll collection system and security feature that will make a significant contribution to stopping crimes on roads and bridges. It will also ease the police authority 's work in catching a criminal. The system carries out the entire task by processing the data received from the police authority via the GSM shield.

C. Automated Toll Collection With Complex Security System.

The paper deals with the automated toll collection system using active RFID tags in which the vehicles pass through a sensor system which is embedded on the highway just before the tollgate. The system classifies the vehicle electronically and calculate the exact amount to be paid by the owner of the vehicle which ensured that the toll amount is not pilfered. Owners of vehicles, who frequently passes through tollgates, must use an automated smart card reader to deduct the appropriate amount. The core technology of ETC was realized using RFID wireless communication from theoretical and experimental analysis because the outdoor prototype system for short-It is also carried out that the data exchange between terminal software and system control center is completed. Then the logical design phase 's business functions and system requirements are achieved by the desired objectives. The amount is debited automatically from the user account .Hence the traffic can be avoided at the toll gates and users can pass through the toll gates without waiting in a queue. wireless infrared communication which was designed and implemented in a way to built a software. It is also carried out that the data exchange between terminal software and system control centre is completed Then the logical design phase 's business functions and system requirements are achieved by the desired objectives. The amount is debited automatically from the user account .Hence the traffic can be avoided at the toll gates and users can pass through the toll gates without waiting in a queue.

D. A Context-Aware Approach for Enhanced Security and Privacy in RFID Electronic Toll Collection Systems.

Smart toll collection system are flourishing across the world to avoid traffic congestion and promote user-covenience. While using such systems security and privacy issues are to be taken into account. This survey paper makes use of sensing technologies to eradicate security issues. This survey makes use of on-board sensors for the collection of contextual information for Rfid tags which is further uses context aware mechanism for toll cards. It comprises of Rfid toll tags inscribed over windshield in vehicles and readers mounted at toll-booths. Transponder which is a wireless device stores information about identifying unique tags. Interrogator is used to check tags holding their identification information. Since Rfid tags can read precisely even fast moving vehicles need not wait in toll queue. This paper uses sensing technology for addressing unauthorized information and relay attacks. Thus aiming to restore the efficiency to enhance privacy and it improves the overall user experience. The proposed system makes use of the speed and location information for designing the speed-aware and location-aware unlocking mechanisms. Since it completely depends upon GPS infrastructure, it may lead to GPS related threads.

E. Optimization Of Toll Plaza Based On Progressive Analysis

Technology is developing so much that it has almost become less time consuming to human in all aspects. When it comes to transportation, roadways play an important role. Where people are running in their busy life routine, no one wish to waste their time waiting for the traffic. Though there are several rules to solve traffic congestion, toll booths are one such finest idea. Manual toll collection systems are prevalent almost more than decades. The automatic toll stations are now becoming a trend and serves as an enhancement for the existing ones. This paper focuses on the progressive analysis of the toll plaza. Initially merging model was introduced where car from different toll booths were made to meet at one merging point with the same velocity. This merge method

deals with three main factors namely costs, throughput and safety. So we have to design rules in such a way that it keeps in mind of these constraints and helps to achieve desirable results. So this paper gives a layer by layer analyses and allocates weights according to different strategies. There are five steps involved in the progression evaluation model. The first step involves the listing of constraints for decision making. The second step involves the allotment of actual weights according to user's needs. The third step involves hierarchy divisions based on priorities. The fourth step deals with step by step analysis for decision making. The fifth step is all about finding the optimal solution.

F. Automated Toll Booth And Theft Detection System.

In our day to day life, the user who uses the toll plaza must wait in a queue and pay an amount to the government. Due to this issue an unnecessary traffic is held and lot of time is wasted. To overcome this issue ,the proposed system approaches to obtain an automatic payment is implemented. By using the RFID tag the user is allowed to login by using the RFID system in which it invades the source and the destination it also displays all the information of the toll booth in the way. The user is automatically redirected to the payment gateway. It provides an anti-theft system by retrieving the data which is stored already by the user. GPRS chip is placed on the vehicle to track the location of the vehicle if it is stolen. When the vehicle enters the tollgate the RFID reader reads the details and it confirms that it is the theft vehicle. By ensuring the security algorithm to overcome the maltreatment RFID is merged with the vehicle number and also the sensor is implanted to notify the time of the vehicle. Hence to avoid the traffic congestion and for the convenient transportation process and also it saves the valuable time this project is implemented. It reduces the manual work of the police man to verify the details. If in any emergency cases like ambulance, fire station the amount is excluded for the vehicle. In future it is enhanced by implementing the mobile devices in the form of application software by tracking the location and theft is easily detected.

III. CONCLUSION

The collection of electronic toll systems offers a great advantage over conventional systems. Although there are some concerns about privacy, electronic toll collection systems have far greater benefits in increasing revenue, operating and economic costs and improving air quality.This can be done without putting anyone at risk or sacrificing the privacy of individuals.By adopting this technology, the benefits could have an impact on millions of people with better travel times and save millions of medical costs from improved air quality by reducing traffic congestion.

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