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## Toll Collection System Using RFID Technique

Sandeep Jain

Department of Electrical and Electronics Engineering, Vivekananda Global University, Jaipur, India

Email ID: sandeep\_jain@vgu.ac.in

**ABSTRACT:**The automatic toll collection system using the passive Radio Frequency Identification (RFID) tag appears as a persuasive alternative to the manual toll collection process used by tollgates. Time and flexibility are a priority at the present time. The RFID technology is used to solve the main problems of traffic congestion and time-consumption. The RFID reader attached to the tollgate frame (or even the hand held reader on the manual lane, in case the RFID tagged vehicle reaches the manual toll pay lane) reads the tag attached to the windshield of the car. The item recognition sensor in the reader senses the arrival of the incoming vehicle tag and the toll deduction takes place via the prepaid card issued to the RFID tag in question that corresponds to the owner's account. This makes it easy for the public to utilize the tollgate fee. In RFID toll tax collection system user do the detection with the aid of the radio frequency. The vehicle carries the RFID sticker. This tag is little more than the specific identifying number issued. This will be assigned to the RTO or the traffic management authority. In accordance with this number, we will store all the basic information as well as the amount paid in advance for the collection of TOLL. Reader would be conveniently positioned at the Toll Collection Desk. Once the car crosses the toll, the sum of the tax would be removed from its prepaid inventory. The current equilibrium is going to be changed.

**KEYWORDS:**RFID, Toll Tax, RFID Sticker, RFID Tag, RFID Reader, Radio Frequency

### I. INTRODUCTION

As it is known that transport is the backbone of the economy of every nation. Improving transit infrastructure contributes to a healthy lifestyle in which people gain exceptional freedom of travel, massive trade in imported products and services, higher job rates and social mobility. In reality, a nation's economic situation was strongly linked to productive modes of transportation. Growing amount of cars on the road contribute to various issues such as congestion, the incidence of injuries, air pollution and several others. All commercial operations use various modes of transport for specific tasks. Of that cause, rising transportation is an immediate effect on nation and economy profitability. Reducing the cost of transportation of materials at manufacturing plants and delivering finished products to customers is one of the main reasons for global competitiveness. Automatic toll collection [1] is a system that provides for automatic online toll collection. Such an Automated Toll Plaza mechanism is needed because it is researched by researchers and implemented in numerous expressways, bridges, and tunnels. ATP is able to assess whether or not the car is licensed and then notify the control center of the penalties, debits and accounts concerned. The greatest benefit of this ATP program is that it is capable of reducing toll plaza congestion, particularly during certain seasons when traffic appears to be higher than normal. Some of this system benefits are given below:

- Shorter lines at toll plazas by increasing the service levels for toll booths [2].
- Quick and more effective operation.
- Option to make deposits while holding the balance on the card itself.
- Usage of postpaid tariff statements.
- Other general benefits involve eliminating gasoline consumption and lowering pollution while decreasing the rate of deceleration, waiting for cars in line and accelerating.

For Toll Operators, the advantages include:

- Reduced toll collection costs.
- Improved audit control by unified user account.



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- Expanded capability without constructing more infrastructure.

Thus, the ATP program is beneficial for both motorists and toll operators, which is the explanation for prolonged usage of ATPs. The fundamental concept behind the introduction of RFID Based Toll System [3] is to simplify the cycle of toll collection and the usage of RFID tags mounted on the vehicles by eliminating manual service in toll booths and long queues at toll booths. Furthermore, traffic police can not only assist car owners and network managers from the identification of automobile burglary, but can also monitor car speeds and cross signals. Here control system can see some points about the reason behind selecting this subject and what is the prerequisite of this sort of project in customer day-to-day life [4].

- Time saving during collection of toll.
- Reduction in fuel loss.
- Reduction in financial loss.
- Easy monitoring of traffic.

According to the Karnataka Government report, they recommended that the annual toll collection be approximately 2400 crores / year in October 2012. But in the current scenario they may raise just 950 crores of toll volume. Means 608 crores are wasted owing to human errors. So someone and we have to monitor the leakage in this case. Now it takes 1 minute to complete the toll collection process for one vehicle with the present device by using RFID technique on the high ways. It should take just under a minute with the automated operation. To render the entire thing complete. As period for completion of the procedure is shortened then implicitly there will be no traffic as such & as traffic is not possible.

### 1.1 General Term logy:

RFID is an automatic data-capture system [5] which can be used to classify, register and store details stored on a tag electronically. A radio frequency reader reads the data tag and transfers the data to a computer that records the data on the tag. The tag, reader, and data base are the key technology components of an RFID system.



Fig. 1: RFID Tag

#### 1.1.1 RFID Tag:

An RFID sticker [6], or transponder, consists of an antenna and a processor. A chip can store a unique serial number or other information based on the tag's type of memory, which can be read-only, read-write, or write once read-many (WORM). The antenna that's connected to the microchip transmits information to the reader from the processor. A wider antenna usually implies a lengthier reading radius. The tag is applied to or inserted in a recognizable item, such as a package, case or pallet, which may be inspected with radio waves by handheld or stationary readers. Fig. 1 is showing the image of RFID tag.

#### 1.1.2 RFID Reader:

In an RFID system to work, a reader or scanning tool is required that can accurately read the tags and relay the findings to a database. To communicate with the tag a reader uses its own antenna. When a reader transmits radio waves, it should reply to all tags assigned to reply to that frequency and within range. A reader also has the ability to communicate with the tag without a direct sight line depending on the radio frequency and the type of tag used (active, passive, or semi-passive). Readers can handle many objects at once, allowing faster read reading times. These may be mobile, such as portable machines screening items such as pallets and cases, or stationary systems used in supermarkets. Fig.2 is showing the working of RFID Reader [7].

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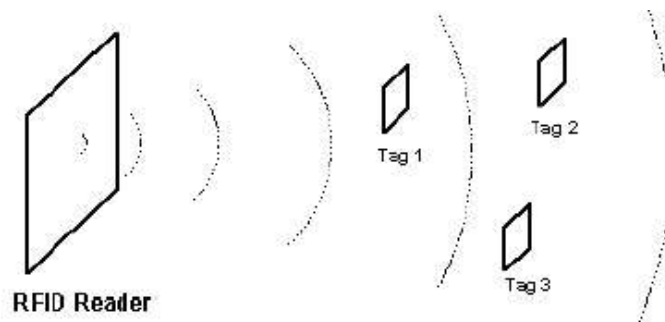


Fig. 2: RFID Reader

## II. LITERATURE SURVEY

According to J. M. Segui et al. research on real-time shopping where actual knowledge is gained, to come to a conclusion that can be given to improve and speed up the cycle of saving busy people's time and also provide them with certain tips to render shopping more efficient and meaningful. This research-based technology focuses on shopping in real time and will help shoppers to easily monitor the items to be bought in a supermarket. According to J. Han et al. search like internet retail, when buying, in-store retail has little opportunities to capture consumer habits. The author describes an on-site Consumer Behavior Identification [8] device focused on passive RFID tags, named CBID, architecture and deployment. The three key aims in defining activities was modelled by practical challenges and addressed utilizing modern methods and algorithms. CBID technology is introduced in which off the shelf systems construct many of the components. There are numerous robberies occurring on the roads and bridges in the developed world. The author has incorporated a protection element in this paper that will prevent the detection of these crimes. This program however is based on RFID technology that replaces the conventional manual tolling method.

## III. METHODOLOGY AND EXECUTION

If anyone buys a vehicle, one needs to sign the user automobile at the RTO office first. RTO officials will not only grant it a number plate but will also send it a smart card or tag that is allowed by RFID [9]. This card should have a special ID and can only be associated for that vehicle. User must also build an identity to use the specific smart card to keep track of purchases in databases. Consumer will deposit to this account any minimum sum. Through when a registered car enters the toll booth, the vehicle's existence is sensed first by the Infrared sensors. This will trigger the RFID circuit in order to read the RFID making a smart card mounted on the vehicle's windscreen. Transaction will start based on whether the remaining usable toll will be deducted immediately or the car will be guided to another lane for manual tax payment. Further the app changes the Centralized Database Server information. This also activates bill generating processes and would be delivered as a text message to the recipient.

On the other side, if any vehicle owner files a report to RTO office about stealing of the respective entry in the database is made. Now any vehicle that arrives at the toll booth with the same ID as already present in the group of stolen vehicle can be quickly detected because the ID assigned with it is special.



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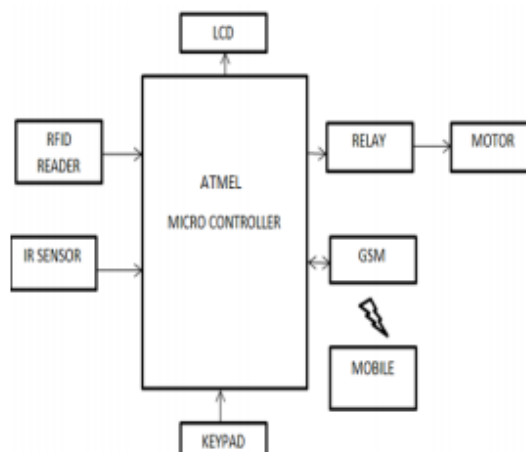
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**Fig. 3: Working Module of RFID Toll Tax**

In the form of a LAN, all of the toll plazas will be linked along with the unified server. Updates with some type of activity should be modified to local servers and centralized repository automatically. Fig. 3 is showing the working module of RFID based toll tax system [10].

## 2.1 EXECUTION OF RFID BASED TOLL TAX SYSTEM:

RFID powered toll collection network [11] is used as an infrastructure to raise tolls easily and reliably at toll plazas. This is necessary since the cars that travel through the toll plaza will not avoid charging toll and the payment is immediately paid through the driver's wallet. The wireless toll lanes are fitted up with the different antennas, which send out signals continuously. Such signals are used to automatically identify the automobiles passing through them. The driver has to set up an account to use the online toll facility to have an automatic transponder installed in the car. Such transponders commonly called tags are usually installed on the vehicle's windshields. The tag includes all the details about the account of the patron. The antenna sends out a radio-frequency (microwave) pulse continuously which returns only when it reaches a transponder.



**Fig. 4: Architecture of RFID Based Toll Tax System**

Those signals are emitted from the transponder and transmitted via the antenna. Such microwaves mirrored from the tags provide details about the amount of the transponder, account of the patron, balance, etc. Certain details such as location, period, and vehicle count may be reported based on the toll agencies request for the data. The device instead uses fiber-optic wires, telephone modems or digital transmitters after encryption of the contents of this microwave to send it back to a central spot, where machines use the specific identification number to determine the account on which toll costs will be deducted. In its function this program utilizes various technology. When the car approaches the toll lane the automobile is identified by sensor. The arrangement of two antennas reads a transponder placed on the windshield of the car. When the vehicle goes through the exit light curtain it is marked electronically by the treadle depending on the number of axles, and the correct amount is credited to the ETC account. The driver is issued input on an electronic sign. Unless the car does not have a transponder, it is marked as a violator by the program, so cameras capture photographs of the car and the production license plate. RFID based toll tax collection system working is describe below-

### 2.1.1 Automatically Identification of Vehicle:

The Automatically Identification of Vehicle relates to the technology that decide the vehicle's registration or ownership such that the toll is paid to the right customer

### 2.1.2 Automatically Classification of Vehicle:

Form and type of vehicles can have different toll numbers. The category of automobile can involve light-duty vehicles such as a commuter car or heavy vehicles such as recreational vehicles. The type of an automobile may be calculated by the vehicle's physical characteristics, the number of passengers in the car, the number of axles in the vehicles and the function (or a variation of such determinants) for which the automobile is being utilized at the moment of classification.



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Many toll companies employ as many as sixteen or more types of vehicles to calculate tolls, while three to six groups are more common for toll collection applications.

### 2.1.3 Camera Enforcement Systems:

The Camera Enforcement System records photographs of the license plates of automobiles that travel into an ETC tollbooth without a proper ETC sticker and used for automated toll collection. Since the introduction of such innovations renders the initial development expense very high, there are immense benefits out there followed by this large expenditure.

## IV. CONCLUSION

RFID is not a substitute for bar code but is a system that provides various apps. In extreme conditions RFID provides extremely efficient data collection. RFID systems can offer additional tools and an effective system for collecting, processing, disseminating, preserving and evaluating knowledge. This not only removes manual data analysis but also encourages innovative software approaches. This radically affects the way operations are handled and the way businesses work. The characteristics of RFID have greater automatic monitoring capabilities than current technologies, while providing incentives to minimize abhorrence, enhance product control and produce improved business insight, resulting in reduced operational costs and enhanced sales production.

Electronic toll collection program is an efficient tool for lowering maintenance expenses and fines while also substantially decreasing toll station noise and pollutant pollution. The implementation of the new Electronic toll collection (ETC) program involves the creation of real-time toll collection and anti-theft response framework. It eliminates physical labor, and regularly occurring congestion on highways. This toll collection system is environmentally friendly, and also leads to increased toll lane capacity. An anti-theft solution module is also implemented which prevents the passage of any default vehicle, thus ensuring road protection.

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