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GPS-Based Toll System: Boon or Bane

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Abstract: *In our everyday lives, we need to access roads in order to go anywhere, and if we are using a national highway, usually we have to pay toll taxes at Toll Plazas for using that particular road. A Toll Plaza Booth is a counter/booth on a toll road where the driver must stop to pay the toll in order to drive any further. To pay taxes, we currently use RFID FasTag technology. As of now, we are in the process of replacing it with a GPS-based system for collecting tolls.*

Key Word: *FasTag, RFID, GPS.*

I.INTRODUCTION

Toll roads (also known as turnpikes, toll ways, or turnpikes) are public or private roads that charge tolls or fees for passage. To help recoup the costs of road construction and maintenance, fees are often used as a form of road pricing. Over the last 2,700 years, toll roads have existed.

In India, tolling is generally conducted under the open system, with a fixed fee payable according to the stretch under one project, which is usually 60 kilometers long. For shorter stretches, the user fee is based on the actual length only. As per the fee rules 2008 the spacing between two adjacent toll plazas should be 60 km. In India, there are more than 1000 toll gates. It's noteworthy that Tamil Nadu has the most toll roads in the country. NHAI (National Highway Authority of India) owns most toll roads, but some are entrusted to private concessionaires for maintenance and toll collection.

Previously, all toll taxes had to be collected through cash, but FAS Tags were supposed to be mandatory for all vehicles from 1 January 2021, but the deadline was postponed to 15 February 2021.

II.FAS TAG

FAS Tag is an electronic toll collection system in India, operated by the National Highway Authority of India (NHAI). Radio Frequency Identification (RFID) technology is used for direct payment of tolls from prepaid or savings accounts. By attaching it to the window of the vehicle, you can drive through toll plazas without stopping. It can be purchased from trusted tag issuers or participating banks, and it can be recharged or topped up according to requirements if it is linked to a prepaid account.

To meet the electronic tolling requirements of the Indian market, the National Payments Corporation of India (NPCI) developed the National Electronic Toll Collection (NETC) program. Besides offering an interoperable toll payment solution, it also offers clearing house services to manage disputes and settlements. FAS Tag is a vehicle-specific and RFID Technology-based device which enable digital cash transaction for paying toll-fare while being a vehicle in motion.

III.RFID TECHNOLOGY

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. An RFID system consists of a tiny radio transponder, a radio receiver and transmitter. When triggered by an electromagnetic interrogation pulse from a nearby RFID reader device, the tag transmits digital data, usually an identifying inventory number, back to the reader. This number can be used to track inventory goods.

FAS Tag, the flagship initiative of the Ministry of Road Transport and Highways (Mo RTH) for implementing electronic toll collection on Indian national highways, relies on Radio Frequency Identification (RFID).

RFID technology uses an Electronic Produce Code (EPC) by which each vehicle can be uniquely identified. This code is different from the vehicle's registration number and is exclusive to it worldwide. Each EPC code, a 13-digit number, **in** RFID FAS Tag is assigned by GS1 India, a standards organization, which ensures that each code is unique and complies with global standards established for proper product identification. In FASTag's case, that's a vehicle.

The code must be standardized to ensure that the data encoded in it is not read differently at different levels. A FAS Tag has what is called a passive RFID chip because it does not contain its own battery. It is activated only when the scanner's beam hits it. When a vehicle is within a certain radius at a toll plaza, the scanner can emit the signals and read the tag, which is the vehicle's identification code. Since a FAS Tag is already loaded with money, the payment that is in the tag is detected and the toll amount is deducted.

All this happens automatically, without the vehicle stopping or the toll collector touching the tag himself.

IV.PROBLEMS DUE TO RFID FAS TAGS AND TOLL BOTH

Roads are frequently accessed, especially national highways, so people frequently pay tolls with FasTags. They face a lot of problems with FasTags, or might face them in the future. Some of them are:

1. **FasTag may not be approved:** If there is no amount in the account, users will not be granted credit. Then the user has to pay in cash. Also, sometimes there are technical problems with the RFID scanner, so the FasTag user has to pay the toll amount in cash.
2. **FasTag can be stolen or lost:** Since the FasTag comes in the form of a tag, it can easily be stolen or lost. In such a situation, the tag may be misused or even cause problems for the owner of the FasTag.
3. **FasTag can be wrongly charged:** Due to technical errors, it may happen that a FasTag user is wrongly charged. In that case, the user's only option is to report the matter as soon as they become aware of it and request a refund.

This system has the major flaw of requiring you to pay the whole toll tax even if you don't use the whole road. Even if you only use the road for 2 kilometers, you must pay the whole toll tax.

Additionally, there are many problems with RFID FasTags that we currently use, it will get damaged over time, and additionally, criminals can hide their fastags on toll plazas and run away, leaving us with no idea where they went.

In order to overcome these drawbacks, the Indian government plans to replace the RFID FasTag system with a GPS-based toll system.

V.GPS-BASED TOLL SYSTEM

India plans to replace FASTag with a GPS-based toll system to ensure seamless payments and vehicle movements on national highways, ending toll plazas' role soon. In his recent address to Parliament, Union Transport Minister Nitin Gadkari said that FASTag, which was implemented in 2015 and made mandatory in 2021, had faced challenges.

The government is now planning to introduce a GPS -based toll system in which ordinary citizens will no longer have to stop at the toll plaza.

How this system will work

To enable GPS -based toll collection, it will be necessary for all vehicles to have a GPS (Global Positioning System). According to government plans, this will be done by equipping them with a microcontroller with third generation (3G) connectivity and GPS.

The government will be able to capture the GPS coordinates of the moving vehicles and track them constantly. This way they will know what route the vehicles are taking and what toll roads they are using. They can check how many toll booths they pass through and estimate the total toll tax.

GPS based toll collection will differ from FASTag because it will track you throughout. It will be vigilant of vehicle movement and collect the toll tax through GPS imaging. This will lead to the removal of all physical toll booths and toll plazas.

Under this system vehicle owner will be required to provide his or her name, address, model of vehicle, registration number, and bank account information.

Benefits of this system

1. **Reduction in wait time:** As the GPS Toll Collection System uses satellite-based navigation and requires no halting of vehicles, it will further reduce the wait time and congestion at the toll plazas.
2. **Reduction in travel costs:** As the vehicles will be charged only for their actual travel on a highway stretch.

Challenges

1. **More burden on consumer:** To enable GPS based Toll Collection System, it will be necessary for all vehicles to have a GPS installed, which will an extra burden on the consumer.
2. **Privacy issues:** With GPS based Toll Collection System, the government can acquire the GPS coordinates of the moving vehicles and constantly track them, which may lead to privacy issues.
3. **Cyber security concerns:** In the case of FASTag, there is a separate wallet for the FASTag account provided by the bank. In the case of the GPS based Toll Collection System, will the money will be deducted from the existing saving accounts of the owners. If this happens it can lead to serious cyber issues.

VI.CONCLUSION

It is our belief that GPS-based toll collection will help speed up travel, increase digitalization, and enhance technology. There will be no long queues for drivers or travelers, nor will they need to stop at every toll booth.

However, privacy remains a concern if the government tracks the entire movement of vehicles. We have yet to see the pros and cons of GPS-based toll collection since it is still in the development stage.

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