



RESEARCH ARTICLE

OTGP AND ANTI-THEFT USING RFID

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ABSTRACT

RFID is Radio Frequency Identification which is used for reading the tags on single products, which emit signals that can be detected by the reader devices. This OTGP (Online Toll Gate Payment) system provides online payment for tollgates and detecting theft vehicles using the RFID technology along with micro controller and GSM modem. The user has to register his/her number and when they need they can make the payment for the tollgates through online. Once the source and destination is selected the number of tollgates is listed and the payment is done. In all the tollgates where the user has made the payment, the number plate of the vehicle is detected automatically and is allowed to travel further. The same method is used to detect theft vehicles by requesting a search in the website for the registered ones.

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INTRODUCTION

RFID is used to track objects using Radio Frequency waves and are preferred due to their low cost and convenience for deployment[3],[4],[7],[13]. Location tracking using RFID can be classified into 'tag tracking' and 'reader tracking'[9],[13].In this paper, tag tracking is done where the tag is attached to a localized object and the RFID reader is deployed in the environment[10],[13]. As the objects moves in the environment, the reader collects the required data into the database where the user information is stored already during the registration of the vehicle[2],[5],[11].

This system is more challenging because the positioning of the object's current location must be executed before a deadline in order to meet the accuracy requirement[10]. Thus, the tracking of mobile objects is made easier.

The basic problem in using RFID is the readings gathered from real world are almost noisy[13]. It means that each tag in the range of the reader is not certainly but possibly to be detected[11],[13]. Though detection failure of tags is normal, using high frequency RFID systems overcomes the existing problems[6].

Thus, the challenge is to design low computational cost methods that would be accommodated by the mobile RFID devices[13],[3]. Fig.1 shows the basic RFID system.

The existing methods use manual collection of money for payment at tolls which is a tedious job and increases frustration for the users during peak hours[1],[9]. In our system, using RFID devices, the online payment is done in advance before the travel starts. Besides the fast and cheap methods to estimate the mobile objects, detection of theft vehicles using RFID is also done by retrieving the information from the database[6],[8].

Designs and Implementation for the System

In fig.2, the components of the online toll gate collection system are shown. It includes the RFID tag attached to the car or inbuilt and the reader attached to the toll gate. There exists a host computer used for controlling the operations performed. The user data is stored in the database which is used for registration and validation on the server side.

Hardware Design for the system:



Fig.1 RFID System

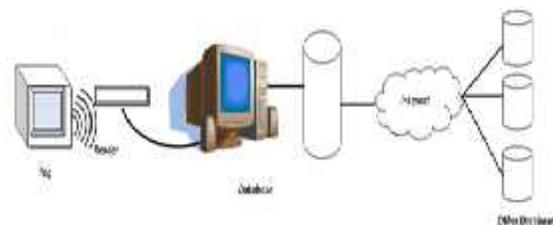


Fig.2. Components of RFID System

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In the hardware design part the automated system using RFID technology can be categorized into two modules. They are the vehicle module and the base module. The vehicle module consists of the RFID tag and the RFID reader, host computer system and gate control system composed as the base module. The general RFID based toll collection system is described in the fig.3.

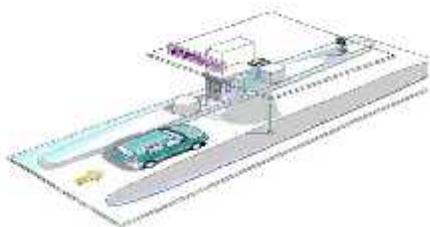


Fig.3 General RFID based Toll Collection System

The major components used in the hardware design of the system are:

**RFID tag/transponder**

As shown in fig.4, an RFID tag/transponder consists of a chip and an antenna. A chip can store a unique serial number. The antenna, which is attached to the chip, transmits the data from the chip to the RFID reader. Typically, a larger antenna indicates a longer reading range and this range is based on the type of environment. The tag is attached to the car to be identified, and can be detected by readers using radio waves.

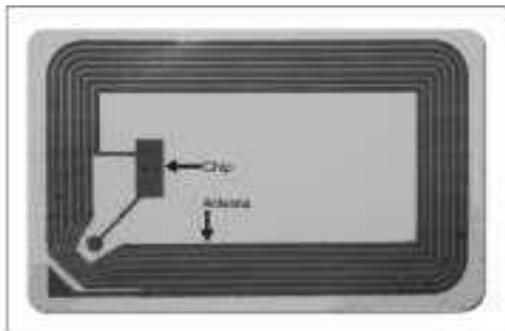


Fig.4 Internal Structure of RFID Tag

**RFID reader**

In order for an RFID system to function, it needs a reader that is capable of reading the tags and communicating the results to the database. A reader uses its own antenna to communicate with the tag. The basic tag tracking operation by the RFID reader is shown in fig.5.

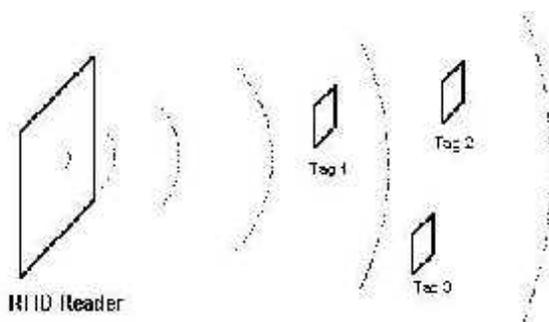


Fig.5 RFID tracking

**Liquid Crystal Display (LCD)**

This module is used to display the present status of the system. Fig.6 is an interface to 4 bit mode with microcontroller LCD screen consisting of two lines with sixteen characters each.



Fig.6 LCD Display

**Power Supply Unit**

The DC power supply unit is a vital component in modern electronic equipment as they need a wide range of DC voltages for their operational purposes. The purpose of power supply is to provide the required amount of power with the specified voltage from primary source.

**Related Works**

There exists a variety of approaches to RFID based tracking and detection[2],[4],[7],[9],[11]. Most of the toll collection systems commonly use normal transactions[1]. Some of the related works use the same RFID technology for toll collections. It uses a smart card where the transaction is already done and the card is recharged for future usage[3],[4],[8],[9]. But this system fails if the user forgets to carry the card or recharge done is not enough for transactions. Detection of number plate is used but the system fails if the number plate of the theft vehicle is faked which has no way to get detected[4]. RFID technology is also used in student attendance system where the RFID tag of each student is used to mark attendance for him/her using a RFID reader [8]. Some of the domestic uses are in the usage of RFID systems in a Malaysian library replacing the traditional system, the Walking Plant System (WPC) to watch the growth progress of plants again replacing the traditional manual method of watching the plants [8].

**OTGP Working Model**

The working model of the OTGP system is shown in Fig.7. The user has to register his/her car number with the required information. This user data is stored in a database through a host computer on the client side. The required amount of money is deducted according to the selected number of toll gates between the source point and destination point. Then the online payment is done. When the user passes the toll gate, the RFID tag is automatically detected by the reader and the vehicle is allowed for further travel. This is done by retrieving the user stored data from the database for validation. Thus, a faster sequential process is performed to avoid traffic jam.

**OtgP Process of The System**

Fig.8, clearly shows the step-by-step process of the system. The RFID reader reads the number from the RFID tag and then it will check with the recorded database in host computer system.

If the user did not register, they need to register and the authorized person at the toll gate gets user information from them as shown in fig.10. The user can update the balance at the user updating form.

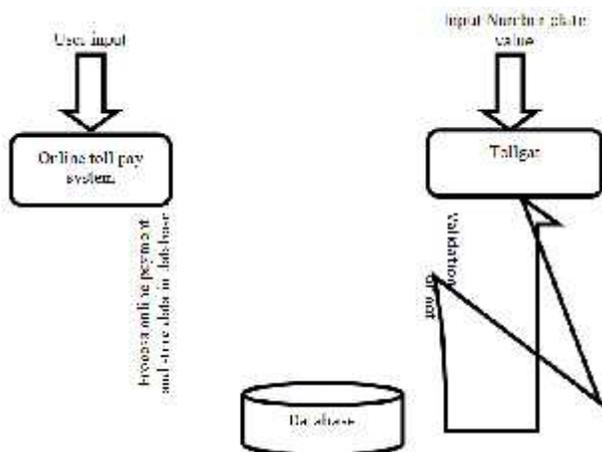


Fig.7 OTGP Working Model

**Otgp Process of The System**

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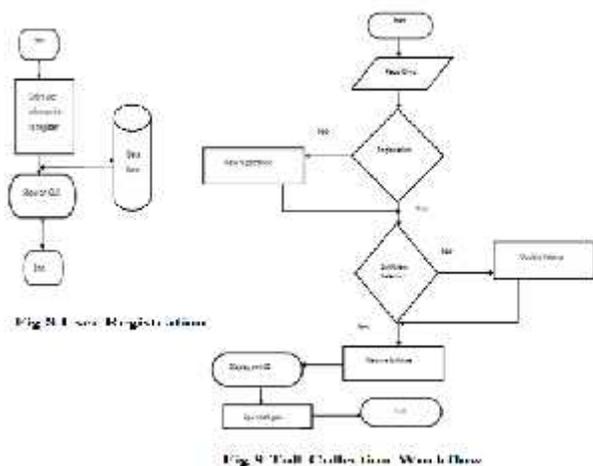


Fig.8 User Registration

Fig.9 Toll Collection Using RFID

**Simulation Results**

In fig.10 we evaluate the performance of the existing and proposed systems by considering a more practical scenario where the vehicle’s time duration in toll plaza varies during traditional manual collection and automated collection using RFID. The graph clearly depicts that the time taken during the automated collection is half the time of the manual collection. In fig.11, it shows if 10 vehicles can leave the toll plaza in 10 minutes during manual collection then during automated collection 20 vehicles can leave the toll plaza in the same time. The following chart gives enhanced information about the existing and the proposed system.

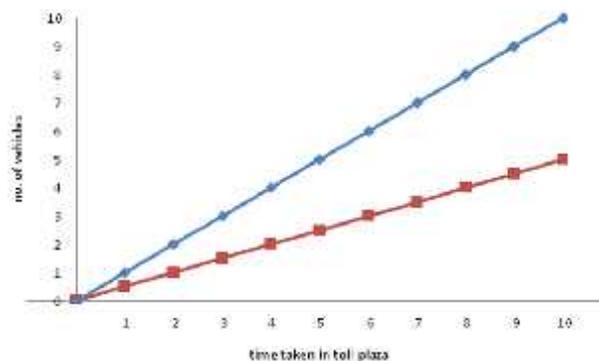


Fig.10 Number of vehicles through Tollgate

**Anti-Theft System**

RFID can provide an effective anti-theft system. This is done by retrieving the data that is already stored by the user during registration. By doing so the theft vehicle cannot cross the toll gate and can be tracked using a GSM module.

**RESULTS**

This report will explain about the utilization of the tollgates fitted with RFID. This is shown in the below fig.12.

This system provides online payment for tollgates and detecting theft vehicles using the RFID technology along with micro-controller and GSM modem. The user registers his/her number and makes the payment for the tollgates through online. In all the tollgates where the user has made the payment, the number plate of the vehicle is detected automatically and is allowed to travel further. The same method is used to detect theft vehicles by requesting a search in the website for the registered ones. Thus, RFID enables online payment for toll gates and also plays a vital role in detecting theft vehicles.

**CONCLUSION**

This report describes that this system is fully automated and reduces the human error which brings a great evolution in the method of toll system by its flexibility and it’s fully an authenticated system. The development of RFID based toll deduction system is proved that online payments are also available not only for commercial goods but also in the road systems. In this toll deduction system RFID is uses permitted frequency bands by using high power levels for a successful system. For the future work RFID speed controlled system vehicle can be save from the accident due to high speed. Some work must be on RFID communication range between the reader/antenna and tag is limited into few meters it will be extend to long range.

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