

Advanced Wireless Automated Toll Tax System

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Abstract - This project is aiming at reducing the running cost of the Tollgate and to increase the functionality and reliability of the system. This is being achieved with the help of wireless transmitter and receiver modules.

I. INTRODUCTION

Tollgates are the common places now days. It is also common that no. of vehicles waiting in a queue near tollgates to pay the toll. As the no. of private constructions increases so the no. of tollgates. In this project we come up with a solution that automates the toll collection of passerby vehicles without stopping them and completely wireless.

This project involves a tamper proof wireless tag fixed in the vehicle and a wireless receiver in the tollgate. Whenever the vehicle passes the tollgate the transmitted value is received in the receiver and the time is automatically noted. The noted values are logged in a common data base server.

The system can automate the toll paying system in both pre-paid and post-paid mode. In pre-paid mode the vehicle owner has to pay the toll amount beforehand. His every tollgate crossing will prompt reduction of his balance. In the post-paid mode, the vehicles each tollgate crossing is identified and a bill for total crossings is calculated.

Our project consists of constructing wireless transmitter for vehicle and wireless receiver for tollgate. Both the ends are controlled through micro controllers. In the reception end the micro controller communicates with PC and loads the dynamic information in the specially designed database.

II. EXPLANATION OF TOLL TAX COLLECTION

- Information of the vehicle is stored in the database accessed through the VB program.
- The coding is written in VB script and it is compiled.
- When the vehicle, named KARHIK is passed through the tollgate, the entry of the vehicle will be stored the data base and accordingly the billing system is registered.
- The information of the vehicle is displayed on the LCD in a detailed way.
- When another vehicle, named YUVARAJ is passed through the tollgate, the entry of the vehicle will be stored the data base and accordingly the billing system is registered.
- The system can automate the toll paying system in both pre-paid and post-paid mode. In pre-paid mode the vehicle owner has to pay the toll amount beforehand. His every

tollgate crossing will prompt reduction of his balance. In the post-paid mode, the vehicles each tollgate crossing is identified and a bill for total crossings is calculated. Thus it is displayed below.

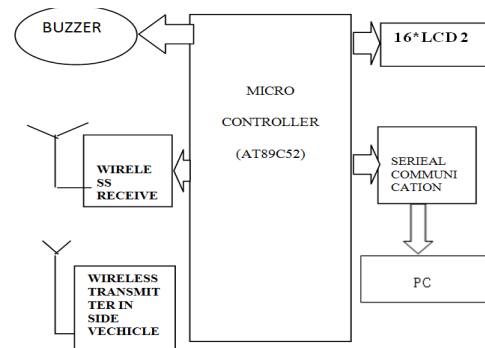


Fig.1 Toll tax collection

III. THEFT

If the tollgate receiver presumes inappropriate data of the vehicle, immediately the buzzer produces the alerting sound and in the LCD display shows as.

A. Canada

The ETC system used in Canada is known as the Canada 407 Express toll route (ETR). It is one of the most sophisticated toll roads in the world [7]. The Canada 407 ETR is a closed-access toll road, which means that there are gantries placed at the entrance and exit points of each toll. In this system, cameras are equipped with Optical Character Recognition (OCR). The OCR cameras are used to photograph license plate numbers of vehicles that do not have transponders. The toll bill will then be sent directly to the registered address of the vehicle owners. Other than that, two laser beam scanners are placed above the roadway to detect the types of vehicles passing through the gantries. Nevertheless, this toll road bears a very high infrastructure cost, and the users are the ones who help recover the cost through increments in their toll bills [8].



Fig. 2 Canada's 407 ETR for ETC [7]

B. Poland

The ETC system used in Poland has been proposed by the Motor Transport Institute along with the University of Technology in Warsaw and Dublin. This system is called the National Automatic Toll Collection System (NATCS), and consists of the National Automatic Toll Collection Center (NATCC), control gates, and on-board units (OBU). The NATCS uses a combination of mobile telecommunication technology (GSM) with satellite-based Global Positioning System (GPS). Using GPS technology, the OBUs determine the kilometers that have been driven, calculate the toll fees and rates, and then transmit the information to the NATCS computer center. Each vehicle will be charged from the highway entrance up until the end of the highway. In order to identify the plate numbers of trucks, the system has control gates equipped with digital short range communication (DSRC) detection equipment and high resolution cameras. [9] Due to the technical specifications, this system incurs a high cost for motorists.

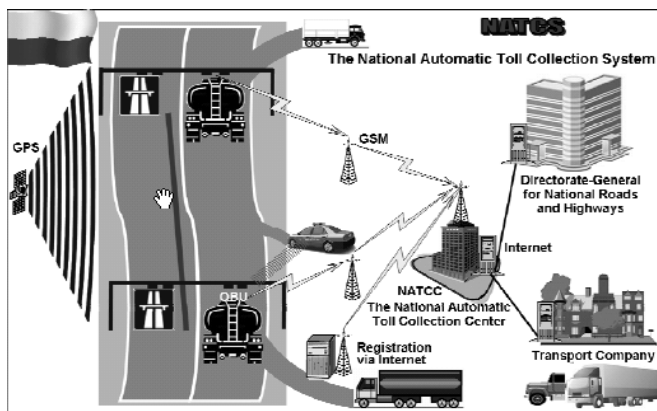


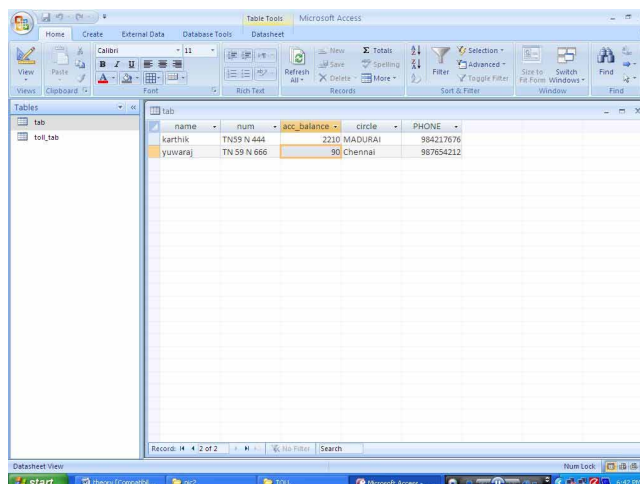
Fig. 3 Poland's ETC System [9]

C. Philippines

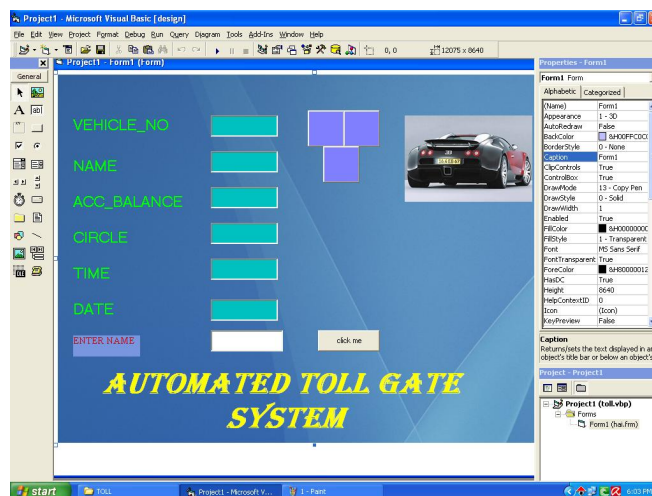
The ETC system used in the Philippines has been implemented at the South Luzon Expressway (SLEX) since August 2000. The ETC is referred to as the E-PASS system, which uses Tran score technology. Here, electronic transponders are placed in front of a vehicle's rearview mirror. Each time a vehicle enters the toll booth, the tag is read by the receiver, automatically identifying the account and debiting the toll fee amount from the corresponding account. Once the amount has been debited, the control gate will lift and the vehicle is allowed to pass through [10].

IV. RESULT SCREENS

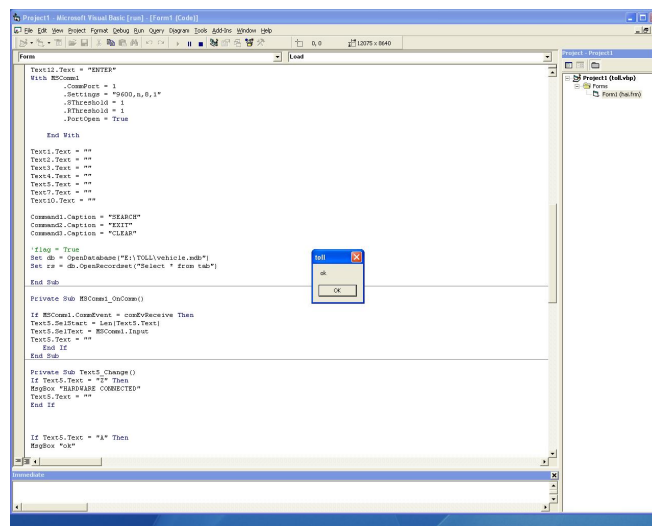
Information of the vehicle is stored in the database accessed through the VB program.



After the compilation, the output is shown below.



When the vehicle, named KARHIK is passed through the tollgate, the entry of the vehicle will be stored the data base and accordingly the billing system is registered.



The information of the vehicle is displayed on the LCD in a detailed way.

V. CONCLUSION

In my project, I have presented the implementation of wireless technology in the application of toll tax system. Wireless toll collection stations allow the traffic to flow continuously and vehicle having avoided stopping and starting again. This in combination with reduced fuel consumption has positive effect on environment i.e. pollution created will be minimum.

Implementing the wireless technology is also not so much costly. Man power and cash risks are also reduced to minimum. Furthermore, only a minimum of traffic disruption is caused during installation. The system also increases safety, as bottlenecks and long queues are avoided. Society and business community also gain from the system as it results in faster transportation. The system is cost-effective, time saving and easy to install, which benefits the operator as well as user.

It is to say that this wireless technology is only recently developed. Much work and experiments based possibilities are yet to work in our country. After about few years, the real fruit of this technology can only be tasted in many fields of science and technology. Smart cards should be integrated with this technology as these are secured electronic devices that are used for keeping data and other information in a way that only "authorized" users are permitted to see or write the data.

The system can automate the toll paying system in both pre-paid and post-paid mode. In pre-paid mode the vehicle owner has to pay the toll amount beforehand. His every tollgate crossing will prompt reduction of his balance. In the post-paid mode, the vehicles each tollgate crossing is identified and a bill for total crossings is calculated.

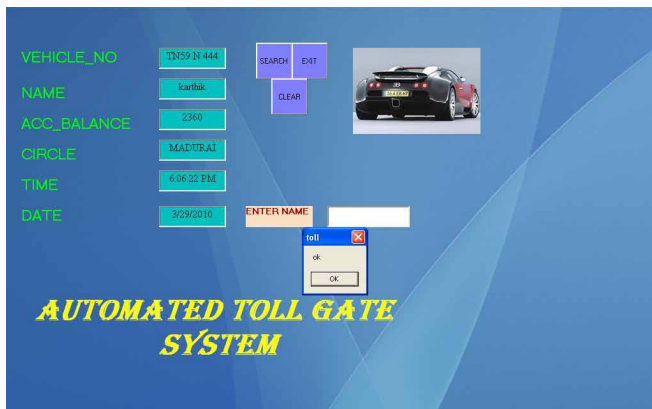
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VI. FUTURE SCOPE

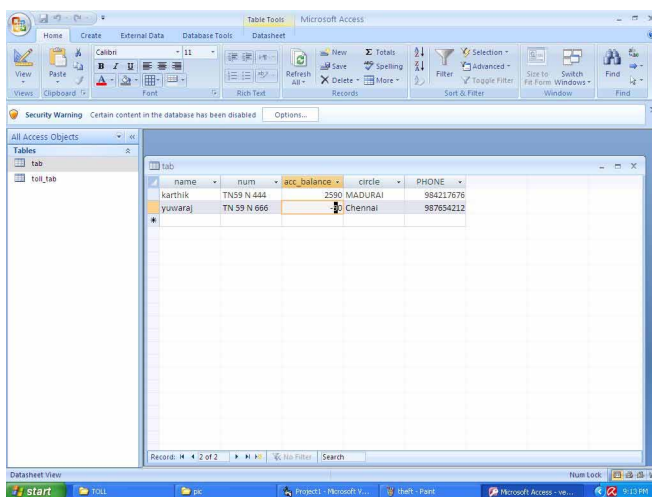
The objective of the wireless standard is to enable seamless communications of data over the short-range wireless links. The wireless specification can ease connection not only to the Toll Tax System but also between vehicles. Indeed, the focus of wireless technology on low-cost, high levels of integration and ease of configuration has the potential to change current manual operation.

I can say with confidence that the work of toll tax be an easy one when wireless technology will be fixed for this purpose. Let us hope that our future experiments will be beneficial to the whole of the world due to this technology.

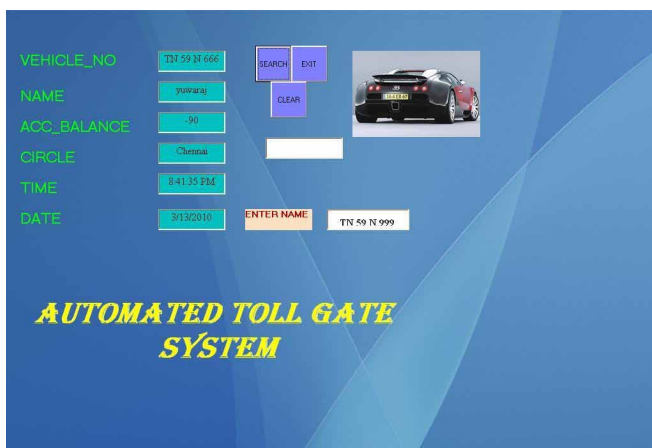
This work can be further implemented in the field of Toll Tax Office for the collection for road taxes, which are applicable on motor vehicles and may be for the collection of insurance fee of the motor vehicles.



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If the tollgate receiver presumes inappropriate data of the vehicle, immediately the buzzer produces the alerting sound and in the LCD display shows as 'THEFT'.



A. Benefits of the New System

When a vehicle (Car, Bus etc.) passes the toll station, the toll fee is automatically charged to the vehicle driver's account with the wireless road operator. A wireless chip inside the vehicle contains its electronic identity.

B. Benefits of System

- Charging accuracy: all fees due are reliably collected.
- Charging flexibility: ability to accommodate varying charging rates.
- Charge type flexibility: ability to support several means of payment.
- Enforcement accuracy: correctly locating violators and non enforcing non-violators.
- Upgradeable as additional charge points are added.

C. Benefits to Society (Nation)

- Economy
- Environment
- Safety

Wireless toll collection stations allow the traffic to flow continuously, and vehicle having avoided stopping and starting again. This in combination with reduced fuel consumption has positive effect on environment.

Society and the business community also gain from the system as it results in faster transport. The system does not require special road lanes to be built at the toll stations.

Furthermore, only a minimum of traffic disruption is caused during installation. The system also increases safety as bottlenecks and long queues are avoided.

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