Electronic Toll Collection System

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Abstract— this paper is based on RFID technology, the RFID system uses RFID tag and RFID reader which collects information of vehicle passing through the toll plaza and automatically debits the toll amount from prepaid account of vehicle owner, which in return reduces the traffic congestion and human errors. The proposed RFID system uses tags that are mounted on the windshields of vehicles, through which information embedded on the tags are read by RFID readers, this system eliminates the need for motorists and toll authorities to manually perform ticket payments and toll fee collections, respectively.
Key words: ETCS, Electronic Toll Collection System

I. INTRODUCTION

In our day to day life, we pay certain amount of tax through toll plaza to the government. The toll gates are mostly found on national highways and bridges etc., and we pay standing over a queue in the form of cash, although, the mobility of vehicles gets interrupted by this method which takes longer travel time, more consumption of fuel and also pollution level get increased in that region, instead of that the method commonly used by industries and in advanced countries is the Electronic Toll Collection System.

"Design and develop an Automatic toll plaza which is based on microcontroller, RFID technology and load cell to save the time at toll plaza and having cash free operation"

As the name suggests "Automatic Toll Plaza" the key theme of our project is the automation. So here we will just take the overlook of what is mean by Automation. So in very simple language the Automation means to replace the human being from the process with the machines .Means what presently the human is doing on the process now onwards the machines are going to do. Before moving further we will just take the overlook of history of the toll plazas. So before the 90's decade the toll plazas were fully manual controlled. Means there are two people for opening & closing of the gate & another two are for reception of the money & data keeping etc.

But in 1995 when the Express ways had been developed the semi-automatic toll plazas were launched in which data is stored in computers & gate operation is automatic, only two personals are required for single booth. But here we are going to see the human less toll plaza.

Here we are going to see some points regarding to purpose behind choosing this topic & what is the requirement of this type of the project in our day to day life.

− Avoid the fuel loss.
− Saving of time in collecting toll.
− Avoid financial loss.
− To monitor the traffic.

II. METHODOLOGY

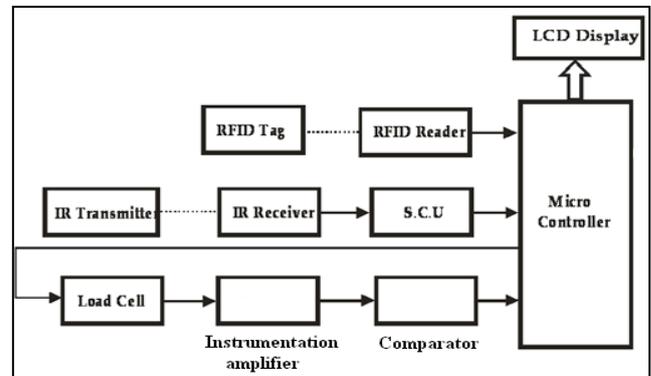### A. Engineering Block Diagram and Description

Fig. 1: RFID

The diagram consist of RFID tag, RFID reader, IR transmitter receiver, signal conditioning unit, micro controller, load cell, amplifier, ADC,LCD display.

Description of various components of our project is as follows:
− RFID Tag: An RFID tag is a microchip combined with an antenna in a compact package; the packaging is structured to allow the RFID tag to be attached to an object to be tracked. "RFID" stands for Radio Frequency Identification.
− RFID Reader: An RFID reader is a device that is used to interrogate an RFID tag. The reader has an antenna that emits radio waves; the tag responds by sending back its data.
− Antenna (RFID Tag Antenna): The antenna in an RFID tag is a conductive element that permits the tag to exchange data with the reader.
− IR Transmitter & Receiver: The IR Transmitter Receiver gate we are using in our project to detect the exact location & position of the vehicle on the load cell plate. The IR transmitter is continuously emitting the IR rays towards the IR receiver. When the vehicle is going to come across the gate the rays are deflected from the vehicle & IR receiver doesn't get any signal. The IR Receiver will give the replying signal to the controller to actuate the load cell plate as the vehicle is at exact location on the load cell plate.
− Payment Mechanism: The payment mechanism we are using here is the smart card type mechanism. Here we are using the chip having the memory capacity of 4K.The memory has in it the stored amount of money value. When the switch is pressed for the payment the desired amount will be deducted from the memory & remaining amount is displayed on the LCD.
− Microcontroller PIC 16F72: In our project we are using the PIC 16F72 chip as we are familiar with them. The controller has 28 pin structures having 3 ports i.e. 0, 1, 2.

- 2X16 Line Alphanumeric LCD Display: The most commonly used ALPHANUMERIC displays are *1x16* (Single Line & 16 characters), *2x16* (Double Line & 16 character per line) &*4x20* (four lines & Twenty characters per line). The LCD requires 3 control lines (RS, R/W & EN) & 8 (or 4) data lines. The number on data lines depends on the mode of operation. The LCD interprets and executes our command at the instant the EN line is brought low.
- D.C. Motor: It is for opening and closing of a barrier on the toll gate. It is done when the customer successfully performs the billing operation through RFID with sufficient balance.

Fig. 2: General Block Diagram

III. RESULT

Whenever a LASER at the entry gate get cut by the vehicle the gate opens & it remain open till the rays are mismatched. As the rays get connected again then the gate gets closed. From RFID tag we get information about vehicle number which is sensed by the RFID reader which will then transmit the data to the controller, then the toll amount will be displayed on the L.C.D. By prepaid account, toll amount will be paid & at the same time exit gate will be opened automatically for the vehicle to pass through.

IV. CONCLUSION

RFID is one of the new technology emerged in ETC applications. This paper tells us about the application of ETC system on toll gates. This paper gives many advantages, such as waiting time of the vehicles, no traffic congestion, assured and accurate collection of toll amount, free from cash, minimum emissions which are harmful for living.

This paper investigates how to use GUI for collection of toll, the real time management and monitoring is done. It has expanded capacity for vehicle without building the big infrastructures. It has improved efficiency and reliability of toll plazas and traffic abilities of Highways.

V. FUTURE SCOPE

A. Implementation of Automatic Money Debit System

In our project now we are implementing the prepaid account mechanism for the payment of the toll amount paid by the vehicle. Here we can also implement the automatic debit system. In this system we have to treat the RFID card also as the smart card for the payment of the toll amount. In the RFID card we have now vehicle number in the code format. So, we can combine the RFID card with smart card as both are the different forms of basic principle of Bar code.

B. Implementation of Image Processing for Centralize Data Recording

In our present concept we are only using the RFID system for vehicle detection. So we can extend the scope of this concept in other way for centralize data recording. For that purpose we can use the IR courten at the entry gate which is followed by the Camera which will be continuously capturing the images of the vehicles entering into the toll plaza and the third step the RFID is collecting the vehicle number. Now when the vehicle passes through the IR courten it tresses the outline of the vehicle, in the next step the camera will take the image of the vehicle & followed by the RFID to record the data related to the vehicle. The whole data collected together & sent to the centralize server which will store it for stipulated time. This application will help in detecting the vehicles in the crime cases like terririsom & smuglling of goods & it will also reduce the load on check posts.

REFERENCES

[1] Smart Highway Electronic Toll Collection System Ganesh K. Andurkar, Vidya R. Ramteke, Assistant Professor, Dept. of Electronics and Telecommunication, Govt. College of Engineering, Jalgaon, North Maharashtra University, Maharashtra, India
[2] RFID Based Toll Collection System Rakhi Kalantri, Anand Parekar, Akshay Mohite, Rohan Kankapurkar Assistant Professor, Department of Computer Engineering, Fr. C. R. I. T., Vashi, Navi Mumbai. University of Mumbai, India
[3] Development of a Model for Electronic Toll-Collection System Md. Farhad Ismail, M.A.R. Sarkar Department of Mechanical Engineering, Bangladesh University of Engineering & Technology (BUET), Dhaka, Bangladesh
[4] www.wikipedia.org