

Automatic Toll Collection System based on Embedded system LINUX

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Abstract - —Many highway toll collection systems have already been developed and are widely used in India. Some of these include Manual toll collection, RF tags, Barcodes, Number plate recognition. All these systems have disadvantages that lead to some errors in the corresponding system

Key Words: LINUX

1. INTRODUCTION

In India, most highway projects are developed by private sectors on PPP (Public Private Partnership) basis. This private organization retains construction capitals and reasonable profit from people. After construction of roads, for some permissible period tax is collected by the companies. This tax is called toll tax. There are many different toll collection system practiced by various organizations at different toll plazas. However this toll plaza wastes the time and increases traffic on the highways. Initially, there was a manual toll collection system in India. This method is insufficient for toll collection because the vehicle owner pays the toll in the form of physical cash. Here we introducing Electronic toll collection system using embedded which will be an automatic system, will not stop the vehicles as well as this system will help to reduce the traffic jam. Here, the payment will be taken from the bank account of the vehicle owner and he will receive a message from the server that the toll payment has been taken. In addition, our system will also help to solve the traffic severe crashes .This was causing congestion of traffic. Automated Toll Collection is beneficial because with the help of this system congestion of traffic at the toll collection areas can reduce and also help in reducing corruption at the toll booth. Some of the existing toll collection systems are discussed as follows:

2. LITERATURE REVIEW

There are following toll collection systems presently used:

A. Manual toll collection

This technique is not a technical method. It requires a toll collector or attendant. The toll collector himself classifies the vehicle, collects the toll, dispense the change, provide receipt to the vehicle owner. All this process is time consuming due to manual intervention. Sometimes, when vehicle comes to booth, toll is charged manually by simply providing just receipt in which no description about vehicle is given, only toll tax amount is present. In this case, what happens, if a heavy vehicle comes to toll booth, Operator charges some amount greater than toll amount of light vehicle but receipt is provided for light vehicle. Thus manual collection can provide loss to the owner of booth.

B. RF Tags

In this system, The vehicles are identified with the help of Radio frequencies. RFID stands for Radio Frequency Identification. RFID is a technology which is used to identify, track and store the information contained in the tag. A RF reader scans the tag for data and sends the information to a database contained on the tag. RFID system consists of two main technology components namely tag and reader. RFID Tag: An RFID tag, or transponder, consists of a chip and an antenna. 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 readmany (WORM). The antenna, which is attached to the microchip, transmits information from the chip to the reader. Typically, a larger antenna indicates a longer read range. RFID Reader: In order for an RFID system to function, it needs a reader, or scanning device, that is capable of reliably reading the tags and communicating the results to a database. A reader uses its own antenna to communicate with the tag. When a reader broadcasts radio waves, all tags designated to respond to that frequency and within range will respond. A reader also

has the capability to communicate with the tag without a direct line of sight, depending on the radio frequency and the type of tag (active, passive, or semi passive) used. Readers can process multiple items at once, allowing for increased read processing times.

C. Barcodes

This method brings our attention to a new technology for an electronic toll collection. In this system, barcodes are mounted on the number plate of vehicles. The information related to that vehicle is embedded on the barcode. Barcodes are read by the barcode scanners present at toll booths. Thus this method reduces the efforts of human authority. Data information are also easily exchanged between toll authority and vehicle owner, hence providing a more efficient toll collection by less traffic and less possible human errors. But Optical systems at toll booth proved to have poor reading reliability especially when faced with inclement weather and dirty vehicles.

D. Automatic Number Plate Recognition

Automatic number plate recognition is a mass surveillance method that uses optical character recognition on images to read vehicle registration plates. They can use existing closed circuit television or road-rule enforcement cameras, or ones specifically designed for the task. They are used by various police forces as a method of ETC system on pay-per-use roads and to catalog the movements of traffic or individuals.

3. METHODOLOGY

The whole system is implemented on the embedded Linux Environment using Raspberry Pi board [4]. The proposed block diagram of the system is shown in the Fig. 3. Proposed Block Diagram The system contains Raspberry Pi board as the main processor. The SD card is used to contain the dedicated operating system which is compatible with the raspberry pi board. The License plate of vehicle is captured by the Pi camera which is directly interfaced with the Raspberry Pi board. Wi-Fi can be directly interfaced with the pi board using serial communication protocol. Wi-Fi is connected by router is used to retrieve the database of the respective vehicle from R.T.O., which is available at toll booth. and also used to send the notification message of the deducted amount from vehicle’s owner account on owner’s registered mobile number. Here Stepper Motor is used to

indicate the status of Barrier, weather it is open or close according to the specific cases.

The whole system will work as follows:

As soon as Car arrives to the tollbooth then the sensor detects motion, the Raspberry Pi camera takes a photo. After that, the Pi sends a request to OpenALPR with the car photo to be identified. Then, the OpenALPR API returns the car details like: plate number, model, color, and the confidence of the results.

Vehicle’s license plate result then sends to the R.T.O. server in form of message through Wi-Fi. The vehicle number is compared with the R.T.O database, based upon which the vehicle category is known. The nominal amount is deducted from user's account. Information of User’s account is also registered in R.T.O. Database. Notification of successfully deducted amount will be delivered to the owner in the form of SMS through GSM module. As toll amount is successfully deducted from user's account barrier will open and the vehicle is allowed to go

4. BLOCK DIAGRAM

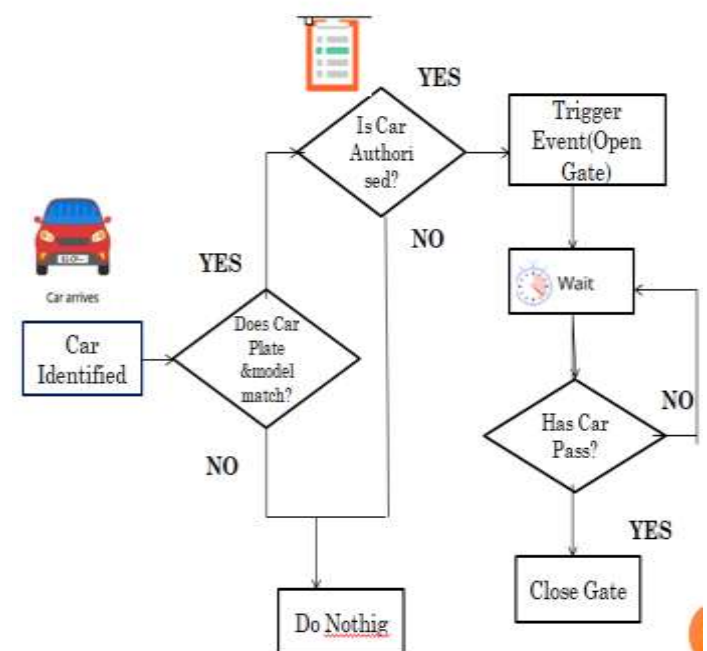


Fig 1.-: Block Diagram

5. FINAL RESULT



Fig 2:- System Starts with glowing LED



Fig 3:- Gate Open to pass Car.

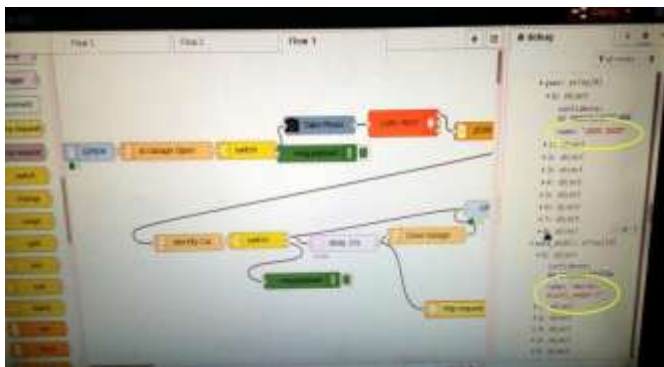


Fig 7:- Final Result 2.

6. DISCUSSION

The result discussion involves the output obtained through EMBEDDED LINUX.

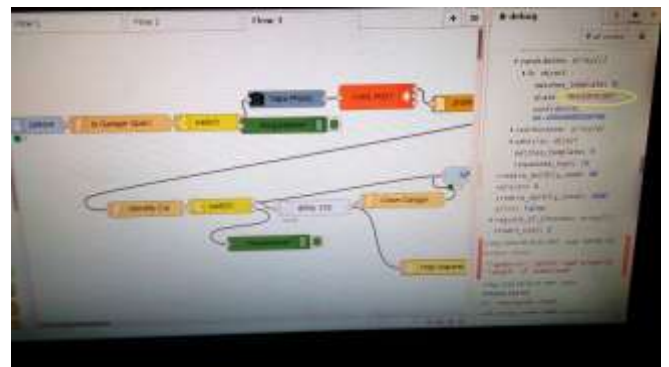


Fig 4:- Shows the Result No. Plate ,Car Name and year



Fig 8:- Final Result After completion of process message delivered to car driver

7. CONCLUSION

The Smart Toll Collection System using Embedded Linux Environment is presented here. The proposed system is efficient than other existing system, because it is implemented on the basis of the fast algorithm for license plate recognition. In the first stage of the algorithm, the license plate is captured from webcam. This Captured image of License plate then passed through the OCR Engine. The text version of the License plate then sends to the R.T.O. database server through GSM module to get the information regarding vehicle's identity.

After conforming the vehicle's identity, according the type of the vehicle like Car, motorbike, truck etc., the nominal toll amount will be deducted from the vehicle's owner account. The account information of respective person is provided in the R.T.O. database. After successfully deducted the specify toll from user's account, the barrier will open and vehicle is

allowed to leave the toll booth. The suggested system is failed to detect blur and damaged license plate. In that case the barrier remains close as system cannot recognize license plate number of the vehicle and cannot convert image data into its equivalent text characters. The system can be enhanced for an anti-theft environment by identifying the unauthorized users.

8. REFERENCES

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