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Vehicle Detection for Toll Collection Using Raspberry Pi 3 Model B

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ABSTRACT: This assumption to be tested develops an algorithm for automatic license plate recognition and implemented it on the Raspberry Pi 3 model B. It is an image processing technology which uses number plate to determinethe vehicle. The main aim is to design a new efficient automatic licensed vehicle identification by using the number plate of the vehicle. The algorithm which is developed here is aimed to be lightweight so that it can be run in real time.This system is implemented and stimulated in Python using OpenCV, OpenALPR,Leptonic and Tesseract OCR libraries and its performance is tested on real image. Under normal condition, with the help of images provided by a USB camera the system will be able to recognize the number plate. Depending on the area occupied by the vehicle, classification of vehicles as light and heavy is done. In addition, this information is passed to the Raspberry pi 3 model B which is having web server set up on it. As the vehicle is determined by the raspberry pi 3 model B, it access the web server information and accordingly to the type of vehicle the charge is collected.This system can also be operated with Mobile/Tablets. Further, it can also use to count the vehicles that have passed through the toll booth from pre-recorded videos or stored videos by using the same algorithm and procedure that are using in this paper.

KEYWORDS: Mobile/Tablets; vehicle detection; Toll collection; Raspberry pi 3 model B; Python.

I. INTRODUCTION

In our day to day life, the need of automatic license plate recognition is increasing rapidly all over the world because of its various essential advantages. Collecting tolls by manual collection, RF Tags, Barcodes and automatic number plate recognition are the typical methods of toll collections.

Electronic toll collection system is the technology that enables the automatic electronic toll collection from the prepaid account registered on the name of vehicle owner, determining whether the vehicle is registered or not and informs the toll authorities avoiding toll violations. Over last decades, electronic toll collection system have been implemented in united states and many other countries with a new improvement in it.

At the beginning, there were toll collection systems such as manual toll collection, they do not create digitally printed receipt for people who is passing through the booth. Inside they require a collector, the toll collector classifies the vehicles, collects the toll, dispense the change, provide receipt. This method is not easy to perform. This method of payment was used to stop the vehicles at toll station and wait for relatively long time for their turn to come, more consumption of fuel and also pollution level get increased in that region. This was also causing congestion of traffic. Because of congestion and inefficiency, the government decided to implement Electronic Toll Collection (ETC) system which will solve the problem of congestion, inefficiency and facilitate convenience for all who involved in the process of toll collection directly or indirectly. ETC systems are designed and developed to cooperate in the operations of toll management through the use of technology. These systems collect data on the basis of traffic, then they will classify the vehicles and collect the amount according to the type of vehicles passing through the booth such as light and heavy vehicle.

Now days the Electronic toll collection system are becoming more and more popular. Unlike manual toll collecting system which require collector or attender they do not require manual collector for their working. Several methods are there of ETC by which toll tax is collected by the vehicle and also there are various toll booths on which these methods of toll collection system are implemented. There are some toll collection systems which are existing from very long duration still they are perform the operation of collecting toll tax from vehicles. From these systems transparency is not



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provided. Transparent systems play an important role in toll collection such that there will be no corruption regarding toll. The proposed system in this paper is transparent to appropriate toll collection.

II. LITERATURE SURVEY

The toll collecting system which are used:

A. Manual toll collection:

According to the manual toll collection methodology, a driver has to stop at a charging booth and pay the required fees directly to a collector. The amount to be paid by each vehicle is determined by its characteristics or classification. It requires a toll collector or attendant for collecting toll tax, the toll collector himself classifies the vehicle and according to the type of vehicle as light or heavy collects the toll from them, dispense the change and then provide receipt to the vehicle holder. Sometimes, when vehicle comes to booth, toll is charged manually by the vehicle owner and just provide a receipt in which no description about vehicle is given, only toll tax amount is present. In such a situation, if a heavy vehicle comes to toll booth, the collector at the toll booth charges some amount greater than toll amount of light vehicle but provides a receipt of light vehicle, because of which the owner of the vehicle will be in lost. Some of the disadvantages of this type of toll collection system is: Less Accuracy, Manual Testing requires more time or more resources (Human resources and Environmental Resources), sometimes both, executing same tests again and again is time taking process.

B. Automatic toll collection system using RFID:

There are many different types of RFID systems employed worldwide, but generally speaking, a device used in cars for toll-collection purposes would be an active transponder that stores a unique serial number associated with a user's personal account. The vehicles are identified with the help of Radio frequencies. RFID stands for Radio Frequency Identification. A RF reader scans the tag for data and sends the information to a database contained on the tag.

The main parts of this system are:

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 read-many (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. The tag is attached to or embedded in an object to be identified, such as a product, case, or pallet, and can be scanned by mobile or stationary readers using radio waves.

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. They can be mobile, such as handheld devices that scan objects like pallets and cases, or stationary, such as point-of-sale devices used in supermarkets.

Some disadvantages of this system, in the short run, costs of diffusion and implementation for an RFID smart card-based fare collection system can be rather high, poor read rate can occur if the reader and receiver are not properly aligned, in case when multiple tags and readers are at work simultaneously, double charges may occur.

C. Barcodes:

This method brings our attention to a new technology for an electronic toll collection. In this system, on the number plate of vehicles the barcodes are attached. The barcodes contain the information about that vehicle to which it is attached. These barcodes are read by barcode scanners present at toll booths. Thus, this method reduces the efforts of human authority. Data information can also be 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. This system consists four devices.

- Tag Barcode
- Barcode Reader: Laser



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- Traffic controller system
- Central Server

Some of the disadvantages of this system, manual work is about 10x less efficient than work with barcode scanners, they can breakdown just like your computers can breakdown at any given time.

D. QR code technology:

QR code stands for Quick Response code. It is an identification for a type of matrix barcode or two-dimensional barcodes first designed for the automotive industry in Japan. A QR code consists of black squares arranged in a square grid on a white background, which can be read by an imaging device such as a camera, and processed using Reed–Solomon error correction until the image can be appropriately interpreted. The required data is then extracted from patterns that are present in both horizontal and vertical components of the image. A barcode is a machine-readable optical label that contains information about the item to which it is attached. A QR code uses four standardized encoding modes (numeric, alphanumeric, byte/binary, and kanji) to efficiently store data; extensions may also be used.

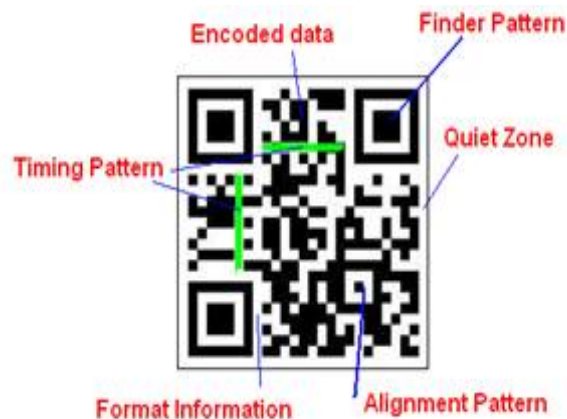


Fig. 1 QR code image.

III. PROPOSED SYSTEM

The system we present is designed using Raspberry pi3 model B which is having OpenCV, openALPR, TesseractOCR and Leptonic libraries, and the embedded hardware is controlled by Python programming. Basically, the system is based on vehicle detection using Image Processing. In this system, the vehicle is detected by using a USB camera for capturing the images of vehicles passing through toll booth. Depending on the area occupied by the vehicle, classification of vehicles as Light and heavy is done. Further this information is passed to the Raspberry pi 3 model B which is having web server set up on it. When raspberry pi 3 model B comes to know the vehicle, then it accesses the web server information and according to the type of the vehicle, appropriate toll is charged.

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Complete system is constructed as follows:

A. Raspberry Pi 3 model B:

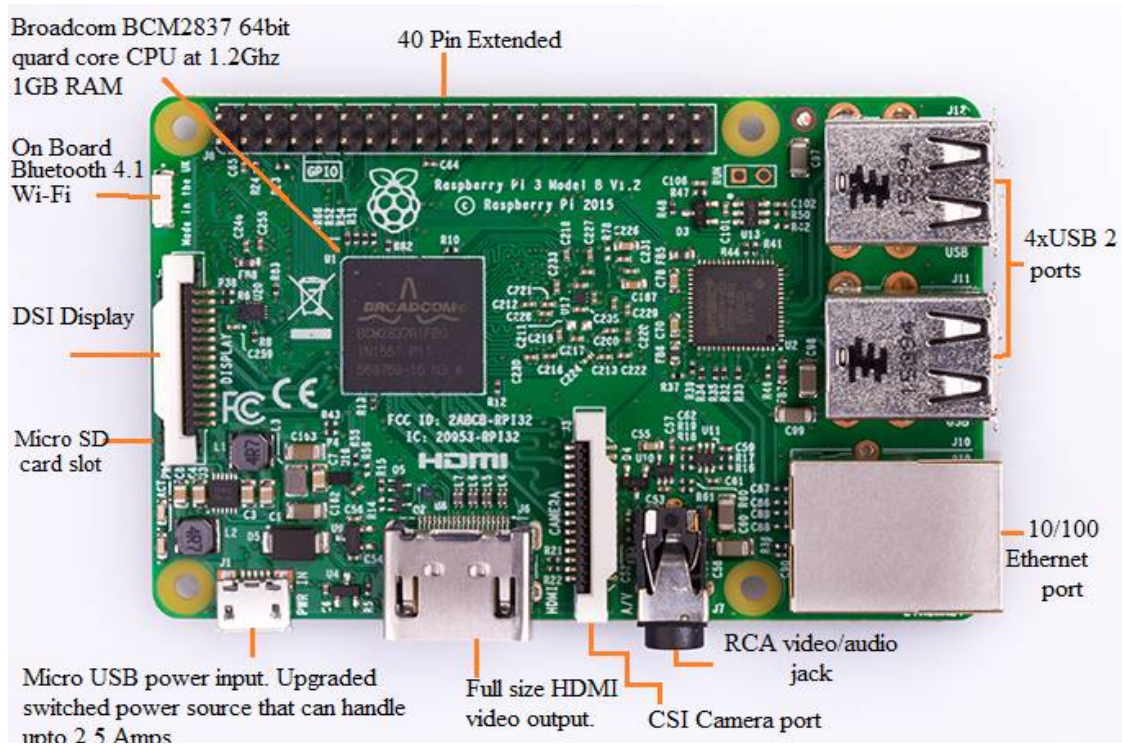


Fig. 2 Raspberry pi 3 model B.

The Raspberry pi 3 model B is the third generation of raspberry pi. It replaced the raspberry pi 2 model B in February 2016. It is the heart of the whole system. The work of Raspberry pi in this system is processing large quantities of data and also it will keep detailed log of vehicles which are in the system. The Raspberry Pi 3 model B is a good choice for a webserver that will not receive too much traffic and only uses around 5 volts of power which will be offered through micro USB power supply slot.

B. Camera:



Fig. 3 Logitech C170 web camera.

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For practical purpose, we have used the above camera just for explanation. We have to use high image capturing digital camera for capturing the image of vehicle. System Requirements are: 1 GHz (1.6 GHz recommended), 512 MB RAM or more, 200 MB hard drive space, Internet connection and USB 1.1 port (2.0 recommended).

C. Thermal printer:

It can print copies of the toll to be collected for the customer. Exchanges and refunds also can be run through the system, and a copy of the transaction can be printed when a printer is attached to the system. For practical purpose, we have used Canon PIXMA MG2470.



Fig. 4 Canon PIXMA MG2470.

This is a multi-function ink-jet printer that offers the print, copy and scan features. Ink Jet printers, although slow at printing, are cheaper on the pocket as compared to laser printers and are perfect for personal use.

D. Monitor:

Raspberry pi 3 model B has one HDMI port so that we can connect it to the monitor which is having HDMI cable. It is used to display Graphical User Interface (GUI) of raspberry pi 3 model B. Also, it is used to check the list of toll collected vehicles. It will help controller to check whether all toll taxes are entered properly or not. It also consists of 4 USB ports in which we have connect mouse, keyboard, USB printer and USB camera. As this model is having Wi-Fi we can operate this system with Mobile/Tablet by connecting it to raspberry pi 3 model B with the help of mobile hotspot.

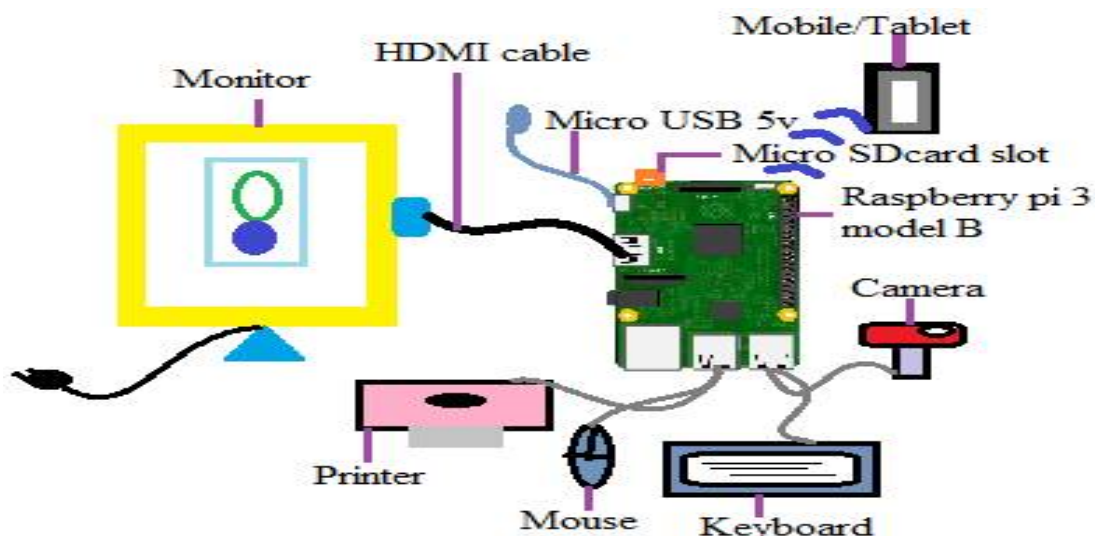


Fig.5 Connecting Raspberry pi 3 model B to Monitor and Mobile/Tablet through Wi-Fi.



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V. CONCLUSION

Raspberry pi 3 model B is one of the new technology which is very useful in ETC system. This paper tells us about the application of ETC system on toll gates. This paper gives many advantages, such as they do not require manual mediation for their working., there is no transparency provided by these systems, vehicles don't have to wait for long time in queue, thus no traffic congestion. And we can operate this system without monitor by using mobile/tablet hence it is not necessary for controller to be at the same place to perform the operation. embedded hardware can be controlled from python programming written using Open CV, OpenALPR, Leptonic, Tesseract OCR.

REFERENCES

- [1] AniruddhaKumawat, KshitijaChandramore," Automatic Toll Collection System Using RFID" in International Journal of Electrical and Electronics Research Vol. 2, Issue 2, pp: (6772), Month: April - June 2014.
- [2] Mr. AbhijeetSuryatali, Mr.V.B. Dharmadhikari," Computer Vision Based Vehicle Detection for TollCollection System Using Embedded Linux" in 2015 International Conference on Circuit, Power and Computing Technologies [ICCPCT].
- [3] Uke Nilesh J., and Ravindra C. Thool. "Moving Vehicle Detection for Measuring Traffic Count Using OpenCV", in Journal of Automation and Control Engineering Vol 1.4 (2013).
- [4] Ganesh K. Andurkar, Vidya R. Ramteke," Smart Highway Electronic Toll Collection System" in International Journal of Innovative Research in Computer and Communication Engineering (An ISO 3297: 2007 Certified Organization) Vol. 3, Issue 5, May 2015.