SMART WAY TOLL COLLECTION SYSTEM

G.Sathya[1], K.Sangeetha[2] & S.Siddharthan[3]
[1,2,3]Assistant Professor, ECE, SNS College of Engineering, Coimbatore, Tamilnadu, India.
Email: sathya.ece.snsce@gmail.com

Abstract— A highway toll collection system is implemented in almost every highway. This is an important component of the modern Intelligent Transportation System (ITS). The usual means of toll collection is by paying manually. The intelligent toll collection system is a technology in which the image of the license plate is captured and processed. When the vehicle crosses the toll booth, it is sensed by the pressure sensor placed on the hump. When it is detected, the CCTV camera will capture the image of the number plate. The vehicle owners account details will be linked to the RTO database. Thus by processing the image captured the vehicle owner's account will be detected and the toll will be collected automatically. The image is processed with the help of OpenCV processing tool .Whenever a vehicle approaches the toll booth, the camera will start to capture the images and stores them. The important factor is the quality of the image captured. The camera should be able to capture good quality images irrespective of the environmental factors. It should be able to process the number plates from different nations as well. Thus database should contain the information of every vehicle owners.

Key Words: *Smart Toll collection, Database,*

I. INTRODUCTION

An intelligent highway toll collection system is an intelligent way of traffic controlling system. It can be implemented for various traffic control applications such as automatic toll collection, traffic management, parking fee collection, monitoring and surveillance. This technology includes image processing which has four processes such as license plate extraction, character segmentation and character recognition. Here the image of the vehicle is captured and processed to obtain the detail of the vehicle owner. A good quality image is to be obtained for better recognition as various environmental factors may pose as a problem while processing. This has four steps for the automation of toll collection such as pressure sensing to know if a vehicle is approaching, capturing the image of the license plate, segmentation and recognition of the image and collecting the toll from the account.

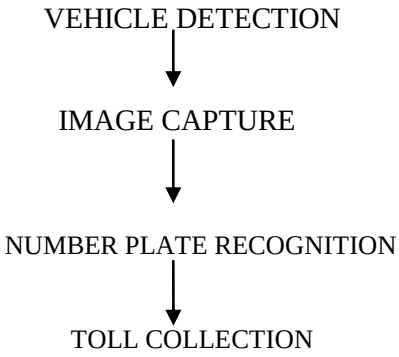


Fig.1 steps in toll collection

II. EXISTING SYSTEM

The existing system consists of a microcontroller, RFID reader, RFID Tag, stepper motor, and bill printer. The reader retrieves the information about the ID number and identifies the vehicle. Then for the tax to be collected the bill is printed at the time of exit. The stepper motor here is used to open and close the gate automatically.

In the existing system, though there is an RFID reader the tax collection is manual and not automated. There are no security features such as identifying a stolen vehicle etc.The toll tax which is collected for all the vehicles is the same and the tax collected is not based on the load carried by the vehicle

III. PROPOSED **SYSTEM**

Then the ANPR systems compare the input number plate image with the database. PC consists of the entire database which is updated periodically. Now after reading the information, PC compares the data in the database and allows the access accordingly by opening/closing the gate. This data is used to print a daily or monthly bill for toll collection from the vehicles. This way even stolen vehicle can be also identified.

The pressure of the vehicle is obtained using the pressure sensor and accordingly the pressure of the vehicle is displayed on the display. A counter is used to count the number of vehicles. The amount on the basis of weight & the count of vehicles is also displayed on the screen. The amount to be paid is automatically deduced from the respective bank account.

IV. BLOCK EXPLANATION

In this block diagram the whole system is controlled by Arm11 processor and this processor is implemented on Raspberry Pi Board. Then this board is connected with monitor, camera, SD card and IP connected through LAN. Raspberry pi is the key element in processing module which keeps on monitoring the vehicles by interfacing camera with it. The extracted information can be used for further verification. The block diagram is shown in fig

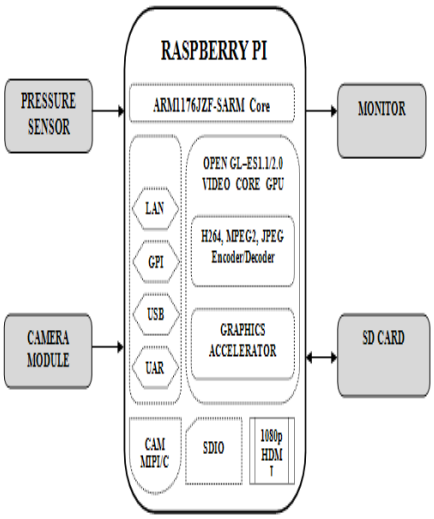


Fig2. Block diagram

Hardware:

- Raspberry pi
- Camera
- ADC module
- Pressure sensor
- SD card

Software:

- RASBI JESSI
- OPENCV

V. HARDWARE

1.RASPBERRY PI:

The Raspberry Pi is a credit card sized single computer or SoC which uses ARM1176JZF-S core. SoC, or System on a Chip, is a method of placing all necessary electronics for running a computer on a single chip. Raspberry Pi needs an Operating system to start up. In the aim of cost reduction, the Raspberry Pi omits any on-board non-volatile memory used to store the boot loaders, Linux Kernels and file systems as seen in more traditional embedded systems. The raspberry pi 3 has a wifi, Bluetooth and a quad core 64-bit ARM cortex. A SD/MMC card slot is provided for storing. After boot load, as per the application program Raspberry Pi will get execute.

All the modules are connected to the Raspberry pi. The raspberry pi will be connected to the internet and the transaction of the toll amount is made.

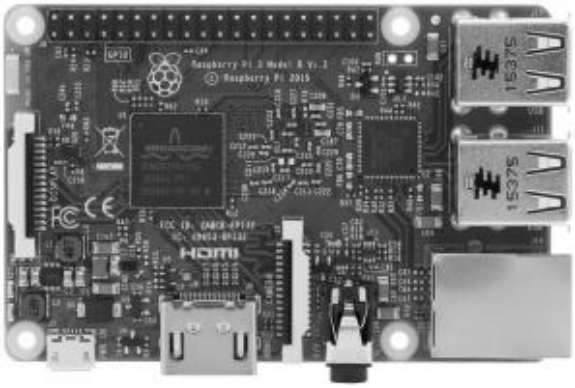


Fig.3. Raspberry pi 3

2. PRESSURE SENSOR:

The pressure sensor is used to know if the vehicle is approaching the toll booth. The pressure sensor responds to the force applied on it. The force applied will deflect the pressure transducer and the electrical output is measured. The output of the pressure sensor will be in the analog form. But the raspberry pi has to take digital output. So an ADC is used for the digital conversion of the output.

Fig.5. Pressure sensor

3.ADC MODULE:

The MPC3008 is the analog to digital converter used here. It is a low cost 8-channel 10- bit analog to digital converter which reads the analog input from the pressure sensor. The MPC3008 is connected to the raspberry pi using a SPI connection which is the Serial peripheral interface. The VDD of MPC3008 to the raspberry pi is 3.3V. When the analog input is given to the ADC it will be connected to either of the channels. Then the electrical input is converted to digital format of 0s and 1s which will be given to the raspberry pi for further operations.

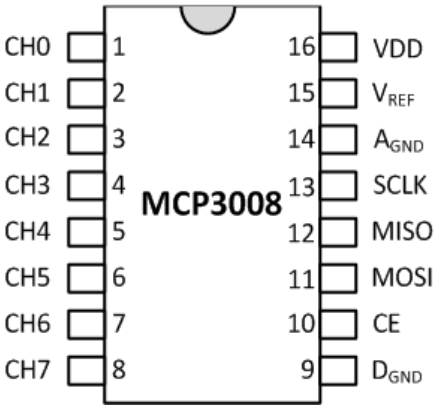


Fig.4. Pin Diagram of MPC3008

4. CAMERA MODULE:

The camera is an important part of the system. The toll can be collected from the respective owners only by taking the picture of the license plate. The image of the number plate is captured and processed. The processing includes the three steps as image extraction, character segmentation and character recognition. The image is captured with certain dimensions to cover the number plate alone for greater quality. The camera should be operable at every environmental condition. The images captured will be saved and then linked to the database to extract the owner's detail and to collect the toll.

VI. SOFTWARE:

The programming of the raspberry pi is done in many ways. It runs different programming languages as a LINUX computer can run. The operating system of the raspberry pi is the raspbian jessi which is preloaded. The python language is used for the programming it will compile for the ARM1176JZF. Python is a simple programming language.

OpenCV is the Open Source Computer Vision written on C++. It supports many languages like python, java, C++ Etc; OpenCV python is faster and easy to code. The program is coded in the OpenCV software. The raspbian Jessie is the operating system based on the Linux. The OpenCV python version will be installed in the raspbian Jessie. With the help of this the python programs are implemented. The program for each and every operation is written and then implemented.

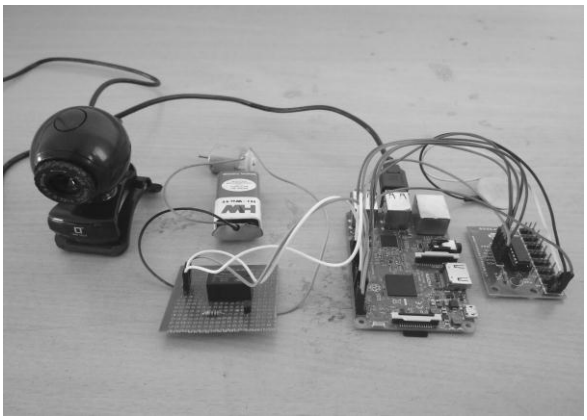


Fig.6. Toll collection system

VII. SEGMENTATION – LICENSE PLATE DETECTION

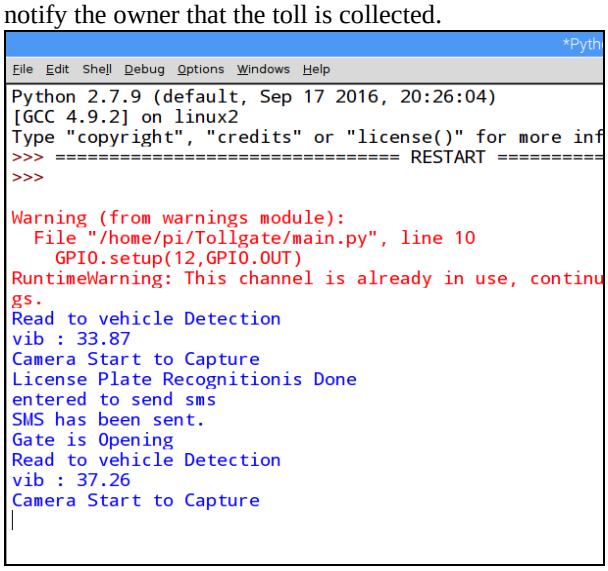
The goal of image segmentation is to cluster pixels into salient image regions, i.e., regions corresponding to individual surfaces, objects, or natural parts of objects. In computer vision segmentation refers to the process of partitioning a digital image to multiple segments. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics.

The result of image segmentation is a set of segments that collectively cover the entire image, or a set of

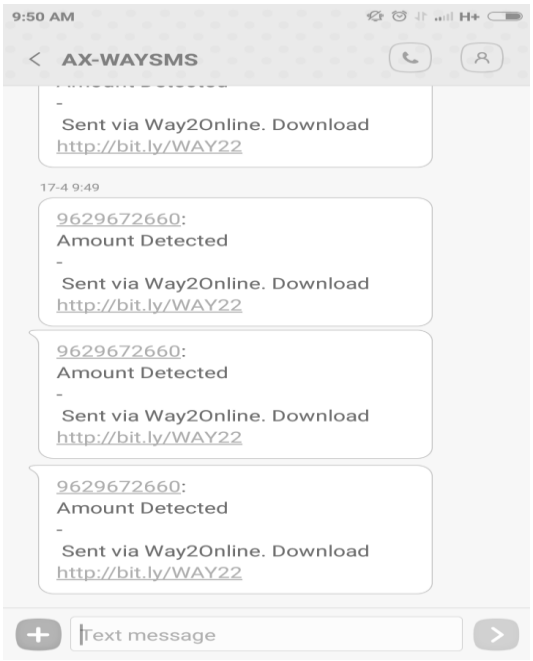
contours extracted from the image. Each of the pixels in a region are similar with respect to some characteristic or computed property, such as color, intensity, or texture, Adjacent regions are significantly different with respect to the same characteristics.

VIII. CONCLUSIONS

This paper "An intelligent highway toll collection system by license plate recognition" presents about an overview of automation in the toll collection by image processing and recognition. By adapting this technology various applications like traffic surveillance, parking fee collection etc can be implemented. Here we propose a method for automatic toll collection without human intervention.
The running process of the program is shown in the figure. When the pressure is exerted it will measure the value. If the measured value exerts the threshold value, then the system will know that a vehicle is approaching. The threshold value is set so that small pressure will not be taken in to account. Then the camera will start to capture the image. After capturing the recognition is done and the owner is identified. The toll will be collected by using the information provided. Then a message will be sent to notify the owner that the toll is collected.



This is a continuous process and will take place with given intervals of time. The message sent to the owner will be in the format shown in fig 4.2. It will sent an SMS mentioning that the amount is detected from the account. Additional features like vehicle theft can also be included. If the vehicle is stolen it should be notified immediately. Thus when the vehicle crosses the toll booth, a message will be sent indicating vehicle's theft.



IX. FUTURE DEVELOPMENTS

- This system can be used for 24/7 surveillance It can also be made to collect up and down timing.
- It can save the license plate numbers of the vehicles crossed and can identify the vehicle's theft.

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