

Use of Embedded Linux for Toll Estimation System Based on Vehicle Detection

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Abstract:

There are many toll collection systems implemented in India. But when factors like reliability and cost matter there is a need of new efficient system. This presented system can be implemented in Embedded Linux platform with the help of OpenCV library. The system is designed using Embedded Linux development kit (Raspberry pi). The input to the system is a camera which captures images of vehicles passing through the toll booth. Depending upon the key pressed by the tollbooth controller, current frame will be passed to the Raspberry pi, which is responsible for all the core processing like vehicle detection and other calculations. Depending on the features (mainly area) of vehicle, classification of vehicles basically as light and heavy is done. Then it will access database (containing standard information) and according to the type of the vehicle, appropriate toll is charged. This system can also be used to count number of vehicles passing through the toll booth.

Keywords — Toll Collection System, Vehicle Detection, OpenCV, Background Subtraction, GrabCut

I. INTRODUCTION

In India there are many national highways. Private companies build infrastructures like road and other facilities with agreement of government. They charge the invested amount from people who are using that facility. In case of road that amount is called toll.

Earlier manual toll collection systems were there, which is very inefficient method of toll collection. Sometimes they don't provide any kind of receipts. Because of this method vehicles have to stop at toll booth for relatively long amount of time until their turn come. This was causing congestion of traffic.

Now-a-days new technologies are developed to support better toll collection like RFID, Barcode readers and Automatic number plate recognition. But they are not meeting factors like feasibility, reliability and cost. And there is no transparency provided by these systems. The proposed system is less expensive, feasible and more practical for toll collection. And efficiency point of view it is more efficient.

II. GOALS & OBJECTIVES

- To design less expensive and more efficient toll collection system.
- To build the system that can work well in adverse climatic conditions also.

III. EXISTING SYSTEM

Manual Toll Collection

This is not appropriate method for toll collection as it very time consuming. This method causes relatively long amount of waiting time at toll booth. Vehicles have to stop until their turn comes.

It requires toll collector for working. Collector classifies vehicles, generates receipts with printer and then gives that receipt to vehicle owner. In all this process takes significant amount of time as there is a lot of human intervention included.

Other ETCs

ETC stands for Electronic Toll Collection. Now-a-days various ETC techniques are coming in picture. They are using different technologies to

support better toll collection. They are mainly trying to avoid manual intervention at toll plaza. Some of them are based on complex image processing algorithms like automatic number plate recognition. Some are using Barcodes, RFID tags etc.

IV. SYSTEM ARCHITECTURE

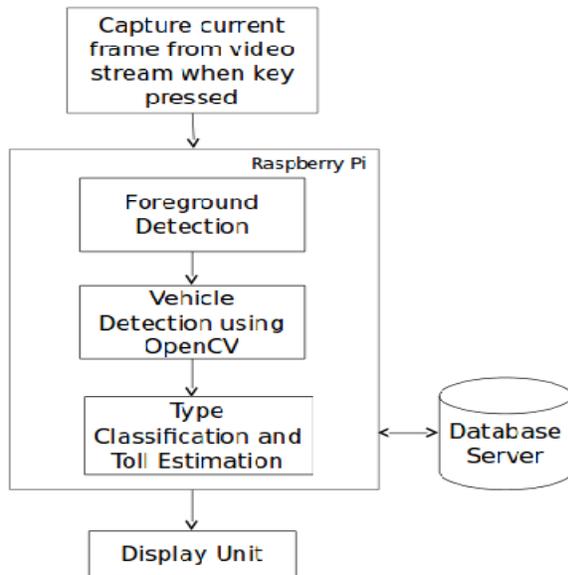


Fig1. System Architecture

Once key is hit by user then camera captures image of vehicle from continuous stream of frames. Captured image is passed to raspberry pi kit for image processing. It detects foreground image of vehicle using Grabcut algorithm and OpenCV. Foreground image is compared with dataset to classify type of vehicles. Raspberry pi accesses the database containing toll for each type of vehicles. Estimated toll is displayed on output screen.

V. METHODOLOGY

Foreground Detection:

For foreground detection Grabcut algorithm is used which detect vehicle in foreground with reference to the background image.

Vehicle Detection using OpenCV

OpenCV Stands for Open Source Computer Vision It is designed in C and C++ mainly. It has got many functions and libraries which can support for object

detection and it very useful for real time image processing.

Type Classification and Toll Estimation:

Type classification is based upon parameters that are extracted from detection and depending upon their values vehicle is classified possible parameters for implementation are length of vehicle, distance between two wheels of vehicle, area occupied by vehicle in image. The more accurate parameter can be used for implementation with corresponding to its constraints.

VI. COMPARISON WITH OTHER TECHNIQUES

RFID TAGS

The vehicles are identified with the help of Radiofrequencies. 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.

BARCODE READER

In this system, barcodes are mounted on the numberplate 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.

PROPOSED SYSTEM

Proposed system is based on vehicle detection Uses Open CV libraries with embedded Linux platform for execution. Response time is quick and it is less expensive, more practical, more efficient than any other system. And with this implementation it is also possible to count number of vehicles passing through toll booth.

VII. CONCLUSION

The technique which is used for implementation is very efficient and more feasible than any other methods for toll estimation. As for development Embedded Linux system is used, processing speed will be fast. And response time is less which is the special parameter about the system. On the other hand, OpenCV plays very crucial role for vehicle detection. It has got libraries which can be used for vehicle detection and further one can extend its use according to requirements.

At the toll collection booth, major task of toll collection will be done with less human efforts. This idea gives very less expensive toll collection system concept. Also the system is transparent to appropriate toll collection. And provides reliability that it can work in adverse climatic conditions also.

VIII. FUTURE WORK

This technology will be used efficiently on different toll booth. The major problems like congestion of traffic, amount of time at toll plaza will be reduced significantly. The more work should be done on time of execution of presented system.

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