Passenger counting in bus transport system: A Review

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ABSTRACT
People are depending on the public transport vehicles for their day-to-day transportation. Considering the safety and comfort of passengers travelling by public vehicles, the main factor is the “Overloading of bus”. We cannot avoid the overloading of the buses as some buses are not having good frequency. But the passengers standing on the stops can definitely come to know about the crowd inside the bus. This needs a passenger counting mechanism. Also, the passenger counting will help to improve the vehicle efficiency, fuel economy and the passengers’ comfort. In this paper, an attempt is made to review a wide range of methods used for face recognition and detection for passenger counting and to find best suitable method.

Keywords: RFID, Principle component analysis (PCA), Viola Jones algorithm, Bayes classifier, neural networks.

INTRODUCTION
As far as the passengers’ safety and comfort is considered, the bus through which they are travelling should not be overloaded. We can put the restrictions on the number of passengers in the bus by displaying the count of passengers inside the bus to the passengers standing on the stops and waiting for the bus. This will help them to know the exact crowd in the bus and to decide whether to wait for that bus or choose another way of transportation. Now, there are many ways to get the count of passengers in the bus. The count can be made by identifying the movable tags given to each passenger by using RFID technology. Also, there is one more way of using “image processing” technique for getting the count. The system will be helpful for the passengers for their safety and comfort. Finally the standard and comfortable passenger system for public buses can then be attained.

BACKGROUND THEORY
There are some papers who have laid the different methodology for passenger counting inside the bus.
“Overview on passengers overloads control in public buses case study: Tanzania” by Kilavohassan, anaelsam, dinamachuve School of mathematics, computational and communications science and engineering, The Nelson Mandela African institute of science and technology.

In the proposed case study, the two techniques are mentioned for passenger counting. The first is about “video processing”. The basic scheme used in this is to set a zenithal camera in the bus for capturing the passenger flow bi-directionally. The captured frame is firstly divided into many blocks and each block will be classified according to its motion vector. If the block quantity of similar motion vectors is more than a threshold, those blocks are regarded as belonging to the same moving object. As a result, the number of such moving objects is counted to be the passenger number of getting in or out of a bus, can be segmented for counting. The second technique mentioned is by using “Infra-Red motion analyzer”. It is based on passive, infra-red, technology to detect and count people moving through a door or gate. The system utilizes specifically developed high-quality sensors with integrated optic elements which allow for both accurate passenger counts.
and discrimination between boarding and alighting through one single sensor. The standard equipment consists of one infra-red sensor, mounted in the door frame, and an analyzer unit to transform the sensor information into counts and transmit the data to the onboard data collector.

[2] “RFID for Real Time Passenger Monitoring” by mauriciolimafereira, claudioluizmarte, Jorge e. Leal de Medeiros, Cledsonakiosakurai, caiofernandofontana

This article has discussed the advantages of using Radio Frequency Identification (RFID) technology embedded on smart card to obtain the required information about the movement of people who use public transport and thus extend the possibilities of greater efficiency in operation of buses and permit to improve the services to meet the real necessities of passengers. The bus in the system has installed a reader device capable of managing a number of data collection antennas. The number of antennas depends on the size of the vehicle and the number of doors. Through the antennas, an RFID reader can transmit radiofrequency waves and perform about 600 IDs by TAGS per second. Records thus collected through smart card tags will allow identifying the passenger approaching the bus for boarding, during its trip in the bus, and when it alights the bus and moves away from it.


In this paper they have discussed the various ways with the help of which we can detect and recognize the faces. Such as:

1. Knowledge-based methods. These rule-based methods encode human knowledge of what constitutes a typical face. Usually, the rules capture the relationships between facial features. These methods are designed mainly for face localization. This can be done using multi-resolution based method.

2. Feature invariant approaches. These algorithms aim to find structural features that exist even when the pose, viewpoint, or lighting conditions vary, and then use these to locate faces. These methods are designed mainly for face localization. This can be done using grouping of edges, space gray level dependency matrix of face pattern, mixture of Gaussian, integration of skin color, size and shape.

3. Template matching methods. Several standard patterns of a face are stored to describe the face as a whole or the facial features separately. The correlations between an input image and the stored patterns are computed for detection. These methods have been used for both face localization and detection. Here shape templates and active shape models are used.

4. Appearance-based methods. In contrast to template matching, the models (or templates) are learned from a set of training images which should capture the representative variability of facial appearance. These learned models are then used for detection. These methods are designed mainly for face detection. This can be done using Naive Bayes classifier and neural networks.


In this work, the features of the face images are extracted using PCA which extracts the variations in the features of face images which contains the highest information with decomposed dimensions. PCA is principle Network Analysis. It is dimensionally reduction method and retains the majority of the variations present in the data set. It captures the dataset and uses this information to encode the face images. It computes the feature vectors for different face points and forms a column matrix of these vectors.
In this paper, the performance comparison has been made of two different algorithms for multiple face detection in color images. First algorithm combines HSI and YCbCr Color models along with morphological operations. In the second algorithm, RGB color model with Viola-Jones algorithm is used. After making comparison, it is inferred that; first algorithm gives better detection accuracy (91%) as compared to the second method (88%). But, first algorithm requires more processing time which is matter of concerned in real-time face detection. The average processing time required for first algorithm is about 6.3 sec, whereas for second algorithm it is 5.1 sec.

III. CONCLUSION

In this paper, we have reviewed on various existing techniques of passenger counting in the bus. We have studied various technologies, algorithms and methods for counting of passenger inside the bus. Every system has different method depending upon application. As to carry an RFID card for daily for counting is not feasible, this will also be problematic to people who do not travel frequently. But our main aim is to count passengers in the bus correctly; hence we have observed that for this application image processing is more accurate considering physical constraints. Also if all the mentioned techniques are compared, there is no any specific algorithm is used. To get the exact count, there is no any need to recognize all the faces, only identifying a human face will be sufficient. Therefore face recognition algorithm is not used. Face detection algorithms are considered for application. And among all the face detection algorithms, Viola-Jones algorithm is more appropriate for real time detection with performance of about 88%. Also it has a huge database available with it, from which it is possible to detect the number of faces and hence total count of passengers in the bus.

REFERENCES


