Vehicle Seat Vacancy Identification using Image Processing Technique

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***Abstract*— This paper is used to identify vacant seat in vehicle using image processing technique. One of the most popular parts of image processing technique is face detection. Face detection technique having many applications such as face recognition, people tracking, or photography. In this paper this technique is used for counting and detecting the number of passengers in public vehicle using webcam. In public vehicle webcam is installed and connected with Raspberry Pi 2 model B. In public vehicle the webcam is installed and connected with Raspberry Pi 2 model B. When public vehicle leaves from the station webcam will capture passengers images in the seating area. The software application is used to adjusting images and improved to reduce the noise. The images are provided to the server by 3G communication. Then the server process the images by using face detection technology and counting the number of passengers in public vehicle. In public vehicle the system is used to obtain the maximum number of travelers and processed on the images then calculates the seat vacancy in the vehicle.**

Keywords— **PI Camera, Raspberry Pi, Face detection, Haar-like features, Morphological image processing, Contrast limited adaptive histogram equalization**

I. Introduction

In day to day life, most people use public vehicle instead of personal car due to the rising of gasoline prices and traffic jams. General company has been developing the system for displaying the position of the passenger vehicle for convenience of travelers. Howsoever those systems only indicate the position of the vehicle but not show the availability of seats in the vehicle. Travelers will waste a time for waiting the next passenger vehicle and cannot manage the time travel or activities correctly. Suppose travelers know the position of the passenger vehicle and vacant seats in vehicle. Travelers can use the time to other activities before the passenger vehicle arrives. Travelers can plan their travel better. In this paper the seat vacancy identification system is designed by using image processing technique. Webcam is connected with Raspberry Pi 2 in the public vehicle for detecting the object on vehicle and sending the data to the server by using 3G communication. This system use Open Source Computer Vision (Open CV) to analyze and process the data then calculated the vacancy of the public vehicle by using the maximum face detection data. It is use for detecting the presence of vacant seats in vehicle or hall. It enhances the speed of union of people in a place and reduces the unwanted waiting time. This system plays a vital role in crowd monitoring and management. Helps in identifying if any of the seats with in a particular place is vacant or occupied and thus the number of vacant seats in that place could be easily identified and calculated and calculated.

II. LITERATURE REVIEW

Literature review is carried out to gain knowledge and skill to understand this topic thoroughly. The main source for this paper is the previous publications related to this topic. And the other sources are journals and articles. Therefore the analysis of the topic did by other researchers; there is the possibility to know the deficiencies in their research work.

Information about few research papers or previously implemented projects that we have used as a reference for making our project is mentioned below: A number of image processing techniques are designed for identification of vehicle seat vacancy. "Real-Time Integrated CCTV Using Face and Pedestrian Detection Image Processing Algorithm for Automatic Traffic Light Transitions", is use for studying the traffic light for pedestrian that wants to cross the street. If the footer crosses the street they press the button and wait for traffic light. This system use CCTV instead of the button and use image processing for detecting the face of footer. If CCTV detects the face of footer, the system will set the red light to show for 45 second. If CCTV does not detect the face, the red light will show for only 30 second. [1] "Analysing Impact of Image Scaling Algorithms on Viola–Jones Face Detection Framework", is use for studying the Viola – Jones algorithm about the problem from low quality of the image and find the optimize solution from Viola–Jones algorithm. The above system uses two methods to scaled image that are window scaling and image scaling. In this the image scaling has 5 techniques that is Nearest Neighbour, Bi-Linear, Bi-Cubic, Extended Linear, and Piece-Wise Extended Linear. System uses 5 difference face database for comparing the performance of 5 different image scaling techniques. The system was developed by using C++, Visual studio2010, and Open Source Computer Vision (Open CV). They used confusion matrix that compose of True Positive, False Positive, and False Negative to evaluate the performance of each technique. According to the result, they found that the analysis in format of the window scaling is better than image scaling. [2] "FACEDETECTION

USING COMBINATION OF SKIN COLOR PIXEL DETECTION AND VIOLA-JONESFACEDETECTOR", is use for studying the detection of the human skin. System uses a combination of two techniques that are a novel hybrid colour models and Viola–Jones algorithms. The system purpose is to identify the object is human or not. System is designed in MATLAB and use ECU face and skin database to evaluate the accuracy. By observing the result, this method has high accurate performance more than another. When use this method with Viola–Jones face detector. It will be more efficient. [3]

Haar-like features are a famous technique for detecting the face of human in the present. These are a method that has fast processing and high accuracy. This method is proposed by Paul Viola and Michael Jones in 2001. [4] Algorithms of Haar-like features are separating the image from input image to the sub window and scanning for detecting the face. The system use integral image technique for finding the summation of the pixel inside the image and then use the detector that can change the size and the position for finding the difference of white and black areas. When finish from integral image process, the next step is calling Adaptive Boosting or AdaBoost. Vacant seat detection system aim is to detecting the presence of vacant seats in a crowded hall [1]. Individual frames obtained from the captured video are analysed to detect human presence, this data is used to find the number of vacant seats in the hall. In this paper, the AdaBoost [2] a boosting algorithm is used to detect the human faces automatically [3], and then the extracted human face is subjected to the Cam shift algorithm [4]. System avoids the subjectivity of the artificial selected objects, combines the merits of the two algorithms and forms an efficient and accurate vacant seat detection algorithm. By using the AdaBoost algorithm the background of the image is separated. The face detection is performed to check for human presence in a seat. The Camshift algorithm performs RGB to HSV conversion, followed by the head shoulder detection to give the ratio between head and shoulder. Range of the head shoulder ratio obtained is used to confirm human presence in the seat [5]. This paper gives us extended form of the algorithm and uses them for detecting human presence using the mentioned techniques. The extension helps in identifying if any of the seats with in a particular place is vacant or occupied and thus the number of vacant seats in that place could be easily identified [6]. System enhances the speed of organization of people in a place and reduces the unwanted waiting time. This system is used to indicate the number of seats occupied in a hall quickly. It efficiently detects the number of empty seats there by enabling the people outside the hall to know the number of vacant seats available. Thus system plays a vital role in crowd monitoring and management [7]. Detecting face is an essential step and usually the first one in various computer vision and biometric applications such as face recognition, criminal investigations, security access systems, video surveillance, and intelligent human computer interaction. Numerous researches were performed in the field of face detection and generally can be classified into four categories: feature invariant approaches, template matching, knowledge-based and appearance-based methods. Comprehensive surveys on face detection in images can be found in [8- 10]. Among feature-based face detection methods, skin colour has been used and proven to be an effective feature to increase detection rate [11].

III. PROPOSED SYSTEM

The architecture of the system includes Raspberry Pi 3, Web camera, Vehicle, Face detection module. The Block Diagram of this Vehicle Seat Vacancy Identification System is as Follows.

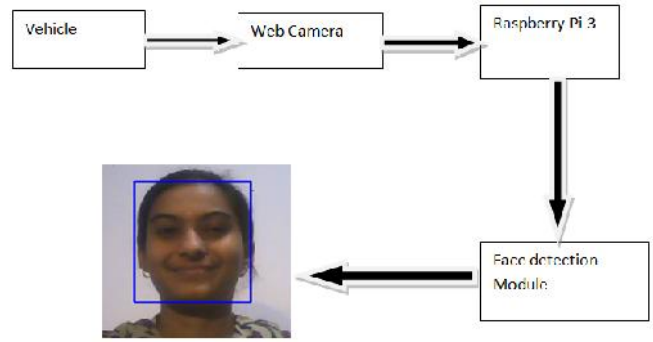


Fig. 1 Proposed system structure

1. Hardware Description

1.1. Raspberry-Pi 3

The Raspberry Pi is nothing but a series of small single-board computers developed by Raspberry Pi Foundation of United Kingdom to provide low cost solution for teaching of basic computer science in schools and in developing countries. The processor used in Raspberry Pi 3 is a Broadcom BCM2837 SoC with a 1.6 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KB L2 cache. It has potentially fast enough to decode H.265-encoded videos in software. The GPU in the Raspberry Pi 3 runs at higher clock frequencies of 300 MHz or 400 MHz than previous versions which run at 250 MHz The Raspberry Pi primarily uses Raspbian, a Debian-based Linux operating system. Raspberry Pi 3 has the functions over other models of Raspberry Pi such as

1. A 1.6GHz 64-bit quad-core ARMv8 CPU
2. 802.11n Wireless LAN
3. Bluetooth 4.1
4. Bluetooth Low Energy

Fig. 2.Raspberry Pi 3

1.2 Web Camera

The Input from camera is provide to the raspberry pi module via USB cable. In the Web camera, we use high quality wide angle lens. Snapshot button for still image capture is provided. This captured image then will be the main source of data for our system.

1.3 Detection of the human presence

The AdaBoost algorithm is used to detect the target area through the three fitting functions to model the human body. Obtaining the minimum vertical rectangle of the body frist and extract the human body from the rectangular area, we define the height of the rectangle as h; by using the transverse line h to capture the body contour from the highest point of the body. As there are a group of people sitting in the hall, we adopt the approach which is based on the counting feature to locate the human head, since the human head is shown as an oval contour. There will be a certain ratio between the human head and shoulder in physical.

2. Software Description

2.1 Open Source Computer Vision (Open CV)

Open CV is uses to reduce the noise from the image which is captured by web camera and stored in Raspberry Pi. Open Source Computer Vision (Open CV) is use to analyse and process the data then calculated the vacancy of the electric vehicle by using the maximum face detection data.

2.2 Haar-like features

A Haar-like feature considers neighboring rectangular regions at a specific location in a detection window sums up the pixel intensities in each region and calculates the difference between these sums. The difference is then used to categorize subsections of an image. An example of this would be the detection of human faces. Broadly, the areas around the eyes are darker than the areas on the cheeks. One example of a Haar-like feature for face detection is therefore a set of two neighboring rectangular areas above the eye and cheek regions.

IV. WORKING

1. When the public vehicle leaves from the station, the system will capture the image in the passenger seat area (1image per 1second) and send to Raspberry Pi module by using 3G communication, image get stored in the Raspberry Pi module.
2. In this system, the Web camera is used to capture the real time image of the product. Which is the given to the main module.
3. The main module is of raspberry pi which is on its own a mini-computer, which processes the image captured by the camera.
4. The Raspberry pi module, which contains the image processing code loaded, optical character recognition technique, is used to process the image. The raspberry pi hardware processes the image internally and counting the number of passengers in vehicle and also calculate the seat vacancy.
5. Webcam will capture passengers images in the seating area. The images will be adjusted and improved to reduce the noise which is done by software application.

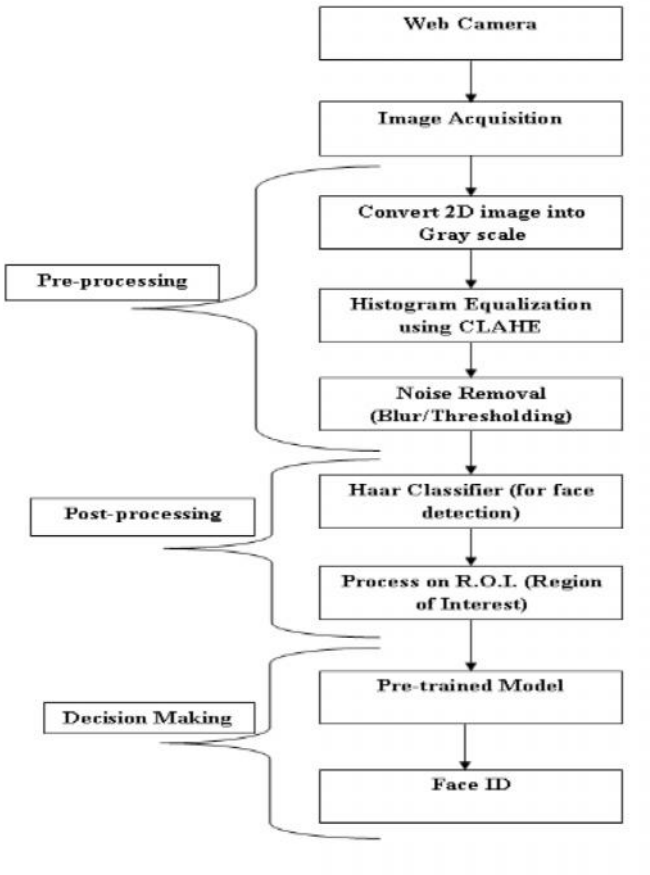
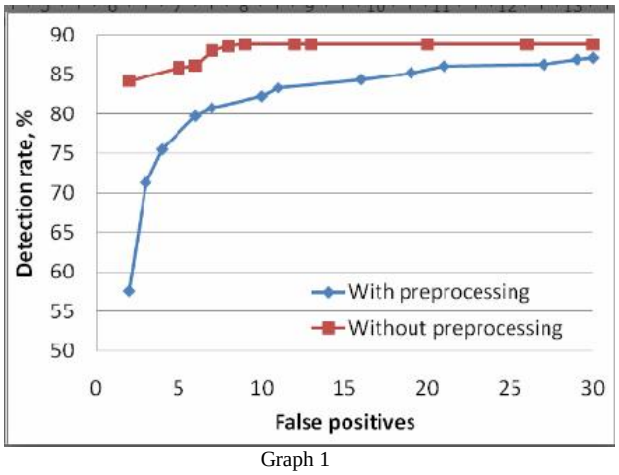


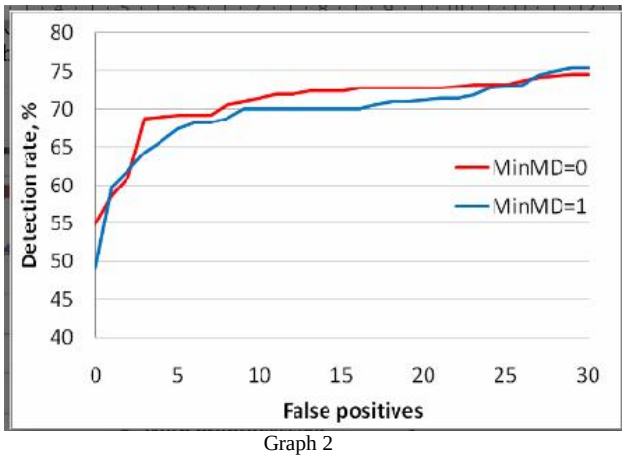
Fig.3. Working Flowchart of System

V. RESULT AND DISCUSSION

The project use different number of passengers and experimental time. This project will be run number of times. The passengers in public vehicle are not equal in each round. In each experiment uses different number of images to evaluate the accuracy of face detection in public vehicle. The result of project is shown in form of the graphs given below.



Graph 1



Graph 2

According to the result, the number of images has an effect for face detection. If we use fewer images, the program will be low performance and accuracy. The system cannot detect the face because the passengers face is not clear. This problem consists from environment around the vehicle. It makes the images too light or dark. If total number of images is increases (long capturing time), the movement of passenger face is increase as well. The System can detect the face of the passenger preferably because the program has a more chance to detect the passengers face from many images.

VI. CONCLUSION

The System proposed the design of a new concept for managing time in busy lifestyle while waiting for public vehicle. This is an application for the all the people who must need to travel by public vehicle daily or rarely. The advantage of the system is provides Real-time information on reservations and seat occupancy, and also tells the exact position of vehicle. This technique improve quality of images by using contrast limited adaptive histogram equalization and morphological process.

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