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APPLICATION OF FACE DETECTION SYSTEM FOR PASSENGER COUNTING IN LIFTS USING HAAR FEATURES

N. V. Rajeesh Kumar, G. DhanaSekar and M. Dennis
Department of Computer Science Engineering, Sathyabama University, Tamil Nadu, India
E-Mail: rajeesh555@gmail.com

ABSTRACT

Face detection is currently used technology and has a wide range of application. This paper presents a methodology for maintaining the elevator capacity based on computer vision. In this paper face detection is done by detecting facial features such as face shape and human eye position. Haar like algorithm is used to detect the face which relies on Viola-Jones face detection algorithm.

Keywords: face detection, haar like feature, openCV.

INTRODUCTION

Face detection is a technology that is used to detect human faces. Facial features are detected by this technique and other objects such as goods, instruments, etc. CCTV Surveillance is widely used application that uses Face detection methods. Computer Vision is done by using OpenCV and Haar-like feature algorithm is used. Calculating the number of people inside the elevator was a tedious process. Often Light ray sensors are used to determine the people count inside the elevator which has a high failure rate.

APPLICATION

In our day to day life we use elevators in many multistory buildings instead of climbing up a flight of stairs. So safety also becomes an important factor to be considered. This paper proposes a system to prevent accident in an elevator due to overload. The idea is to maintain the number of people inside an elevator rather considering the weight alone. Also a rational statistics of the use of the elevator in a building helps the personnel of the building to know whether the current number of elevator in the building is enough or extra elevators need to be constructed. Most elevator systems also have a load sensor in the car floor. The load sensor tells the computer the number of people inside the car. If the car is full, the computer won't make any more pick-up stops until some people have gotten off. Load sensors provide a good safety. If the elevator is overloaded, the computer system will not close the doors until some of the weight is removed.

Nowadays, it is not rare to find elevators equipped with some electronic or computer system to prevent the overload in cabin. The introduction of new electronic systems based on weighing cells has been exiling the cheap image and doubt that the first mechanical detection systems created. Though much elevator accident does not incur any loss of life; a large amount of money is spent in replacing it. To find the number of passengers inside an elevator car was a tedious process when we use weighing sensors. In this project we use multiple cameras positioned at different levels to detect the count inside an elevator car before operating it.

The camera will capture the image and send to the people counting software, this image is processed using image processing and the count is sent to the sensors. The objective is to avoiding excess crowd inside an elevator so as to avoid accidents in an elevator and provides security for the people using the elevator. In this system the image is captured at finite intervals and processing is done immediately to find the number of people inside the elevator car. This system also helps to provide a statistical report which is used to decide the overall people using the elevator per day so that the building's personnel would decide of building an extra elevator and also for elevator maintenance such as lubrication and changing the rail and elevator cable.

OBJECTIVE

The main objective of this idea is to avoid excessive crowd inside an elevator and also to provide security for the people using it. Most of the accident occurring in an elevator occurs due to overload. By implementing this system many lives could be saved and also elevator accident involves more money for replacing it. Even a small move of any one of the passenger inside the elevator induces a pressure thus might make the elevator to stop in-between two floors and also in skyscrapers, when more people are inside the elevator, there might also be a reduction the oxygen level causing the passengers to faint. So to avoid problems like these, this system has been implemented.

This system also helps to know how many times the elevator has been used and so the maintenance team will be able to schedule their maintenance of the elevator. Also in case of any emergency situation like the lift is stuck between floors due to motor failure or a theft, the situation of the passengers in the elevator could be known by the presence of a camera. The camera captures the image continuously at finite intervals and sends it to the people counter which produces the people count and sends it to the door control panel.

MOTIVATION

In our day to day life we use elevators in many multistory buildings instead of climbing up a flight of

stairs. So safety also becomes an important factor to be considered. This study proposes an automated system to prevent accident in an elevator due to overload. The idea is to maintain the number of people inside an elevator rather considering the weight alone. Also a rational statistics of the use of the elevator in a building helps the personnel of the building to know whether the current number of elevator in the building is enough or extra elevators need to be constructed.

PROPOSED ARCHITECTURE

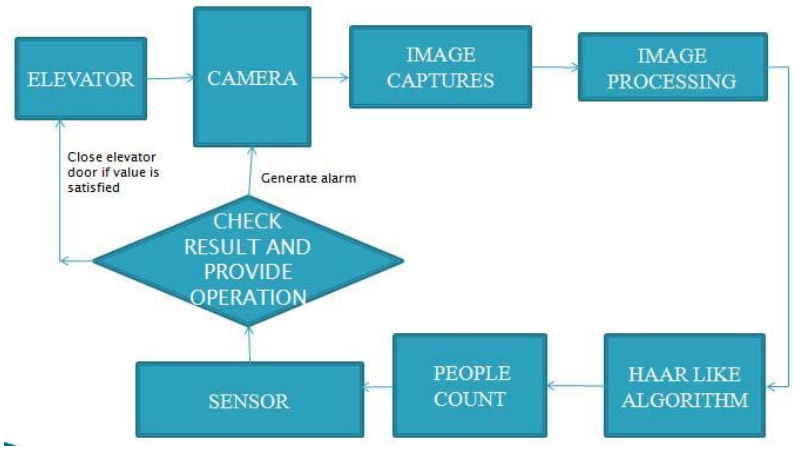

Figure-1. Architecture.

The proposed technique is to be implemented inside an elevator where people enter into the elevator and two cameras are positioned at two different altitudes so as to detect the human facial features.

The modules those are included,

- Image capturing
- Image processing
- Face detection
- Elevator door controlling
- Statistics

The camera captures the image inside the elevator and this image is processed and haar algorithm is applied on it to detect the human face. This count is sent to the elevator again which contains the door control panel. When the elevator door is about to close, the camera sends the snapshots taken inside the elevator at that instance to the people counter. The image is processed and the count is delivered to the door control panel which makes the decision of closing the door, or sends a request to the camera to take another picture and generate alarm for overload.

People keep entering into the elevator as soon as the elevator door is open. The camera which is set up inside captures the image at a certain interval (say 9 micro second) and forwards it to the People Counter. This will process the image by detecting the various human facial features and produces the exact count of the number of people who are entered into the elevator. This information is passed on to the door sensors which has the access to the door control panels. Based upon the values specified this sensor determines whether to close the door or keep it open and start the beep sound. Again the camera sends the image to the system and the people count is determined and this loop keeps repeating.

PROPOSED SYSTEM

This system is an effective way for preventing accident and to ensure safety to the passengers using the elevator. The people count is determined and sent to the door control panel and it is also displayed inside the elevator car to the passengers. The door control panel determines whether to close the door or keep it open based upon the count produced. Calculating number of people inside an elevator was a tedious process when we use weighing sensors. In this project we use multiple cameras positioned at different levels to detect the count inside an elevator car before operating it. The camera will capture the image and send to the people counting software, this image is processed using image processing and the count is sent to the sensors.

The objective is to avoiding excess crowd inside an elevator so as to avoid accidents in an elevator and provides security for the people using the elevator. In this system the image is captured at finite intervals and processing is done immediately to find the number of people inside the elevator car. Computer Vision is done by using OpenCV and Haar-like feature algorithm is used. The camera to be used must be wide-angle lens camera to get a clear view of the human face. The load carrying capacity of the elevator is much needed to prevent accident. It must also consider the number of people using it. So in this automated system several wide angle lens cameras are mounted at a higher altitude to capture the

image. The door control panel closes the door only after getting the results from the admin.

This system uses OpenCV for face detection rather than using Matlab or Labview software. The development is done using Visual basic 2010 using C language coding. While using OpenCV, the speed is increased and the response time is very low and also it occupies only low space. The API for these interfaces can be found in internet. OpenCV was designed for computational accuracy and with a powerful focus on real-time application. Using OpenCV, it can take advantage of the hardware acceleration of computer. It uses Haar cascade for detecting the face.The key supremacy of a Haar-like feature comparing other features is its speed of calculation. Due to the use of *integral images*, a Haar-like feature of any image size can be calculated in constant time.

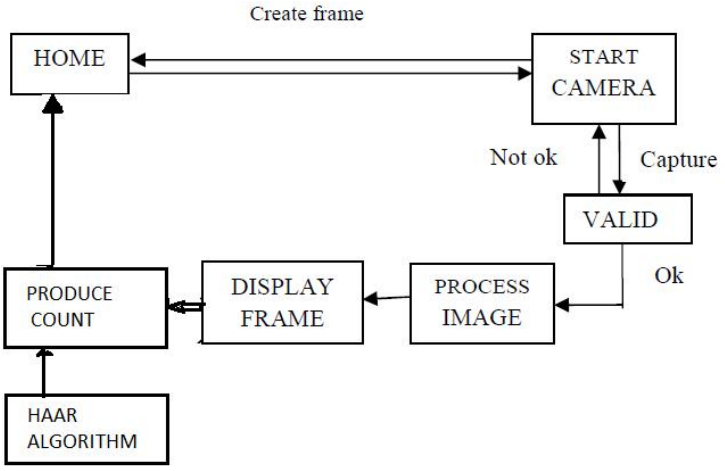

Figure-2. Working procedure.

ALGORITHM FOR FACE DETECTION

Haar like algorithm

In the paper, "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001 proposed by Paul Viola and Michael Jones proposed that Object Detection using Haar-like feature based cascade classifiers is an efficient object detection method.

Here from a lot of positive and negative images a cascade function is trained which a machine is learning based approach. Then we need to extract features from it. So, Haar feature must be used similar to the fig2. Every feature is a single value obtained by subtracting aggregate of pixels under light rectangle from aggregate of pixels under dark rectangle. For each feature calculation, we need to find aggregate of pixels under white and black rectangles. To solve this, they made use of the integral images. It eases calculation of aggregate of pixels, how big may be the number of pixels, to an operation involving just four pixels.

The Haar cascade include
Haarcascade_eye.xml
Haarcascade_eye_tree_eyeglasses.xml
Haarcascade_frontalface_alt.xml
Haarcascade_fullbody.xml
Haarcascade_upperbody.xml

These set of files is used to detect the human face.

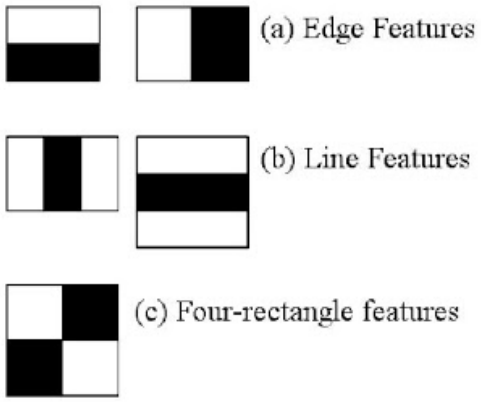

Figure-3. Haar feature filters.

OPENCV

Open Source Computer Vision referred as OpenCV is a well-known computer vision library started by Intel in 1999. The cross-platform sets its target on real-time image processing further includes patent-free implementations of the latest computer vision algorithms. OpenCV 2.4 now comes with the very new Face Recognizer class for face recognition, so you can start experimenting with face recognition right away. The library is cross-platform. It focuses mainly on real-time image processing. If the library finds Intel's Integrated

Performance Primitives on the system, it will use these proprietary optimized routines to accelerate itself.

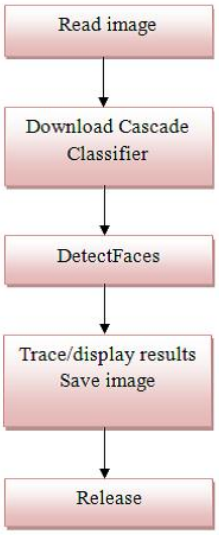

Figure-4. Face detection processing.

LITERATURE WORKS

The literature survey was quite comprehensive. Hence we review only the papers which were similar to our works. Human recognition is the trending aspect in most software packages it is highly used by security Organizations [2]. Several methods for image processing for detecting people with a still camera were studied. The next advancement was to implement a real time algorithm, adopting OpenCV libraries and computer vision to produce the count with the desired accuracy [5]. The paper "Application of Computer Vision Systems for Passenger Counting in Public Transport" [1] was our main inspiration in developing this paper. In order to determine a human face, an image must be captured by the system using a camera and a frame-grabber to process the image and then search the image for determining some of the important facial features. Face detection algorithms such as haar like features, adaboost and cascadeClassifier are used with skin color. Color is also an important feature of human faces [6]. Also it was found that a video camera was the most reliable and accurate sensor but was also expensive and heavy on computing [11].Haar-like feature was mainly used to describe the intensity difference in objects. Face detection can be done in a short time with integral images which is very faster than many other features which is the main advantage of Haar algorithm [12].After detecting the count must be produced. When the detection is done a circle is marked around the human face (i.e.), each circle represents a human. By counting the number of circle we can determine the number of people [14].

EXPERIMENTAL RESULTS

Figure-5. Basic project layout.

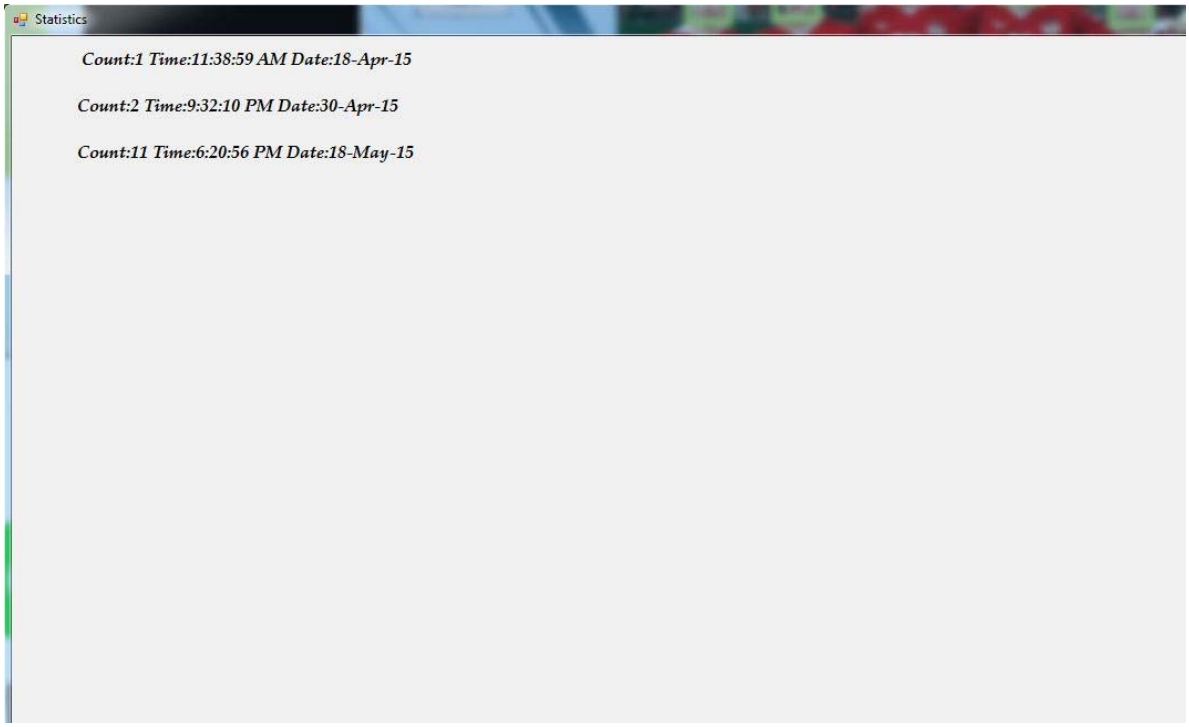

Figure-6. Statistics.

CONCLUSIONS

In this paper, we develop a computer system for maintaining the load balance of an elevator by counting the number of people inside the elevator car before operating it. The Haar like algorithm was implemented which helped to detect the human face at a faster rate. The statistical report will provide the report on frequency of overload and the overall people who have used the elevator per day.

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