Smart IoT based Passenger Monitoring System in Airports

P. S. Poojitha
pooji.chippi@gmail.com
Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamil Nadu

R. Anitha
anithanathan@siet.ac.in
Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamil Nadu

P. Naveen Kumar
naveenkumar2018@siet.ac.in
Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamil Nadu

S. Nikiil Gowtham
Nikiilgowthamravi@gmail.com
Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamil Nadu

S. Niranjan
Niranjaniselvan1@gmail.com
Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamil Nadu

ABSTRACT

In the civil aviation airport, how to ensure the security of passenger travel is the focus of the work. Therefore, we need to inspect the certificates of the passenger for travel security, and the face recognition method is researched. An improved face recognition method and inspection of Certificate methods are proposed for passenger travel security based on relevant rules algorithm. The facial features of people need to be inspected are extracted, and the relevant probability of facial features are calculated. The disadvantages of the traditional algorithm are overcome. The experimental results show that can improve the airport security certificate inspection efficiency, the face recognition efficiency is improved, and the satisfying results are obtained.

Keywords: Automatic Passenger Counting, Stereoscopic Vision Technology, Face Recognition, Database, and Human Binocular Vision.

1. INTRODUCTION

With the rapid development of computer image recognition technology, face recognition of civil aviation airport security inspection has been obtained more and more attention from people. To improve the recognition ability, and ensure the airport security, the face recognition algorithm is an important content in the field of civil aviation airport security research. The certificates inspection method of the passenger is taken based on the face recognition so it has become the core problem to research the civil aviation security. It plays an irreplaceable role in the aviation airport security. At present, the civil aviation airport security inspection methods of certificates contain face recognition method of nonlinear dynamic transformation algorithm, the face recognition method based on genetic algorithm and the face recognition method based on neural network algorithm. Among them, the most commonly used algorithm is the face recognition method based on nonlinear dynamic transformation algorithm. Due to the civil aviation airport, security certificates inspection technology with face recognition is very important, the applications are very extensive. A lot of scholars have paid attention to it, and it has become a hot research topic in the area of civil aviation security protection. In our project, we used a RASPBERRY PI controller that is interfaced with the camera. Here the RF id reader is also interfaced with a controller. If any person that is not matched with the memory card immediately the controller sends the signal to the buzzer.

An Automated Passenger Counter (APC) is an electronic device available for installation on transit vehicles including buses and rail vehicles which accurately records boarding and alighting data. This technology can improve the accuracy and reliability of tracking transit ridership over traditional methods of manual accounting by drivers or estimation through random surveying. These
devices are becoming more common among American transit operators seeking to improve the accuracy of reporting patronage as well as analyzing transit use patterns by linking boarding and alighting data with a stop or station location.

### 1.1 TECHNOLOGY USED IN AUTOMATIC PASSENGER COUNTING

One way APCs work is by using infrared lights above the doorways to a vehicle. A set of invisible (to the human eye) beams of infrared light shine down, spaced so that the order in which the beam is broken by a person determines if they are entering or exiting the vehicle. Except in extreme crush-loads, the accuracy of this technology is quite high.

Alternatively, CCTV cameras can be used together with intelligent people counters to log numbers of people getting on and off at each stop or station. These video passenger counting systems can be over 98% accurate.

With CCTV counting, operators can verify that the system is counting properly simply by watching the video back - this shows people getting on and off the vehicle together with the increasing counts.

The APC computer can also integrate with an on-board GPS system to link passenger data to vehicle location. This provides a wealth of data for agencies to analyze the utilization of the system based on location, the direction of travel, and time.

Like many other on board transit vehicles, the information can be transmitted wirelessly to a server when a bus is garaged for the day, may need to be downloaded through a physical connection, or could be uploaded in real time.

![Automatic Passenger Counting System](image)

**Fig1.1 Automatic Passenger Counting System**

### 1.2 STEREOSCOPIC VISION TECHNOLOGY

Computer stereo vision is the extraction of 3D information from digital images, such as obtained by a CCD camera. By comparing information about a scene from two vantage points, 3D information can be extracted by examination of the relative positions of objects in the two panels. This is similar to the biological process Stereopsis. Stereoscopic images are often stored as MPO (Multi Picture Object) files. Recently, researchers pushed to develop methods aimed to reduce the storage needed for these files allowing to maintain a high quality of the stereo image. In the traditional stereo vision, two cameras, displaced horizontally from one another are used to obtain two differing views on a scene, in a manner similar to human binocular vision. By comparing these two images, the relative depth information can be obtained in the form of a disparity map which encodes the difference in horizontal coordinates of corresponding image points.

The values in this disparity map are inversely proportional to the scene depth at the corresponding pixel location.

For a human to compare the two images, they must be superimposed in a stereoscopic device, with the image from the right camera being shown to the observer's right eye and from the left one to the left eye.

In a computer vision system, several pre-processing steps are required.

- The image must first be undistorted, such that barrel distortion and tangential distortion are removed. This ensures that the observed image matches the projection of an ideal pinhole camera.
- The image must be projected back to a common plane to allow comparison of the image pairs, known as image rectification.
- An information measure which compares the two images is minimized. This gives the best estimate of the position of features in the two images and creates a disparity map.
- Optionally, the received disparity map is projected into a 3d point cloud. By utilizing the cameras' projective parameters, the point cloud can be computed such that it provides measurements at a known scale.
AIRPORT PASSENGER MONITORING SYSTEM

The latest in people and passenger counting technology is a compact device based on non-contact stereoscopic vision technology specifically designed for accurately counting individuals entering or leaving public transport vehicles such as trains, metros or buses. Stereoscopic cameras capture images of the area below the device and instantly analyze the data in real time through a sophisticated algorithm. The algorithm analyzes the height, shape, and direction of any objects that are passing through the field of view. Instead of needing an entire body to pass through the view of the camera to count, these advanced cameras can count from just a shoulder or part of the body, greatly reducing the margin of error. When the device determines that a person is entering or leaving, the incoming and outgoing counters are incremented accordingly, along with time information. By implementing this technology we can identify the unauthorized person entering into the particular place.

- Visual perception of the passenger is recorded by the camera and 3D image is been obtained as an output.
- The Output is been matched with the database stored in the System.
- The status of the matching process is been displayed on the screen.
- In case of a mismatch the alert is done by the buzzer and also the status is displayed.

RF Transmitter / Receiver

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).

Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long-range applications. Also, while IR mostly operates in a line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency, unlike IR signals which are affected by other IR emitting sources.
Fig2. RF Transmitter/Receiver

This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.

RF TRANSMITTER PIN DETAILS:

<table>
<thead>
<tr>
<th>Pin No</th>
<th>Function</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ground (0V)</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>Serial data input pin</td>
<td>Data</td>
</tr>
<tr>
<td>3</td>
<td>Supply voltage; 5V</td>
<td>Vcc</td>
</tr>
<tr>
<td>4</td>
<td>Antenna output pin</td>
<td>ANT</td>
</tr>
</tbody>
</table>

RF Receiver Pin Details:

<table>
<thead>
<tr>
<th>Pin No</th>
<th>Function</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ground (0V)</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>Serial data output pin</td>
<td>Data</td>
</tr>
<tr>
<td>3</td>
<td>Linear output pin; not connected</td>
<td>NC</td>
</tr>
<tr>
<td>4</td>
<td>Supply voltage; 5V</td>
<td>Vcc</td>
</tr>
<tr>
<td>5</td>
<td>Supply voltage; 5V</td>
<td>Vcc</td>
</tr>
<tr>
<td>6</td>
<td>Ground (0V)</td>
<td>Ground</td>
</tr>
<tr>
<td>7</td>
<td>Ground (0V)</td>
<td>Ground</td>
</tr>
<tr>
<td>8</td>
<td>Antenna input pin</td>
<td>ANT</td>
</tr>
</tbody>
</table>

The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E-HT12D, HT640-HT648, etc. are some commonly used encoder/decoder pair ICs.

4. CONCLUSION

In this project, an improved a face recognition method and inspection of certificate method are proposed for passenger travel security based on relevant rules algorithm. The facial features of people need to be inspected are extracted, and the relevant probability of facial features are calculated. The disadvantages of the traditional algorithm are overcome. The experimental results show that can improve the airport security certificate inspection efficiency, the face recognition efficiency is improved, and the satisfying results are obtained. It can meet the actual demand of airport security; it can ensure the passenger safety.

5. FUTURE ENHANCEMENT

A high definition camera can be used in order to overcome the image results perfection. Sometimes a mismatch can occur at desks due to images that are already fed as database and hence to avoid this kind of situation a camera can be inserted with good resolution.
6. REFERENCES


