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Smart Baggage Handling System – A Review

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Abstract: Several security methods have been suggested and implemented for some essential activities in public or commercial institutions where security has become an increasingly important problem. Over the past two decades, face recognition has attracted a lot of interest. It may be attempting to investigate the broad range of commercial and security applications as one explanation for this. Automation is the development and use of technology to manufacture and provide goods and services with little or no human involvement. An automated luggage counter that combines software and hardware technology can be created by using automation and facial recognition principles. The user can store their valuables in the counter and only utilize facial detection and identification to open the system.

Keywords: LBPH, OpenCV, Haar Cascade.

I. INTRODUCTION

Face detection performance could be a big problem in non-frontal face recognition. The foundation of modern face recognition systems is subspace modelling and learning dimension-based dimension reduction techniques. This area's exploration of these sub-areas to find useful traits and create reliable classifications presents another problem. Facial recognition has caught the attention of academics in a variety of domains, including psychology, image processing, and computer vision, because to its high accuracy and minimal penetration[3].

The human face, which is a person's distinctive biological features, contains a wealth of biological data, including skin tone, face shape, and facial traits (hairdos, beards, wrinkles), among others. Additionally, face information might also reflect a person's social activity. To infer the data about human features, such as expressions and ages, many studies have calculated and modelled human faces. Identifying human gender is one of the most important research. Security systems, biometric identification, user profiles, intelligent monitoring, and human-computer interaction all make extensive use of the study on face gender classification[3].

Face detection is the process of recognizing faces in photos or videos. It could be applied to remote distinguishing proof administrations for security in industries like banking, transportation, law enforcement, and electrical enterprises. This ability is quite potent despite the enormous variations in visual improvements caused by changing health, ageing, and interruptions like beards, spectacles, and haircut changes[8].

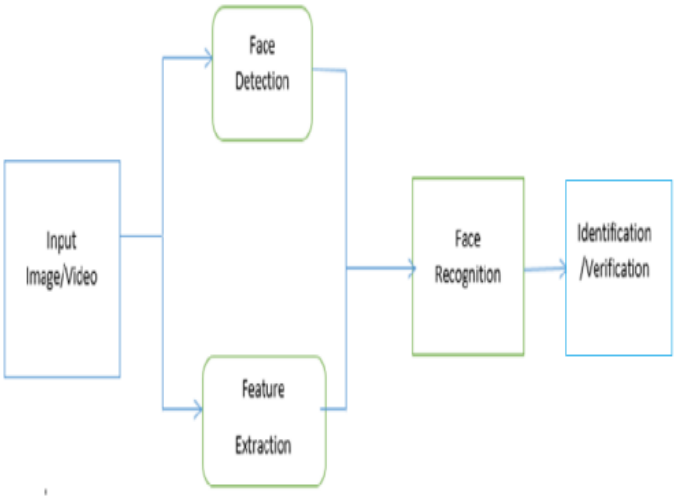

Figure 1: Block Diagram[6].

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The major computational advancement of the LBPH is to create a center picture that, by including the face characteristics, presents the primary picture in an unmatched manner. In order to achieve this, the algorithm considers a sliding window from the viewpoint of the parameters clear and neighbors. For the purpose of properly appreciating the image, it should be divided into a few small propels: consider a grayscale image of a face. To do that, take a 3x3 pixel window from the image. It can also be thought of as a 3*3 structure with pixel intensities that range from (0 255). At that point, decide to utilize the system's central estimation as the edge. The taken value is utilized to depict the 8 neighbor's new qualities[8]. It has been demonstrated that Eigen face detection is accurate and quick. With the use of a typical web camera, a computer can detect and comprehend a person's face; a distinctive login page will be created with the capacity to channel client access based on the customers facial traits.[6].

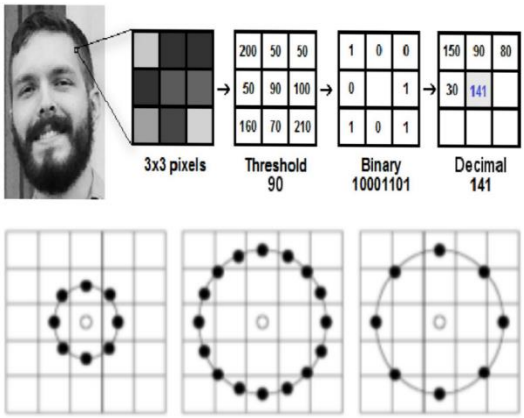

Figure 2: Haar Cascade classifier and spherical LBPH[8].

Set some other combined good worth for each neighbor of the middle tremendously worth (zone). Set a value of 1 for highlights that reach or surpass the consensus and a value of 0 for characteristics. The system will initially only have parallel characteristics (ignoring the central worth). Each dual driving force from each place in the system must be connected, equation by equation, into a different parallel value (for instance 10001101). Although other manufacturers manage the twofold qualities in somewhat different ways (for example, by using a clockwise course), the proportionate outcome is always the same[8].

A cross section is centrally estimated by a two-fold motivator to a decimal value and is actually a pixel from the main image. Nearing completion of this method (LBP framework), have another image that more effectively corresponds to the primary picture's features. The fact that LBP is simple and interpretation invariant gives it some leeway. Chose an 8-point neighborhood, although as the following example shows, most people use a circular neighborhood[8].

In order to produce better results, the first LBP computation has been further improved. The Uniform LBP is one of these procedures. Uniform LBP is used in the code. The Spherical LBPH method was developed to replace the range and neighbor counts used in the LBP approach. It usually ends up using a bilinear introduction. If a few significant points are located between the coordinates of the four nearest pixels (2 2), it is possible to estimate the coordinates of the new data[8].

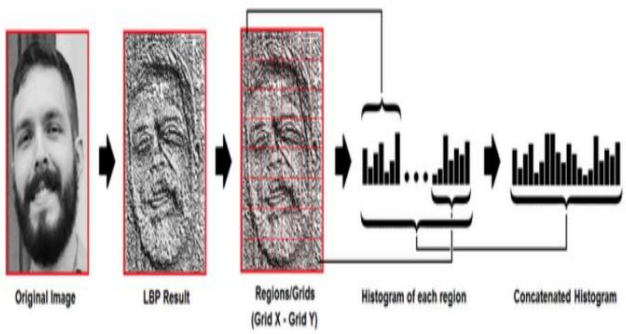

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Figure 3: Histograms of facial images[8].

Face detection and recognition are built in real-time using OpenCV and the Python programming language. The samples are collected and modified to meet the requirements. A Local binary pattern histogram algorithm is used to train the samples, and an array of data sets is created. In the following phase, using data samples from the trained dataset, compare the face and send a respectable signal to the Arduino board. Arduino functions as a controlling unit, controlling the basic operation of the prototype model.

II. LITERATURE REVIEW

In order to make sure that the luggage system followed the user's directions, R. Priya et al. [1] employed a six-wheeled robotic system with a Mini Arduino implementation. The user of this system can utilize it to pinpoint their precise location and tell it to follow them. The user and the luggage system will be separated by 2 meters in order to prevent a collision.

A face recognition system with audio output was introduced by Md. Golam Sarwar et al. [2]. In order to create the dataset, the Haar Cascade Classifier is utilized to find faces in video streams. The recognizer is then made from the predefined dataset using the LBPH technique. This system can recognize faces with an accuracy of roughly 93% using LBPH. The Fisher face algorithm was also utilized in this work for comparison, with an average accuracy of roughly 86%.

Jeevan Singh et al.,[3] describe the methods and applications of selected face recognition, and also their application in the context of face recognition. Taking more photos of each person an enables you to make better decisions on the dataset and improve the facial recognition accuracy. If you are unable to take additional images, make mirror copies of your facial images so that your pass training images are doubled and not slanted to the left or right.

Yongjing Lin et al. [4] extract feature features from the face in order to produce feature vectors using a pretrained face recognition algorithm. Lastly, artificial intelligence a model for predicting feature vector categories based on feature vectors is trained using algorithms. The model training step is analogous to the face gender prediction stage, with the exception that the test data feature vectors are directly predicted using the model developed during the model training stage.

Following face detection, key facial features are predicted, as shown in Figure. 3, and the predicted key points are utilised to linear transform the cropped image.

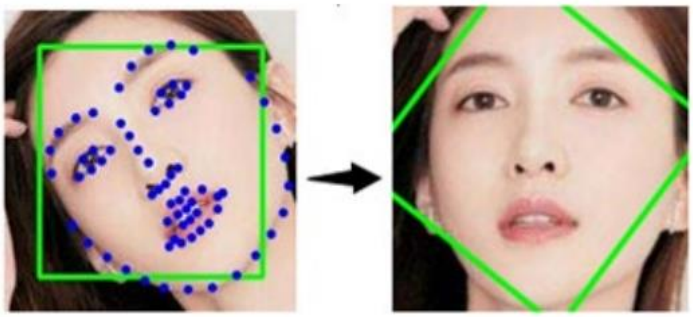

Figure 4: Preprocessing process of a face image[4].

LBPH is described by Anjali T et al.,[5]. A frequent facial recognition method is LBPH. Our algorithm recognizes pupils who unintentionally alter, like donning glasses or shaving their beard. The dataset is too tiny, which is an issue. A better dataset might be created in the future, which, in theory, would produce a more accurate result. By creating fresh training instances, It can enhance haar cascade classifiers, which raises the recognition rate for a typical individuals

J. Manikandan et., recognition system[6] uses a photo from a video or a digital camera as input and outputs the subject matter of the diagnosed photo. The formatted and stylized portions of the face, changes in the structure of the face, face cuts, and angles can also be considered facial features. Face extraction provides the ability to capture video.

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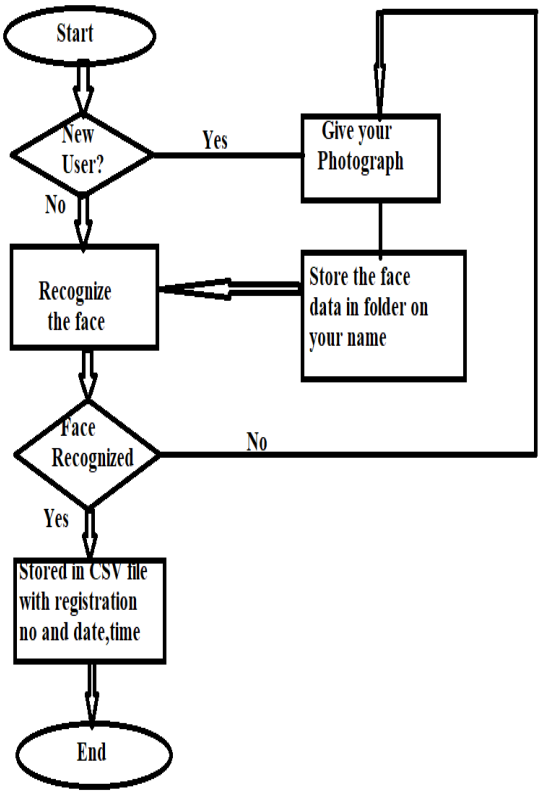

Figure 5: Flow chart[5].

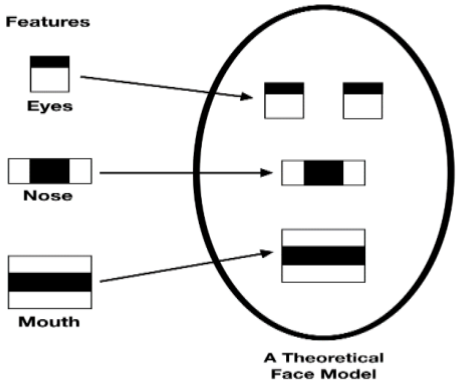

Figure 6: Detection of Theoretical Face model using Haar like features[6].

Lixiang Li et al.,[7] Although face recognition technology has come a long way, there is still potential for development in terms of practical applications. A specialized camera for face identification may exist; it can enhance image quality and address issues with image filtering, image reconstruction, denoising, and other issues. Additionally, we may leverage 3D technologies to enhance 2D photos in order to address issues like rotation and occlusion.

D. Bhavana et al. claim that [8] uses speech-to-text conversion to identify students in a real classroom with a variety of postures. It also claims that [8] produces more accurate findings when compared to other best-in-class estimates. The total precision of the suggested executive participation framework is 85%.

Face net and the histogram object gradient were both utilized by R. Rameswari et al. [9] to recognize faces and extract features. Face encoding, facial feature extraction, and face comparison are only a few of the various facets of face recognition that are covered. Face recognition and RFID technology are used to increase system security. It can be used with the Jetson board in a real-time setting to build a reliable security system.

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Including Jae Jeong Hwang,[10] The employment of LBPH, HOG, and linear SVM object detector in an effective face recognition method is suggested and put into practice in order to quickly distribute biometric data recognition into the market. For both front-view and slanted facial photos, the identification performance for recognizing the face region is improved by introducing the LBPH algorithm into the traditional Haar cascade technique. Results for both single and multiple face photos were shown.

The Haarcascade method is based on the Haar wavelet, integral image analysis, Adaboost, and cascaded classifier, as seen in Figure 6. Results for face detection using photos of slightly tilted faces are shown in Figure 7. In the case of non-front view photos, two rectangles on the images indicate incorrect performance of the Haarcascade system. Figure 8 shows blocks for distance measurement and an array of LBP histograms. As shown in in Figure 9, which depicts a rectangular section of the face even in slanted photos, the method successfully detects the right faces.

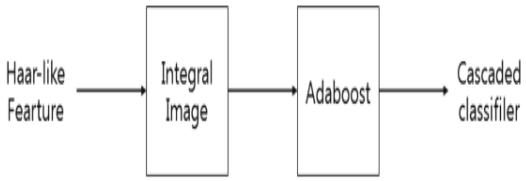

Figure 7: Face detection using Haar cascade method[10].

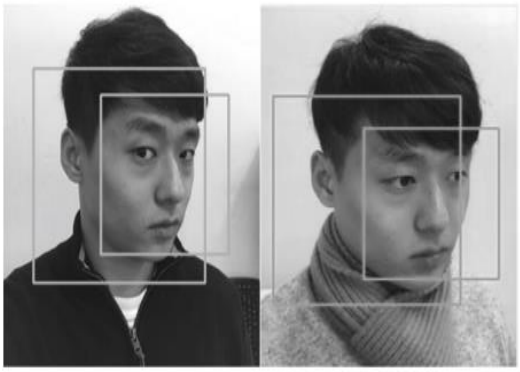

Figure 8: Face detection using Haar cascade scheme[10].

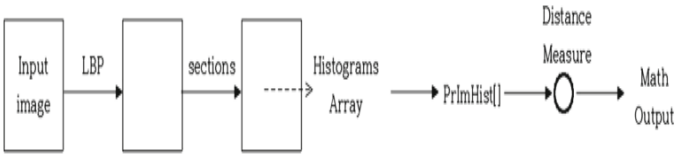

Figure 9: LBPH face detection scheme[10].

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Figure 10: LBPH based Haar cascade scheme[10].

Further advanced algorithms are suggested, including the LBPH, HOG, and CVM detectors (see Figure 10). Using the OpenCV dlib library, HOG is implemented. In Figure 11, which serves as an example for the Lena image, the facial feature detector is pre-trained to yield 68 coordinates that may be mapped on the face border. Figure 12 illustrates the traditional Haarcascade method for solving the detection failure with two rectangles and mapping points overlaid on slanted images.

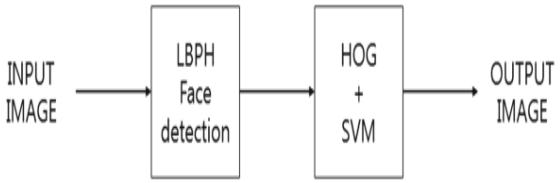

Figure 11: Block diagram of LBPH, HOG and SVM[10].

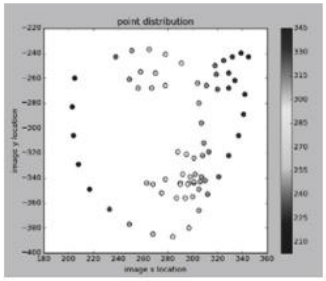

Figure 12: Mapping points using LBPH based scheme[10].

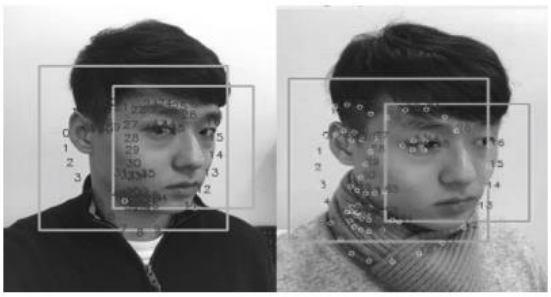

Figure 13: Result of face detection using Haar cascade[10].

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III. SUMMARY

Face detection and face recognition using different algorithms and approach is used for security purpose. The implementation of a automated control system and its uses that benefits the basic sectors. Haar Cascade Classifier is used to identify faces in a video stream in order to create the dataset. The recognizer is then created using the predefined dataset and the LBPH method.

IV. CONCLUSION

Face recognition systems finds wide use in SMART environments, where computers and machines serve as helpful assistants. This aims to create a secure system, such as an automated luggage counter, based on the needs of customers. This type of environment can be found everywhere, including airports, seaports, railway stations, large events and happenings, shopping malls, and so on. There are numerous algorithms used. It is found that Haar cascade and LBPH algorithm are more effective algorithms.

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