ATTENDANCE SYSTEM USING FACE RECOGNITION AND RASP BERRY PI–REVIEW

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ABSTRACT

The attendance process is currently done by hand. This results in significant time loss for both instructors and students. When attendance is manually recorded, pupils have to wait longer. Manual work is intimately associated with human error. The face of every individual is significant, identifiable evidence. As a result, automating the attendance process will extend classroom instruction. We chose the Raspberry Pi so that everyone could use face recognition. Traditional face detection and recognition techniques are used in a Raspberry Pi-based facial recognition system. Facial recognition is essential for surveillance and security. As a result, an economical and efficient method is required. The identification method is based on face recognition and is further divided into three steps: real-time detection, feature extraction and classification, and face recognition. Facial recognition is recognized as a critical phase in our system. The OpenCV library is used in Python to construct this system.

INTRODUCTION

An attendance monitoring system is a vital tool used by almost all organizations and institutions. Currently, there are two types of systems available: automatic systems and manual systems. The most often used technique for keeping track of attendance is completely manual and involves using paper sheets. Impersonation is made feasible by this practice, which sometimes leads to the attendance sheet being lost. Due to the lengthy nature of this procedure, a reliable, automated system is needed to minimize its shortcomings. The instructor must fill out a lot of paperwork, which is difficult to keep up with, and our manual attendance method wastes a lot of time calling out each student's name and number. The issue of illegal attendance might sometimes come up. Using facial recognition to register attendance is the most intelligent way to activate the attendance management system. Face recognition is quicker and more accurate than previous methods. Face recognition provides passive identification, which eliminates the need for the individual to be identified to provide specific identification; instead, the efficient system captures the frames through the live stream, allowing for more precise and reliable recognition. Facial recognition technology is a very important real-time and contactless attendance monitoring solution. By connecting to software, a network connection, sensors, and other electronic devices, the Internet of Things (IoT) is a network of interconnected gadgets that collects and exchanges data to help those devices become more advanced [1,2]. Every year, billions of devices connect to the internet to share information. In 2015, there were around 15 billion connected devices, and in only five years, that number had doubled. In the next five years, there will be 75 billion gadgets. IoT has many applications in everyday life, and one of the fundamental elements of any system based on IoT is security monitoring [3,4]. The Raspberry PI is among the most widely used IoT devices [5]. An affordable, small, and portable computer board is the Raspberry Pi. It may be connected to a keyboard, mouse, television, computer screen, and other gadgets like flash drives. Software like Scratch, which is included with the Raspberry Pi, enables users to make fun games, animations, and films. Because Python is a key component of the Raspbian operating system, programmers may use it to write scripts or programs [6]. The main goal of any face detection system is to locate faces in pictures. Each face must be able to be accurately located if there are any, and the face identification technique must draw borders around each face. How hard it is to identify individuals in photos depends on a number of factors, including image backdrop, background color, postures, emotions, position and orientations, skin tone, the presence of glasses, facial Among the several face recognition methods that have been developed and put into practice, the Viola Jones Haar Cascade Classifier (V-J) and Histogram of Oriented Gradients (HOG) are two of the most popular. To create a robust cascade classifier, HOG computes the classifier for each image in its scale, applies sliding windows, extracts the HOG descriptor at each window, and then applies the classifier. If the classifier detects an object that resembles a face with a sufficient probability, it records the window's bounding box and applies non-maximum suppression. The V-J approach uses the AdaBoost algorithm and a Haar-like feature to compute the integral image.

LITERATUREREVIEW

According to Gupta I's study [8], a Raspberry Pi-based face recognition system might be developed by using popular face detection and identification techniques as Haar detection and PCA. For this investigation, they linked a motor, a camera, and an LCD to the Raspberry Pi board. The motor turns to show when the gate is opening and shutting, and the LCD shows the name of the individual being recognized. They developed a real-time program that serves as a gate pass by comparing the scans to data stored on the Raspberry Pi. The capabilities of this system may be divided into three categories: registering and recognizing faces using a camera; displaying the match status on the LCD and VGA monitor; and directing the motor according to the current scenario. Identification and authentication systems involve four processes: capture, extraction, comparison, and match or non-match. A system integrating Raspberry PI, OpenCV, and Python is suggested in the work by Wazwaz AA [9] to enhance face recognition and identification in real-time. A Python-based program is used to crop the faces in the camera's acquired frames, identify them using the Boosted Cascade of Simple Features (BCOSF) approach, and then send the data via TCP/IP across an Ethernet connection to one of the PCs (Linux-based servers). The chopped faces are identified using the Local Binary Pattern Histograms (LBPH). If a face is too unfamiliar for the recognition system to recognize, it is sent to another computer. However, the average error rate rises as picture quality diminishes with decreasing image size. Factors like as camera resolution, distance, and lightning affect the system's performance. The more servers there are, the more accurate the result will be. Cost and server security should be taken into account while building the system. The use of machine learning algorithms for real-time face picture identification is the subject of another Singh S. article [10]. Each method's limitations and range of uses are emphasized. The Haar-Cascade method was one of the first techniques for face recognition. The HOG (Histogram of Oriented Gradients) approach is suitable for face identification as it has shown remarkable effectiveness with object recognition. Both methods are compared using the Eigen feature-based face recognition algorithm. Operational speed, illumination, side and frontal profiles, picture distance, image size, and other important factors are investigated. The facial recognition model is implemented to recognize and identify faces in real-time using the Raspberry Pi and Pi camera. The accuracy, speed, and reliability of the Haar and HOG algorithms are compared. The Haar technique was implemented using a Raspberry Pi 3 Model B+ with a 1.4GHz Cortex A53 and 1GB of RAM. The Raspberry Pi was also used to test the HOG approach, however it was shown to be too computationally demanding and to crash often. Consequently, HOG was deployed on an Intel i5 CPU system, and the choppy real-time video was enough to verify accuracy and reliability. Since the HOG approach identifies edges well, its accuracy was 98%. The Raspberry Pi 3 Model B+, which has a 64-Bit quad CPU, is utilized to train the Haar cascade algorithm, and the Raspberry Pi camera is used to take real-time face photos for the identification process. The Haar technique's accuracy is less accurate than that of the HOG approach. The HOG approach may achieve up to 80% accuracy for a wide range of pictures, while the Haar cascade technique only achieves roughly 50%. According to Rahmad C.'s article [11], The system is capable of classifying and identifying faces in a range of situations, according to a previous experiment. Utilizing V-J and HOG, five trials under six distinct situations yielded accuracy of 75.33% and 80.22%, respectively. In terms of size, location, cosmetics, expression, and lighting, the V-J algorithm can recognize frontal faces in photographs rather well. However, it has a harder time identifying faces with occlusions, such as masks, helms, or spectacles.

The V-J technique can run in real-time on a range of hardware and software, however the basic problem with Haar cascades is in the parameters known as detect multiscale and scale factor. numerous faces in an image may be detected with the help of the assessment of numerous pyramid layers, which happens when the scale factor is too low. However, this would slow down the detection process and increase the rate of false-positive identification. However, if the scale factor is too large, the face cannot be seen in little pixels. the recommended size for datasets with pixel resolutions of at least 250*250. The HOG captures local look very well and is more accurate than V-J for face identification. According to Shrivastava K. et al.'s article [12], It can handle issues that arise when creating a face recognition system, including information retrieval time, image properties like size, quality, and intensity settings, and face orientations, by utilizing a sizable and precise training dataset, pre-processing techniques, and Haar-cascade classifiers. To ensure that lecturers or professors can record students' attendance with the least amount of human contact (and therefore, human error), it is crucial to develop an automated attendance system that records the output of class sessions. The solution is relatively cost-effective due to the use of the Raspberry Pi3 and Pi camera. Combining the Linear Discrimination Analyzer (LDA) and Linear Binary Pattern Histogram (LBPH) makes the system more dependable and efficient in identifying students' faces and providing a safe environment.

PROPOSEDALGORITHM

We will be able to recognize faces in photographs by using the Haar-Cascade method, which recognizes both face and non-facial patterns. Regardless of an object's size or position, the Haar-Cascade method can identify it in an image. This method may be run in real time and is not very complicated. A haar-cascade detector may be trained to recognize a variety of items, including vehicles, motorcycles, buildings, fruits, and more. The cascading window is used by Haar-Cascade to calculate features in each window and determine whether it is an object. The Haar-Cascade algorithm is a machine learning-based technique for object recognition in pictures. It is particularly adept at identifying faces, however it can be taught to recognize other objects such as cars, motorcycles, buildings, fruits, and so on. The method uses Haar wavelets to calculate attributes for each of the tiny windows that are created in a picture. These characteristics are then used to train a classifier that can differentiate between windows that contain the target object and those that don't. We initially give the Haar-Cascade algorithm a picture in order to use it for object detection. Next, we specify the target object that we want to detect. The next step is to create a set of both positive and negative pictures in order to train the classifier. Positive pictures include examples of the desired item, whereas negative ones do not. The classifier is trained using a machine learning method, such Adaboost or SVMs, that computes features in each window using Haar wavelets. Once the classifier has been trained, we apply it to every window in the picture. The classifier calculates the properties of each window and then assesses if the target item is present. To identify objects of different sizes and forms, the picture is processed using the cascade window approach at many scales and orientations. If an item is located in the picture, a bounding box is created around it to indicate its location. All things considered, the Haar-Cascade algorithm works well for recognizing objects in pictures. It is effective and relatively easy to use, and it can be taught to locate a wide range of objects. By using a cascading window technique to analyze the picture and Haar wavelets to produce features, the system is able to recognize objects in an image regardless of their size or position.

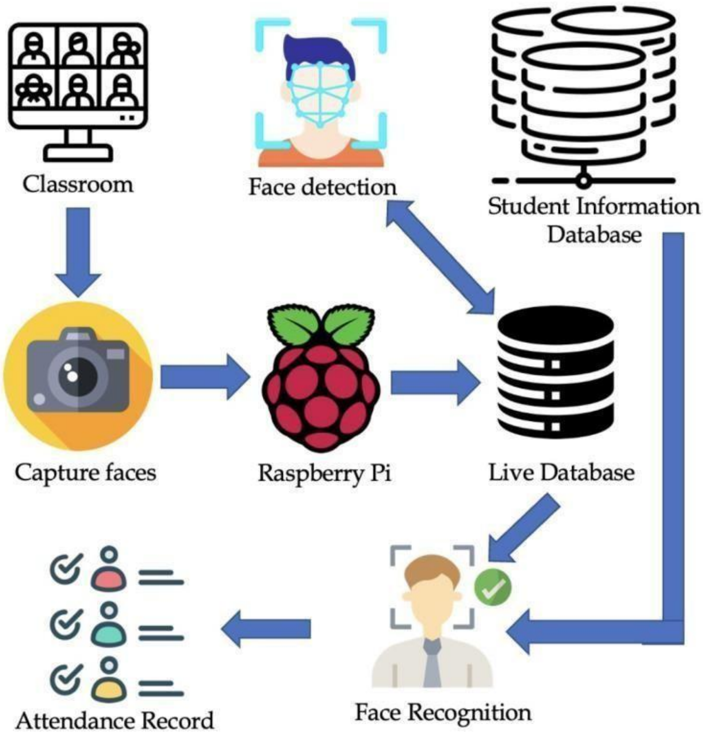

Figure Block Diagram of Proposed Project

CONCLUSION

The findings of this study on object detection systems are fascinating. According to the research, the HOG approach requires a lot of images even if it is more accurate than other algorithms. As a result, it may not be as helpful in places with limited resources. However, the lower-end, RAM-constrained Raspberry Pi 3 model was shown to work better using the lower-end Haar- Cascade method. The research also found that the Haar-Cascade approach is less accurate than the HOG algorithm, with an accuracy rate of around 50% to 60%. Additionally, false detections were often seen, which may be troublesome for applications requiring a high degree of accuracy. This finding implies that the application's requirements, such as the resources at hand, the required level of precision, and the potential for false detections, should guide the choice of object detection technique. The HOG approach could be better for certain applications while the Haar-Cascade technique might be better for others, depending on the particular needs and constraints of the application.

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