

Automatic Gate Opening System with Face Recognition

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Abstract – Despite the limitations of current technology, facial recognition from still or moving sources is developing into a useful tool for law enforcement, security, and counterterrorism applications. Currently, facial recognition shows promise and has been used in a small number of applications, The effectiveness of a facial recognition algorithm is examined in this assessment, specifically with regards to factors such as age, gender, ethnicity, facial characteristics, and lighting levels. Face recognition is being used more frequently as a non-intrusive identity verification technique. In this paper, we propose for the first time a strongly privacy-enhanced face recognition system that effectively uses secure multiparty computation techniques to conceal both the biometrics and the result from the server performing the matching operation. These issues can be easily solved by Explainable AI (XAI), and the solutions are clear to the end users. The proposed system is entirely implemented on a Raspberry Pi, enabling a full embedded application. With the aid of open-source libraries for training, defining, and running machine learning models like Tensorflow.js, Keras, and OpenCV, the application was created using Python and HTML on PyCharm/Visual Studio Code. An entire application can be run on a microcontroller, like the Raspberry Pi, which enables plug-and-play operation of the system at any time. The face detection subsystem, which is based on an improved PCA algorithm, can identify faces in moving vehicles and communicate with the vehicle's owner via GSM. The car's location is sent via GPS. This is the most reliable car security system because we can still locate the car even when it is lost and we can see the thief's face. The owner of the car is free to give the password to new drivers as well. This makes the car security system safer and more comfortable.

Keywords – Gate Opening System, Keras, OpenCV, Face Recognition.

I. INTRODUCTION

As a result of the introduction of new technologies, many businesses are using clever solutions for personal identification verification in duties like confirmed admission at the gate, staff attendance tracking, and numerous other surveillance operations. As these systems are vulnerable to theft, fabrication, and user memory passes, an amazing interest in biometric identity systems has emerged in recent years. Well-known biometric identity verification methods include fingerprint, iris scan, speech recognition, and face recognition, although each has drawbacks. For instance, if the hand is dirty during fingerprint identification, the attempt to properly establish identity will fail. The aim of this paper is to help users improve the door security of sensitive locations by using face detection and recognition. This paper is comprised mainly of three subsystems: face detection, face recognition and automatic door access control. The door will open automatically for the known person due to the command of the microcontroller. In order to increase security, we have suggested a facial recognition door lock system in this article using the Pi camera and Raspberry Pi platform, facial detection. Python and the Open CV libraries are utilized for creating applications. We have suggested the Haar classifier approach for face identification in order to obtain a precise and clear image of an intruder. All groups manually record each person's attendance by calling their name or register number, noting it in the department head-issued attendance registers as verification, and in some organization asking the students to sign the sheets that are kept for future use. Although few students consistently sign for their missing pupils or report proxy attendance of the absent students, this approach is repetitious, difficult, and prone to mistakes. The automated door is relatively pricey and readily available locally. By removing some of the sensors and unneeded chips or objects, this exorbitant price is minimized. The goal of our project is to create and test an automatic door opening system. The study article I read on low speed, high torque DC motors and sensors that meet the needs of our project's automatic door opening system is suggested as a source of locally affordable raw materials.

II. LITREATURE SURVEY

Eric P. Kukula et. al. [1] investigated on the biometric authentication entry point. The work involved with study of factors affecting face recognition process. In Due to their ability to considerably alter face recognition performance over the course of several trials, ambient lighting levels, reflection, and directions were found to be controllable independent variables. Measurements were made of the false non-match rate, failure to enroll and failure to acquire. The matching algorithm's mistake rate from one real attempt at a template comparison is what is meant by the false nonmatch rate used in this evaluation. The FRS was unable to collect 100 photos of adequate quality during an enrollment attempt, which is how this evaluation's failure to enrol rate is determined.

Martin Franz et. al. [2] August 2009, He studied about the privacy preserving face reconigation. Face biometrics are widely used, which raises serious privacy concerns. Particularly troubling are situations in which a face image is automatically matched against a database without a person's explicit consent (such as in the afore mentioned surveillance scenario), as this enables the tracking of individuals against their will. A thorough policy defining to whom biometric data is exposed is required due to the widespread usage of biometrics, especially if biometric matching is carried out at a central server or in partially untrusted contexts.

Rashmi Deshmukh et. al. [3] October 2022, He investigated on the ML and IOT. The issue with the usual method of verifying that every person is wearing a mask is that a person must be designated to the duty of physically verifying that people are wearing masks and possess valid vaccination certificates, which are often cross-checked with government identification. This problem has harmed business owners because it is a laborious task to constantly remind people to wear a mask. One possible cause of this problem is that strict action can't be taken on such people. A potential solution would be to restrict the entry of people unwilling to wear a mask. This is difficult for people, especially old people who don't have a smartphone, to always show their vaccination certificate.

Sreenivasa Rao. Ket. al [4]. November 5, 2013. Keyless car entry authentication system. This Keyless Car Entry Authentication System Based on A Novel Face-Recognition Structure is used to identify the driver's face and compare it to a predefined face. For instance, if a car is stolen at night while its owner is asleep, the FDS gathers images using a small web camera that can be placed anywhere in the vehicle. If there is a discrepancy between the retrieved image and the preset photos, the information is sent to the owner through MMS.

Monikha sha et. al. [5], January 2020, smart gate. Using multiple datasets, the suggested integrated face recognition algorithm has been evaluated, and it has been found to be more accurate than previous tested algorithms, achieving up to 97% face identification rate. A scenario where reflection from spectacles complicates facial characteristics and leads to faulty face detection was revealed through an analysis of a failed face recognition system. Here, a smart gate architecture with a highly accurate facial recognition algorithm is suggested to cut down on the amount of time required for real-time identification verification by people.

Florin Grofu et. al. [6] January 22, 2017. He studied on projecting the face vector to the basis vectors, the suggested system may identify a person who is stored in the database. The test face image's identification and The generated projection coefficients, which serve as a representation of each facial picture feature, are utilised to determine the training prototype. We have the finest recognition when the match is high. We may infer from the findings that the gaze can be laterally oriented at an angle of 45° and need not be in the centre of the image in order for the person to be identified.

Mahendra. Ret. al. [7] December 2020, He practiced the project on facial recognition door lock system into practise. Using cascade classifiers, which achieve high accuracy and are stored in the database, faces are recognised. We just utilised 40 photos for this testing. In the IOT, computer vision is employed. For safety reasons, we have, Here classifier-based real-time face detection has been implemented. So, this technique can be helpful for elderly individuals who live alone and for people who are disabled. As a result, the suggested system is very simple to build and straightforward to follow the journey.

Shushma Mnjulaet. al. [8] January 2020. He done this experiment to reduce the mistakes that result from human attendance taking, we are automating the procedure. If cameras were being used in classrooms to gauge student inter Students are more likely to pay attention if an AI-enabled system can track and record their attendance, and faculties will at least come to school or college every day because, in the past, they used to arrive, put up a sign, and then leave; now, if a faculty member leaves the college, the system automatically marks them as absent. As a result, everyone will regularly attend school or organisations. The system for tracking staff and student attendance uses artificial intelligence and is exceedingly secure, accurate, and simple to use.

Suraj I. Shende et. al. [9] May 2020. He investigated the project "Automatic Door opening system" project is a straightforward creation that uses an Arduino Uno as a microprocessor. Second, the expanding field of motor driver integrated circuits. The microcontroller receives the output from the IR sensor as input. The output from the IR sensor will be continually monitored by the microcontroller. A door mechanism that automatically opens and closes has been devised in this study. There are three ways to open the door: first, when an Infrared sensor is detected; second, in the event that the system

malfunctions; and third, anybody can simply accomplish this since the door rotates 360 degrees when someone enters or exits, allowing anyone to push or pull the door with little effort.

Shalabah Gaur et. al.[10] April 2019. He studied about the PIC microcontroller with a several physical IC components. The sensors serve as input devices for switches and sensing. This system produces both motor activity and LCD display outputs. The circuit diagram is quite simple and without any complication. The structure of this gadget requires just a basic understanding of programming and microcontrollers. Several component types, such as the solenoid valve and the motor, can be used to open and close the door. In this thesis, a DC motor is powered by an L293 motor driver. The DC motor drive may be bidirectionally controlled by L293. The motor on/off is limited by edge detection switches. Forward, reverse, and stop motor operations can all be managed by software.

MahindraKumarSubramaniam et. al. [11] May 2022. He investigated on the global population and ensures about the global population's safety. People can feel comfortable with them thanks to the monitoring system. The embedded systems have greatly illuminated the networks that rely on detection and monitoring. This study may be expanded upon by connecting it to the IoT (Internet of Things), it may be expanded to save the information in the cloud for further study. By using an embedded system created for this research, automated decisions are performed that add an additional layer of protection against the covid-19 infection.

Ela Okowa et. al. [12] May 2020. He featured about a face-recognition smart door lock system using a Raspberry Pi. Python was used to implement the classifier and feature extraction. The facial recognition algorithm's output controls a relay circuit, which locks or unlocks the magnetic lock at the door in the prototype design for actual implementation. We've discussed how the Raspberry Pi's low processing power impacts several aspects of picture capture, including image resolution, processing speed, memory use, and power management. The test revealed a 100% identification rate among the three participants. For increased security, this proposed system might be linked to the smart home system over the Internet. Optimization of hierarchical image processing and the application of various feature extraction techniques are included in further study.

Nitin patilet. al.[13] May 2021. He investigate on access monitoring and control system utilising the Blynk application is the focus of this study. In this project, an Atmega16 and Node MCU will be used to construct a smart gate. There will be two modes, automatic and manual. An android application will be used to monitor and operate the gate. So that security parameter may be implemented properly.

Ishita Singh, et. al.[14] December 2014. Floods and water waste are two major issues the globe is now dealing with. There was a significant loss of life and property due to the older technologies' limitations, which included their lack of full automation and inability to gauge water pressure and level. The concept intends to fully automate and utilise technology throughout the entire process. The system will send out a prompt warning for the abrupt increase in water pressure and level. This reduces the number of lives lost and the damage caused by floods by warning the adjacent areas in case the situation worsens. The system may also be used on a small scale, like as a water storage system for

Kola Micheal KAREEM et. al. [15] December 31 2019. He studied on the face recognizing effectiveness in both adverse and favourable weather circumstances allowed the completion of the work's objectives. Within a range of 0.42 to 0.52 metres, the automatic gate can reliably sense and identify both moving cars and people, as well as carry out the necessary operation.

EveretusZewula Orji et. al. [16] April 2018. He studied and demonstrated a door automation system based on Arduino that uses an ultrasonic sensor and servo motor. The door automation system sends a signal to the Arduino microcontroller, which tells the servo motor to open the door and keep it open, when it detects the presence of a person or item inside its radar. A second signal is sent to the microcontroller so that it may tell the servo motor to automatically close the door after the object has passed the ultrasonic sensor radar. It may save a lot of energy in the form of air conditioning because the door only opens when a person is detected and remains closed at all other times, making it handy for elderly and disabled people.

PionaLoba et.al.[17] May 2020. He investigated on the automatic gate opening system for limited locations is discussed in this study, and we have also put the system into use. Using RFID technology improved It is simpler to distinguish between approved and illegal cars using this system than it is with any other technology. This approach offers a lot of benefits. The system may be utilised extensively and remotely monitored the quantity of entry/exit records because it is dependable, reduces manual labour and human error, is simple to deploy, and is economical. This kind of technology is useful and is typically utilised in restricted locations like military installations, sizable companies, government forests.

Purvi D. Chauhan et. al. [18] July 2021. He made the project based on constructed mechanism is correctly functioning and may be utilised wherever the gate is, according to the coding and application discussed before. must operate automatically utilising proximity to open and close.

R.F. Rahmat et. al. [19] 2020. He investigate based on the extreme learning based automated doors on the results of the testing of the Extreme Learning Machine-based automated door access system, it can be said that if the system detects the facial image, the door will open successfully. In contrast, if the facial picture is not there, the door will stay shut. acknowledged or not recognised at all. So, the device may be installed as a security feature on a door to a private room.

When it came to extracting face features based on texture, the Local Binary Pattern technique performed effectively. Due to the inability of these approaches to discriminate between face photos that are quite similar to one another, the percentage decreases. As a result, the effectiveness of the categorization process is crucial to the system.

Razanmohammad et. al. [20] February 2020. He studied on a real-time automated gate that included facial identification, licence plate recognition, and make and model recognition for cars. The installation of such a gate may Reduce human effort as much as possible while boosting security at the desired location. The quicker authentication method might lessen traffic jams that could be caused by installed card readers or human screening. The system evaluations carried out with the aid of our prototype showed that real-time implementation was feasible. The dataset for Qatari automobile make and model recognition, which is based on actual surveillance photographs, is another part of the effort.

Kalpana Maple et. al. [21] January 2022. He studied on the basis of IOT based door system. The IoT device industry has seen significant changes. The industry has expanded to include business companies that are working together to establish ecosystems, optimised for mobile technology, which allows IoT devices to become networked, from an initial state of disjointed devices and no ecosystems at all. Based on a Raspberry Pi minicomputer with IoT incorporation of cutting-edge technologies like tensorflow deep learning for face recognition. Also, this technology offers users who access the internet a live video broadcast.

NwukerFrances Nkem et. al. [22] August 2022. He studied on the PC-Windows based face recognition system to set up a facial recognition system using a Raspberry Pi because the Linux operating system can make the system smaller, lighter, and function effectively with lesser control utilisation. Also, it sets off the security alert for unauthorised individuals whose faces don't match the information recorded inside its database. The primary goal was to develop a facial recognition-based door access control system that could identify knowing individuals with their ID before granting entrance to the known individuals and sounding an alert for the unknown individuals.

Sujatha.R et.al.[23] October 2022. He studied and made the project for the shops. We have completed a solution that may be used to monitor all customers entering mall gates round-the-clock with minimal expense. Shopping centres will indirectly gain from this since they will need to pay fewer employees to physically check visitors into malls and other places of a similar nature. In order to identify whether or not people were wearing face masks, we employed CNN, OpenCV, Tensor Flow, Keras, and Keras. The models were evaluated with the use of still images and live video. The model has been validated, and model optimization is an ongoing process where we get a precise response by modifying the hyperparameters. With this idea, an example of edge analytics is feasible.

Hla Myo Timet.al.[24] June 2015. This study represents a face detection and identification automatic door entry system. By using a Computer application called Matlab, automatic face identification and detection is performed. Depending on the incoming data supplied from the personal computer, the microcontroller is employed to operate the door access system (PC). As soon as it is determined that the individual is legitimate, the door is opened. A door is automatically closed after two seconds. In actuality, though, 2 seconds is insufficient to penetrate a person. For real-time conditions, a longer duration should be selected. The Viola-Jones face identification algorithm is used to locate faces in images. This technology has restrictions regarding head direction because this detection approach can only accurately recognise facial pictures from the frontal perspective.

III. CONCLUSION

Investigated on the advancement and trends in face recognition demonstrate the huge amount of study that has been done over the past forty years. Face recognition technology is already used in several real-time applications, but there are still a number of issues that need to be resolved in order to develop a robust face recognition system. Face recognition systems that have been developed can assess faces with a variety of expressions, poses, and lighting circumstances. The most recent face databases and benchmark data might be used for assessment. As with face image recognition, video image recognition is more difficult and requires investigation.

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