IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024

DOI: 10.17148/IJARCCE.2024.13648

Survey Paper on Face Detection for Thief Recognition and Locker Safety using ML and IOT

Pooja P. Vajramatti[1], Mr. Mrutyunjaya S. Emmi[2]

MCA student, Department of MCA, K. L. S. Gogte Institute of Technology, Belagavi, Affiliated to Visvesvaraya Technological University, Belagavi, Karnataka, India[1]

Associate Professor, Department of MCA, K. L. S. Gogte Institute of Technology, Belagavi, Affiliated to Visvesvaraya Technological University, Belagavi, Karnataka, India[2]

Abstract: There are numerous challenges facing a nation, and security concerns are among the most important ones. Although face detection and recognition technology has many applications, its main uses are in the fields of banking, document security, smart home security, autonomous face detection, automotive security, face detection for surveillance applications, multi-face recognition, etc. These technologies are critical given the state of the nation today. Facial recognition is thought to be the most accurate and dependable technology available for identifying individuals for security purposes. One of the main problems we are currently dealing with is protecting thieves, despite the fact that we have numerous methods for apprehending the offenders, we are unable to manage the risk of escaping thieves.

Here, we provide a solution to these issues by putting forth the notion of facial recognition using machine learning-related Python software. Here, we may use facial recognition to identify the robbers and apply face detection algorithms to secure the lockers. The door will be unlocked if the person at the door is identified. Automatic email notice to unauthorized users has been accomplished by sending an SMS and a security alert email to the authorized user's email address. This method can be used to enhance security systems without causing any issues because it is more dependable, efficient, and uses very little data.

Keywords: Face detection, face recognition, security, Open CV, Python, Home security system, Door lock access.

I. INTRODUCTION

Security is the main problem with the current locker systems in the modern world. A traditional locker system makes use of a password-and key-based method. Just like someone could misplace their key or forget their password. This research offered a facial recognition locker system as a solution to this issue[5]. A computer technique called face detection is used in numerous applications to algorithms used in face detection, training, and identification. Codes is a K-NN algorithm implementation. Here, the algorithm processes the solution. Face recognition may be used to increase security in any kind of business, and because of its adaptability, it is the recommended option for increased security. Face recognition algorithms recognize the distinctive characteristics of human faces and compare them using an existing image collection. In this instance, the database containing all authorized users and the police station records of each thief must be established first. After that, we train every single image in the dataset. The pre- trained photographs in the dataset are compared with the camera's acquired images while writing the Python code for face detection. It will be simpler to capture the perpetrators if the picture in the database matches the face of the person in question. This is because the face is verified and may be shared. Voice messages are produced in the event of locker safety, identifying approved and illegal users as well as identifying potential thieves.

The allowed individual is identified by matching his image with the dataset, after which it allows him to continue by providing the right password. Error messages are displayed to us if the password is entered wrong[9].

Fig. 1 shows certain unstable features, such as facial hair and glasses, complicate face recognition. These characteristics may influence how well faces are detected. Additionally, when detecting faces, different lighting types and angles can result in unevenly illuminated faces, which will impact the detection process. A comprehensive analysis of the OpenCV platform and its integrated libraries has been conducted to generate code that enables innovative and efficient hardware use for reliable and accurate facial recognition.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024

DOI: 10.17148/IJARCCE.2024.13648

To construct this, a programmable relay motor will be used to open the door lock, a pi camera module for facial recognition, and a Raspberry Pi microcontroller board for system development. We plan to set up a suitable operating system on the microcontroller board for the Raspberry Pi[3].

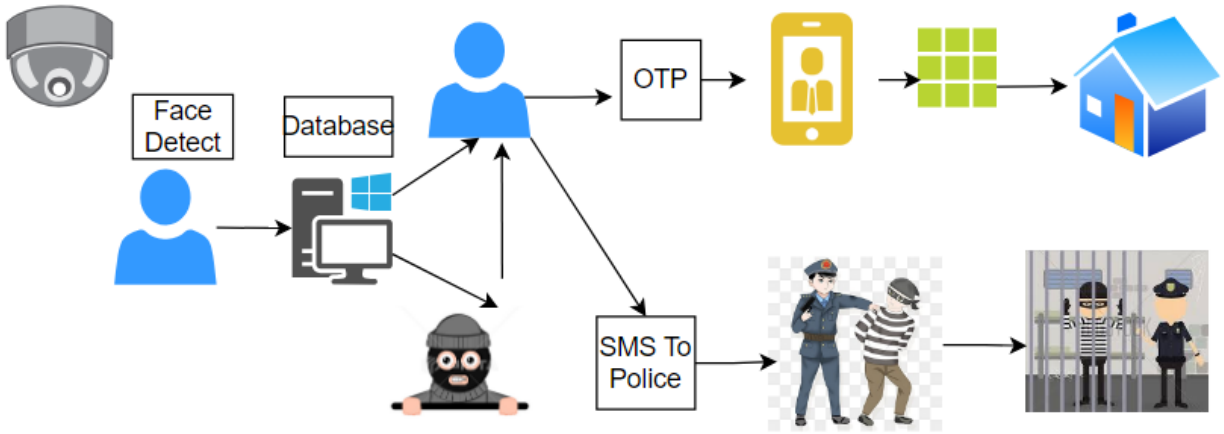

Fig. 1 Architecture diagram

Fig. 1 shows we will make use of image processing tools to verify the person entering the house. The Pi Camera Module will be utilized for image processing. Because it is connected to the device, the Raspberry Pi camera module aids in the storing of various faces in the databases. When someone wants to enter a house, they should face the camera. After identifying the face, the camera will compare it to the faces that are saved in the database[3].

Fig. 1 shows one-time passwords (OTPs) are dynamic passwords that are valid for just one session. OTP uses mobile devices for two-way authentication. Several algorithms implement a technique for OTP. Secure Hashing Algorithm is used in the suggested solution[5]. Face recognition and a one-time password provide a unique and effective way for the system to be implemented in the suggested framework.

Their work is made easier and the security of the country may be improved by using this facial recognition technology. The engine looks for the user's face in the database and attempts to identify it when the user wants to start it[1]. It is suggested to use a face recognition system to identify faces of different lengths, orientations, and light intensities. Better accuracy is offered by the suggested system, which is also easily applicable to intelligent applications. Such a system must be supplemented by a pin number or password in order to increase security[7].

II. LITERATURE SURVEY

A. Existing System

The most common method for locking and unlocking doors is a lock and a physical key. The procedure is entirely mechanical. Should the key get lost, misplaced, or stolen, the entire locking system must be replaced. In large enterprises, where employees must carry many keys for different doors, the problem of physical keys becomes more urgent. In addition to adding weight, having a lot of keys increases the likelihood that they may be lost. There is an alternative to physical keys RFID technology. (Identification of radio frequencies). Pass keys are being replaced with RFID cards. Multiple cards can be linked to the device. They are nevertheless vulnerable to loss or theft, though[2,3]. It also negates the purpose of not having a key. Apart from RFID cards, there are other ways to open doors, such as PIN-protected digital keypad locks, barcode locks, and biometrics—which use a person's voice to, fingerprint, hand geometry, or eye scan voice to verify their identity. Furthermore, the problems are not addressed by these remedies. To address all of these problems, we propose substituting a human face for the existing technology.

B. Proposed System

The goal of face recognition technology is to identify a human face without the need for direct physical touch. The system matches a person's facial nodes with photos stored in the database using algorithms and code. Utilizing facial recognition technologies can enhance security in any type of business or important place. Facial recognition is a recommended option for increased security due to its versatility. Face recognition, in contrast to other identification methods, recognizes the distinctive characteristics of the human face and compares them using the current photo database.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024
DOI: 10.17148/IJARCCE.2024.13648

First, we need to build an interface for the camera module, which is mostly used to capture real-time face images of users, in order to complete the specified task. We then need to make a database. This database contains the photographed photos of authorized users. Access to the individual is enabled by comparing the detected face with the images stored in the database[2]. A Raspberry Pi is used to take a picture of the individual whose access needs to be verified. Next, a comparison is made between the currently obtained face image and the previously stored images in the database. Based on the output result of the comparison that was made, the controller decides whether or not the user is a real, authentic user. If a user is not authentic, access is refused to them.

III. METHODOLOGY

Our project system is divided into two sections: one for collecting data and building a database, and the other for collecting photos that are utilized for database identification or comparison.

A. Camera Module

The Raspberry Pi module is interfaced with by a Pi camera. It is employed to take pictures and transfer them to the Raspberry Pi module.

B. Raspberry Pi Module

The tiny computer board known as the Raspberry Pi B+ module. The image captured by the Raspberry Pi is compared to a facial image saved in a database. The Raspberry Pi module initially records a set amount of face images in accordance with the image capturing module in order to construct a database in the system, which is then compared with the real-time taken image. When the output from comparing the two photos is affirmative or negative, the GSM module receives commands.

C. Arduino Software (IDE)

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar features a number of menus and buttons for standard operations. It links to the Arduino and Genuino hardware to upload programs and communicate with them.

D. Python

Python is a programming language that lets you work more quickly and integrate your systems more effectively.

IV. METHODS AND TECHNIQUES

A. Algorithm

Once trained on a set of labeled (known) faces, the K-NN classifier finds the k most similar faces (images with closest face features under Euclidian distance) in its training set and performs a majority vote (possibly weighted) on their label. This allows the classifier to predict the person in an unknown image. 'Obama' would be the outcome, for instance, if k=3 and the three face photos in the training set that are closest to the provided image are two of Obama and one of Biden.

Steps For Algorithm:
Step1: Start
Step2: Import libraries including sklearn and cv2
Step3: Create database
Step4: K-NN classifier is trained on a set of known faces and save it
Step5: load a trained K-NN model
Step6: loop through each person in the training set, find the best matches for the test face and make predictions for unknown images.
Step7: Display the resulting image.
Step8:
if result =authorized user
Entered correct password: Login successfully (Gives voice output)
Entered incorrect password: Login failed (Gives voice output)
if result=unauthorized user
Unauthorized user and thief recognized(Gives voice output)
Step9: Stop

The votes of those who live closer together are given more weight in this implementation because it uses a weighted voting system. Use[10]:

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024

DOI: 10.17148/IJARCCE.2024.13648

1. Get ready a collection of pictures of the well-known individuals you wish to identify. Put all of the photos in one directory and give each known individual their own subdirectory.
2. Next, use the relevant parameters to invoke the 'train' function. If you wish to save the model to disk so you may use it again without having to retrain it, be sure to provide in the 'model_save_path'.
3. Use the 'predict' function and feed it your trained model to identify the subjects of an unknown picture.

B. Flowchart

Fig. 2 shows this method is employed in police stations for criminal identification. If facial recognition technology is installed in police stations, it can be used to locate wanted individuals with criminal histories. It is simpler to apprehend the offender/criminal when the database matches the individual's face. Additionally, if the system detects a facial match, police security is notified as well via voice output. A facial recognition technology has the ability to stop crimes before they happen. With this method, authorities can also exhale with relief. This technique serves as a safety measure in prestigious establishments and places of employment to guarantee that no harm may possibly occur. This method is also applied in online payments, airports, attendance monitoring, and other areas.

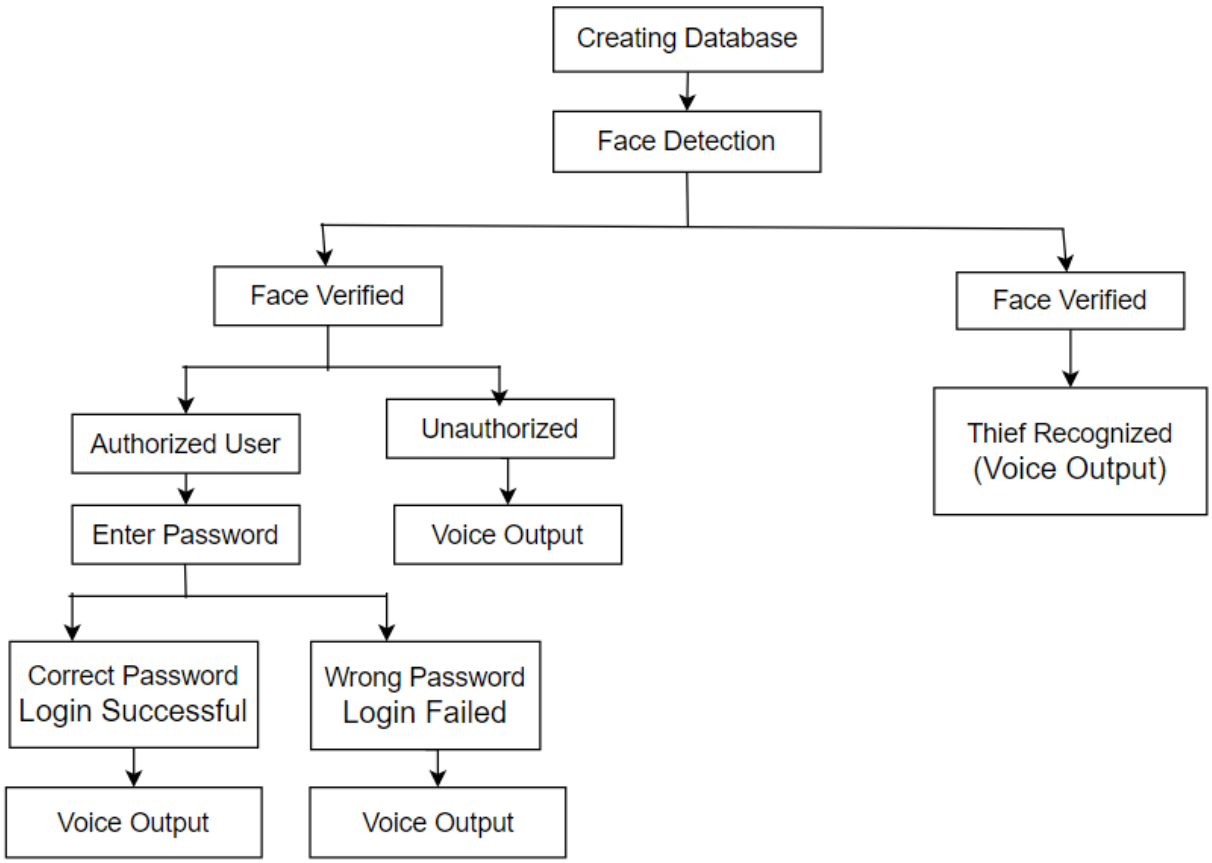

Figure 2: Flow Diagram

V. IMPLEMENTATION

In this case, the police station records of every thief and the database of all authorized users must be created initially. Next, we train each and every image included in the dataset. When we write the Python code for face detection, we compare the images captured by the camera with the pre-trained photographs provided in the dataset. If the image in the database matches the face of the individual in question, the face is confirmed and can be passed along, making it easier to apprehend the offenders. When it comes to locker safety, we compare the user's image to the dataset to identify the authorized user[5,6]. If the user enters an incorrect password, the password is marked as invalid. We also receive voice messages for the identification of authorized and unauthorized users as well as thief recognition.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024

DOI: 10.17148/IJARCCE.2024.13648

VI. RESULT

Police authorities: facial recognition technology is used at police stations to trace individuals who are wanted for past criminal offenses. When a person's face matches the database, apprehending criminals becomes simpler with this method. If the technology detects a facial match, the police are notified.

Fig. 3 Face Recognition

VII. COMPARISION OF VARIOUS SMART APPLICATIONS

Table 1. Comparison of various smart security applications

S.No	Techniques Used	Advantages	Disadvantages	Implementation	Accuracy
1	Principle component analysis [1]	Can handle different light intensities	Less accuracy with accessories	Lab VIEW, MyRIO 1990, webcam, USB cable	80%
2	LBPH [3]	Identifies low resolution videos	Less accuracy	C++, Surveillance cameras	89%
3	Palmvein technology [7]	Better security	Time consuming	MATLAB, hardware-based sensors	88%
4	Haar classifier Cascade [11]	Applicable to any type of camera	Light intensities can affect the system	OpenCV, C, C++, ATmega328, Arduino, RS232, 16 MHz quartz crystal	92.3%
5	Haar Cascade with integral image [12]	Recognizes face side up to 15 degrees	High processing	OpenCV, Webcam	91.67%

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024
DOI: 10.17148/IJARCCE.2024.13648

VIII. ADVANTAGES

1. Our suggested system's centralized controller, the Raspberry Pi, makes the already-developed system more adaptable and expandable.

2. The system is easily scalable, allowing for the addition of new components or the replacement of old ones without affecting the system's present components.

3. Since the Raspberry Pi camera is being used for face detection, the accuracy of face detection is great. Because it is a high resolution camera, this has excellent accuracy.

4. The entire system is now low power because we are developing it with a Raspberry Pi as our centralized controller.

5. Because of the Raspberry Pi, new embedded technologies can be readily incorporated into this development.

6. To expand the system, add new connections such as parallel, series, and cascade connections.

7. No lost

8. No key required

9. Security

IX. LIMITATIONS OF THE EXISTING SYSTEM

There are numerous issues with the current system, including:
1. Lack of an automatic door lock mechanism

2. Electric Issues Code Hacking Forgetting Password

3. People who are not allowed can access the passwords.

4. Set a maximum length for the PIN code.

5. Access may be refused if a person's biometric features are damaged.

6. memory control

7. Cost-related concerns

8. Security-related concerns

X. CONCLUSION AND FUTURE SCOPE

In the best establishments and workplaces, facial recognition systems are employed as a security measure to make sure that there is no possibility of any harm.

Identity theft: With the facial recognition system, the authorities may exhale with relief. Its comprehensive database of criminal data facilitates the process of apprehending them. It's a victory if the identified face fits the database and is that of the criminal! A face recognition technology can stop a crime before it happens. This method works well for tracking attendance, online payments, airports, and many other applications.

REFERENCES

[1]. Vendra, B. S., Dasari, P. R., Vydehi, K., & Kiruthika Devi, B. S. (2023). “Face detection system for smart security application.”
[2]. Bhowate, S., Bashine, K., Gajbhiye, P., Paidlewar, S., Dharpure, N., & Langde, P. (2020). “Smart security system for theft protection using face recognition”

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024

DOI: 10.17148/IJARCCE.2024.13648

[3]. Fernando, D. B. S., Srivarsha, A. B., Pirathisha, K., & Rubiya, K. (2019). "Face recognition for home security". International Journal of Computer Science and Engineering (SSRG-IJCSE), 6(10), 7-12.

[4]. Qezavati, B. Majidi and M. T. Manzuri, "Partially Covered Face Detection in Presence of Headscarf for Surveillance Applications," 2019 4th International Conference on Pattern Recognition and Image Analysis (IPRIA), 2019, pp. 195-199, doi: 10.1109/PRIA.2019.8786004

[5]. Nguyen, T., Lakshmanan, B., & Sheng, W. (2018). "A smart security system with face recognition". arXiv preprint arXiv:1812.09127.

[6]. K. Artem, T. Vasyl and T. Ivan, "Development of Face Recognition Module for a "Smart Home" System Using a Remote Server," 2018 IEEE 13th International Scientific and Technical Conference on Computer Sciences and Information Technologies (CSIT), 2018, pp. 25-28, doi: 10.1109/STCCSIT.2018.8526642.

[7]. Anusha, N., Sai, A. D., & Srikar, B. (2017). " Locker security system using facial recognition and one-time password (OTP)". In 2017 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET) (pp. 812-815).

[8]. D. A. R. Wati and D. Abadianto, "Design of face detection and recognition system for smart home security application," 2017 2nd International conferences on Information Technology, Information Systems and Electrical Engineering (ICITISEE), 2017, pp. 342-347, doi: 10.1109/ICITISEE.2017.8285524.

[9]. Z. Jian and S. Wan-juan, "Face detection for security surveillance system," 2010 5th International Conference on Computer Science & Education, 2010, pp. 1735-1738, doi: 10.1109/ICCSE.2010.5593578.

[10]. J. Patoliya and M. M. Desai, "Face detection based ATM security system using embedded Linux platform," 2017 2nd International Conference for Convergence in +Technology (I2CT), 2017, pp. 74-78, doi: 10.1109/I2CT.2017.8226097.

[11]. E. Arubas, "Face Detection and Recognition (Theory and Practice)," 6 April 2013. [Online]. Available: http://eyalarubas.com/face-detectionand-recognition.html. [Accessed 16 January 2016].

[12]. Se Hyun Park, Eun Yi Kim, Sang Won Hwang, Yeon Chul Lee and Hang Joo Kim, "Face detection for security systems on the Internet," ICCE. International Conference on Consumer Electronics (IEEE Cat. No.01CH37182), 2001, pp. 276-277, doi: 10.1109/ICCE.2001.935308.

[13]. Akhilesh Raj, Soumay Gupta, Nishchal K.Verma, "Face Detection and Recognition based on Skin Segmentation and CNN", 2016 11th, International Conference on Industrial Information Systems, ICIIS.

[14]. Hteik Htar Lwin, Aung Soe Khaing, Hla Myo Tun, "Automatic Door Access System Using Face Recognition", International Journal of Scientific & Technology Research Volume 4, Issue 06, June 2015.

[15]. J.Shankar Kartik1.K. Ram Kumar, V.S. Srimadhavan, "security system with face recognition, SMS alert and embedded network video monitoring terminal" Vol 2, No 5, October 2013, International Journal of Security, Privacy and Trust Management, IJSPTM