Face Recognition and IoT Based Smart Lock Access System

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ABSTRACT

Smart security and remote monitoring have become vital and indispensable in recent times, and with the advent of new concepts like Internet of Things (IoT) and development of advanced authentication and security technologies, the need for smarter security systems has only been growing. The design and development of an intelligent web - based door lock control system using face recognition technology, for authentication, remote monitoring of visitors and remote control of s mart door lock has been reported in this paper. This system uses Haar-like features for face detection and Local Binary Pattern Histogram (LBPH) for face recognition. The system also includes a web- based remote accessing, an authentication module, and a bare-bones embedded IoT(Internet of Things) server, which transmits the live pictures of the visitors via email notification, and the owner can then remotely control the lock by responding to the email with predefined security codes to unlock the door. This system finds a wide application where the physical presence of the owner at all times is not possible, and where a remote authentication and control is desired. The system uses arduino controller to lock/unlock the door. Python language along with OpenCV packages and embedded C are used to program this system. The proposed system is designed by considering the physically challenged persons also.

Keywords: IoT, Face Recognition, Local Binary Pattern (LBPH)

I. INTRODUCTION

Security system plays an important role in various places like industries, banks, airports, military etc. for protection against the intruder. The current authentication systems are based on password, pattern, RFID tags, Iris detection, fingerprints etc. There are advantages and disadvantages in these systems. Since there are some disadvantages in these technologies, we have come up with a solution to overcome all these problems. Face detection is one technology which is used to get access through the secured system. But there might be a risk of entering an unauthorized person into a restricted area. So upgradation from face detection to face recognition

helps to achieve good security level compared to previous technologies. Instead of detecting the face, recognition of face plays a important aspect in security system. IoT is a new technology which has made an enormous impact on the modern world. IoT is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators and connectivity which enable these objects to connect and exchange data. IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems and resulting in improved efficiency, accuracy and economic benefit in addition to

reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber physical systems. Using the face recognition system and IoT technology, we have come up with this paper to access the door. This system even helps for the physically handicapped people. If the system fails to recognize the person, the intruder image is sent over internet to the owner. Due to increase in number of Internet users in and around the world face detection and recognition have advantages over other technologies to establish communication between the client and the end user.

II. LITERATURE REVIEW

Since last few decades, the security systems have been configured to recognize the intruder's face and thus some of the face images at various angles and light conditions are added to the database. The system correctly recognizes the face and unlocks the door with an SMS alert. In case of an unauthorized person, the system reports non- availability of the face in the database, which in turn forwards the live snap chat of the intruder to the owner's e-mail address for authentication along with an SMS alert [1]. An USB camera captures the image to identify the intruder and unlocks the door via facial recognition over internet [2]. Various algorithms are used for Face recognition and detection to provide solution with higher accuracy and experimented results showed that LBP face recognition technology had the best results [3]. Automatic face detection and recognition is also done on MATlab. Microcontroller is used to control the door access system and door is immediately opened when recognized and closed after few seconds. Principal Component Analysis (PCA) is used to extract features of facial images [4]. GSM modules acts as both receiving and transmitting unit serving as communication device between the user at one end and the object of access i.e. the door at the receiving end[5]. RFID tags are used as security passes which contains integrated circuit that is used for storing and processing information,

modulating and demodulating the radio frequency signal that is being transmitted. Card reader scans the data present in the RFID tag and compares it with the present data and access through the system if the tag is a valid [6]. Access through the door can also be attained through Bluetooth of a personal smart device which controls the electromagnetic device. When user reaches within a reading range of the system, he/she can open or close the lock by just sending a command through an application in the owner's device [7]. Some security systems use AdaBoost algorithm for face detection in OpenCV face database. Local Binary Pattern (LBP) operator extracts facial feature rapidly. PCA method is used for reducing facial feature matrix dimensionality [8]. Microsoft Face API is used for Facial Recognition for enabling through door and implementing it with the help of key research areas of Neural Networks and IoT APIs [9]. Many door locking automation systems utilize IoT for door unlocking in various fields like home, banks, MNC's through the GSM module. It uses an image capturing technique in an embedded system based on a Raspberry Pi server system which controls the camera to capture the face of the intruder and compares it with the database and provides access when recognized if not owner is notified through SMS, and relay is used for door unlocking[10].

III. METHODOLOGY

Face recognition and smart lock access system uses web camera attached to Laptop/ desktop/ Raspberry Pi3 for face recognition and an arduino board to control the door. The system is designed on the basis of simple machine learning. Initially the owner's image is captured in different angles and is stored in database. These images are trained to produce a single data set so that it helps in fast comparison and recognition.

Figure 1 shows the block diagram of the proposed system. The functionality of this system works as, firstly it captures the face of the intruder using a web camera and then the process of face detection takes

place. Fig 2 shows the face recognition. Once the face of the intruder is recognized, the person is allowed to access through the door. If the intruder face is not recognized then the owner gets notified through an e- mail, if the owner recognizes the face he/she gives command for unlocking the door and if the owner fails to recognize the intruder's face, the owner can deny the request which in turn keeps the door locked. Fig 3 shows the notification to the owner. The system also keeps a track of all the visitors by storing the date and time of visit in a database. Here, face detection and face recognition is done using Python Language. The figure 4 flowchart depicts the identification and authentication technology operation.
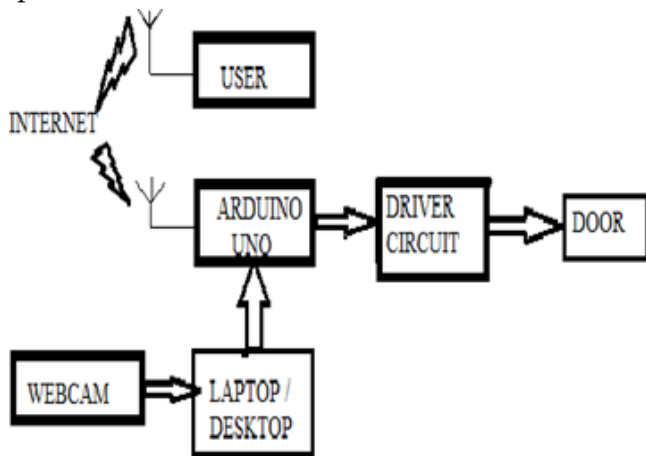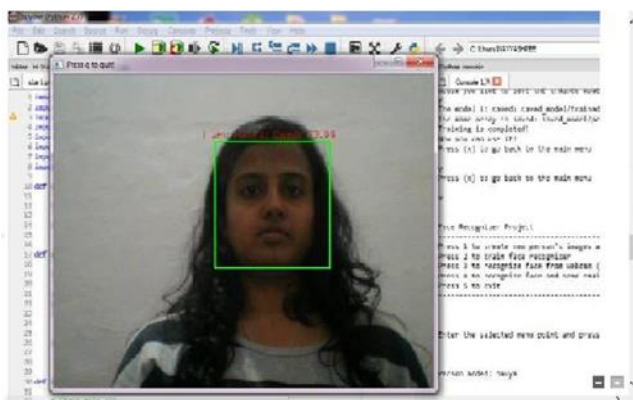

Figure 1. Block Diagram

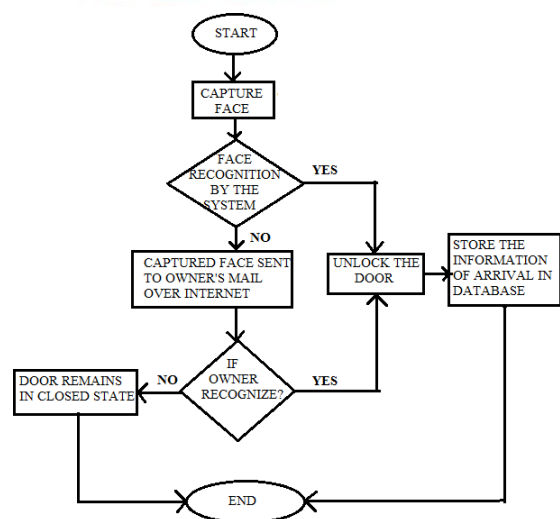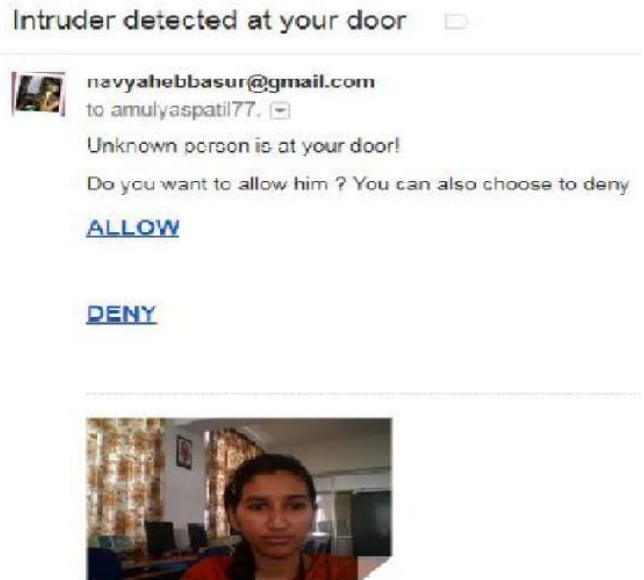**Figure 2.** Face recognition

Figure 3. Intruder Image Sent To the Owner via E-Mail

IV. RESULT

This work was aimed to be a complete system for detection and recognition of human faces, which is easy to build and cost effective. Its utility is to be set as an alert for home visitors, industries, air- ports or in offices and provide information about the visitors. An automatic smart lock monitoring system using webcam, Python, OpenCV, arduino Uno controller is designed for monitoring and security purpose. Since IoT is a booming technology we can also explore the possibilities of IoT in security and automation. The system design is based on face detection and recognition from a camera installed outside the main door, which can be accessed from the phone of the owner.

V. CONCLUSION

Security systems used now-a-days require user key, passwords, patterns, ID card etc. to have a access to the system and these methods can be copied by the unauthorized person or the user may forget to bring their ID cards, user key. Some of the security system uses Bluetooth, Zigbee and wifi but it is restricted to certain ranges. The proposed system uses the current technology of face recognition and internet to access the door. The proposed system is also helps the physically challenged person to access. The system also keeps track of the visitors by storing the date and time of the visit along with their name in the database.

VI. REFERENCES

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