

# IOT BASED DOOR UNLOCK SYSTEM USING FACE RECOGNITION

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## I. ABSTRACT

In the era of crimes , especially in Pakistan where the dacoities and target killings are at its peak. We decided to build the security system, which detects the person's face and open the door if the authentic person comes. When someone comes at our door , the camera takes the picture and send it to the system. The pictures of all the authentic persons are saved in our database. Our algorithm matches the person's picture ,if the person is authentic then it automatically opens the door , otherwise the door remains locked and the message will be sent to the owner through WhatsApp with the picture that who comes. This was only hypothesis but now it is going to convert into reality. We can do it also through finger print detection but face-recognition is the need of the present information technology charms.

## II. INTRODUCTION

Our project is the combination of hardware and software with 50% of each. In our project, raspberry pi is the main component used. When someone comes in front of the door, the raspberry pi camera captures the picture and transfer that into the software system through raspberry pi. The pictures of the persons that we want to enter in the house are saved in the directory about 20 images of each authentic person. Our 'HAAR-CASCADE' deep learning model of OpenCV recognizes the picture and returns the command to the raspberry pi whether to open the door or not. Message will be sent to the user through GSM module to the WhatsApp about the person who came .The relay module is used to step down the voltage to 5v.

There are some issues in our face detection because people's appearance changes day by day like beard or shaved and some people might have same appearance. So the accuracy is very important in our system. We will try our best to keep accuracy up to the mark by applying different models of face detection.

## III. OBJECTIVES

- To learn how to operate raspberry pi
- To learn complete knowledge of raspberry pi
- To learn software and hardware combination
- To operate pi camera and web camera
- To operate GSM module
- To use electric door lock with relay module
- To use OpenCV library
- To apply face detection algorithms
- To explore deep neural networks

## IV. LITERATURE REVIEW

In today's modern era of Science and Technology, security is one of the basic needs of lives. New innovations and inventions in the field of Science and Technology play an important role in increasing the security as well as reducing the manpower efforts.

There had been observed many methods and techniques for face recognition. GSM services and relay were used for face recognition but the limitation was that it could not control the background light situation and surroundings light condition. That is why, Y. Januzaj. et al. [1] proposed that by using such embedded systems such as Raspberry pi, we can access to real time face detection.

H.L win.et al. [2] has put forward another door lock access system which consists of three subsystems: particularly face recognition, face detection, and automated door access control. Face recognition is using PCA (Principle Component Analysis) in which the door will be unlocked itself for the known person sitting in command of the microcontroller and alarm will be rung if any unknown person is detected by the machine. The disadvantage of this system is input images are taken using a web camera continuously until the 'stop camera' button is pressed. A person is required at the location on run time to check

unauthorized images of the face being detected or status of the system and take further suitable actions. Personal computer (PC) is associated with the microcontroller. The entire system will not work if PC is crashed or malfunctioned.

M. Chowdhury et al. [3] implemented a security system in which when any person comes to the door, the owner of the home gets notified via email or twitter and a picture is also got captured and sent to the owner. The owner then permits the person whether to access the door or not. This security system reduced unauthorized access to the door. The limitation of this security system was that it requires a smooth and stable internet connection and if the owner does not have internet connection, then this security system would not work.

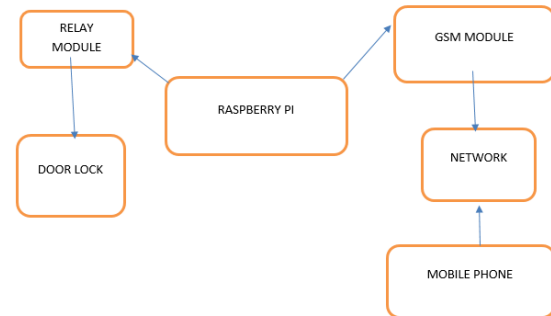
G. Senthilkumar et al. [4] put forward a security system designed on Raspberry pi which takes pictures of the persons on run time and then compare it with the image stored in database. The restriction with this security system was that it fails in ambient light conditions.

M. Carikci et al. [5] experimented a face recognition system based on Eigen face method in which they used Eigen method for face identification and Euclidean distance method was also used to compare the image of the person captured on run time with the image stored in database. It was very efficient and fast method with high accuracy.

S. Jogdand et al. [6] put forward Implementation of Automated Door Accessing System in which Viola Jones method was used for face detection and PCA (Principle Component Analysis) for the comparison of images. The only limitation with this Automated Door System was that it had low efficiency.

J. Kartik et al [8] proposed Face Recognition System in which two systems were introduced. The first one was based on web camera and the second system uses GSM technology to detect the intruder. In the first system, the web camera is installed in the house premises. It was controlled by the software installed on the personal computer of the owner and it requires internet communication. Any time the intruder comes within the range of the web camera the camera identifies him and in the meantime a sound alarm was rung. In the second system based on GSM technology, SMS service is used and an SMS is sent to the owner when the

camera detects the image of the person coming under its range.



## V. HARDWARE REQUIREMENT

- **RASPBERRY PI**

Raspberry pi is a full fledge computer which has a LAN cable to connect it to a display LED device. It has input and output pins. Input pins has a maximum voltage of about 5V. It has a memory SD card with 32 GB without which it cannot function. It also has a camera port to which PI CAMERA is attached to capture pictures. It has the main component which is microcontroller which is the brain of the system. We can control input and output through coding. In our project it serves as the main board which handles all operation either software and hardware.

- **GSM MODULE**

Its stand for GLOBAL SYSTEM FOR MOBILE COMMUNICATION. It is a communication device which is used to communicate between mobile device and machine. It can function like a normal mobile like receiving and sending SMS, MMS and calls. In our project it help us to communicate between machine and owner of the house. The owner receives the message that who comes.

- **RELAY MODULE**

Relay module is a switch which works between 2 states i-e 0V(off)---5V(on). It is used to filter the voltage.

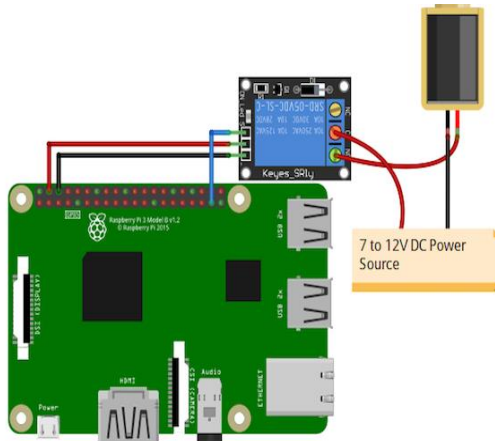
- **DOOR LOCK**

We used solenoid door lock which requires 12V DC power supply. It is an electrical small lock designed for small cabinets.

- **PI CAMERA OR WEBCAM**

In our project picture capturing is the main task to detect the faces ahead of door. For this purpose ,pi camera which is supported by raspberry pi and its related libraries are used. Webcam is also used for this purpose.

- **HARDWARE CONNECTION FOR DOORLOCK**



## VI. SOFTWARE REQUIREMENT

- **PYTHON 3.7 FOR SOFTWARE WORK**

Python is the object oriented language with the vast collection of libraries like NumPy , Pandas , etc. In our project we use following libraries:

- OpenCV for face detection
- NumPy for image processing
- Pandas for data collection (if needed)
- Face\_recognition library
- Imutils
- dlib etc
- GPIO for raspberry pi
- Tkinter for UI design
- Python basic libraries

## VII. METHODOLOGY

In this project, we used Raspberry pi, PI-Camera module, door lock and relay.

### STEP1

For Detection of face, we used open CV and haar-cascade model to detect faces and to store it in memory card. Then we take pictures for our model .After that we compared face from camera to stored images saved in database and if model accuracy is

more than 80 %, we then enable the pin of our door lock to grant the access to the user.

### STEP2

We used relay module to regulate voltage so that high voltage cannot effect our whole project:

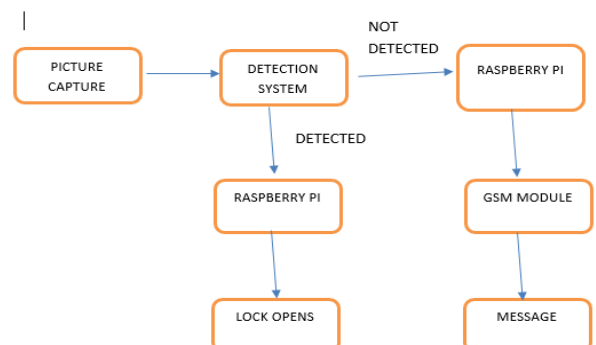
### STEP3

We also thought to use GSM module with our project so that we can send information of that particular user to owner of the home that whether the following person at door is angry or happy or whether he is male or female. Then through sim module, we would be sending message to that person that any unrecognized person is at your door. We would be also creating an interface for admin so that he can stored person in his database who would be granting access to the door. For interface, we would be using Tkinter for windows form GUI and it is more secure than using any website.

## VIII. RESULTS FOR HARDWARE

COMPONENT	RANGE	EXPECTED	ACTUAL
GSM	Within Wi-Fi range	Message sent	yes
GSM	Outside of wifi range	Not sent	yes
CAMERA	Face within it	detect	yes
CAMERA	2m	detect	yes
CAMERA	3m	Cannot detect	yes
CAMERA	People of same appearances	Cannot detect	no

## IX. FLOW DIAGRAM



## X. ACKNOWLEDGMENT

First of all, we are very thankful to Allah that He gave us such a great knowledge and temper to complete this amazing project which enhances security in our lives as well as it saves our time.

Secondly, we are thankful to Miss Sana Fatima that she gave us the chance to prove ourselves and Miss Zainab Fatima to support and guide us.

Finally, we would like to thank all the people who support us.

## XI. CONCLUSION

Finally, we have build the software and hardware combo which enhances the security and saves people's time . since, it enhances security and privacy then it can also be use in banks, shopping centers, airports , private and public companies etc. If we talk about all over Pakistan, this technology which is from the field of INTERNET OF THINGS is not much implemented nowadays but in the future, it will be published in Pakistan as well with remarkable more discoveries.

Since, we are passionate about ARTIFICIAL INTELLIGENCE and also half of our members are enrolled in AI program that's why we explored the knowledge of deep neural networks and face recognition by making this project. Also we are seeing many privacy and security issues in Pakistan , so we created the same.

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### **XIII. BIOGRAPHY**

<b>MEMBER</b>	<b>ROLE IN PROJECT</b>	<b>AIM</b>
MUHAMMAD FARAZ ANSAR SE-061	Report Manager and contributed a lot in project. Hardware connection, circuit formation of door locking system and understanding benefits of relay module. Helped Hassan in deploying AI model in project	To be a data scientist To be a machine learning analyst To be a full stack web and desktop applications
HASSAN-UR-REHMAN SE-062	Connection of Raspberry pi with laptop, installation of library(esp. OpenCV),demonstrating camera module, deploying AI model, building UI in Tkinter, making dataset to test data. Helped Faraz Ansar in hardware	Want to be ML engineer Want to create an impact of Ned in global market related from AI
ABDUL AHAD SE-005	installed Raspbian (Operating system) in Raspberry pi, connected raspberry pi with laptop. Installed libraries (Open CV, face recognition, Numpy etc). Participated in hardware setup and finding all the research papers and made literature review part of project report.	Backend Software developer Ethical hacker
JAHANZAIB RASHID SE-095	Work as a participant and spectator	My goal is to become a good software engineering. I want to be a good person and serve the society.
TANVEER AHMED SE-103	Work as a participant and spectator	I was very found in Information technology so due to this I choose software engineering