

# SMART SECURITY SYSTEM FOR BUILDINGS USING VEHICLE LICENSE PLATE RECOGNITION AND BIOMETRICS

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**ABSTRACT:** Security is now more important for buildings. Everyday many unknown visitors visit the buildings. As the number of crimes are increasing every day, there has to be something that will keep us safe. We are all aware of the security systems present in the market like CCTV, Token Based Security systems etc. but they are having limitations. We therefore intend to provide a solution by constructing a cost-efficient electronic system that will automatically recognize the number plate of vehicle and create the entry in the database and taking the details of the visitor, removing the limitations of existing systems. The basic idea behind this project is that by using Vehicle License Plate Recognition we are extracting the number plate of the vehicle and creating the entry in the database and taking the details of the visitor we are informing the resident about the visitor and using Biometrics we are verifying the residents.

**Keyword – Vehicle License Plate Recognition, Biometrics.**

## I. INTRODUCTION

We are developing the Smart Security System for buildings. As the number of crimes are increasing every day, there has to be something that will keep us safe. We are all aware of the security systems present in the market like CCTV, Token Based Security systems, or a security guard who maintains the log of every incoming and leaving visitor from the building but it is a tedious task to maintain that log and also there are other limitations like it CCTV we cannot recognize the person only by his face as we are not having any details of that person. So, we are developing a system which will overcome these limitations.

In our proposed system we are verifying every vehicle and person who enters the building and if they are not resident or the vehicle does not belong to resident of the building then we are taking the details of that person and creating the entry of the same in the database and notifying the resident of the visitor, which will improve the security of the buildings and will overcome the limitations of the existing systems.

## II. RELATED WORK

Security system for particular building or area includes some steps. Steps like Verification of visitor and resident, retrieving data from visitor such as his name, vehicle number, purpose of visit etc.

Now the Smart security means performing above steps automatically with the help of modern techniques. Many researchers have proposed good techniques for verification of visitor and resident or for Vehicle number plate recognition. Like verification of visitor using face recognition or using fingerprint recognition. Further Face recognition using algorithms like viola-jones or convolutional neural network (CNN) etc. This system is having limitations, implementing such heavy algorithm is not good for smart security system as it requires more computation also in face recognition it is difficult to identify the face of the person who is on bike wearing helmet or in the car.

In Vehicle number plate detection, it can be implemented with CNN using YOLO algorithm but as we say it requires high computation cost. Vehicle license plate recognition can be also done with SVM OAR but it requires large dataset for classification and training the module but it ultimately requires high computation cost. The above discussion revealed that performing only face recognition and only fingerprint recognition for human verification in smart security system is not efficient. Also using neural network for vehicle number plate detection is not possible with less resources.

## III. PROPOSED METHODOLOGY

The work presented in this paper focuses on developing Smart Security System which can be explained by following System Architecture.

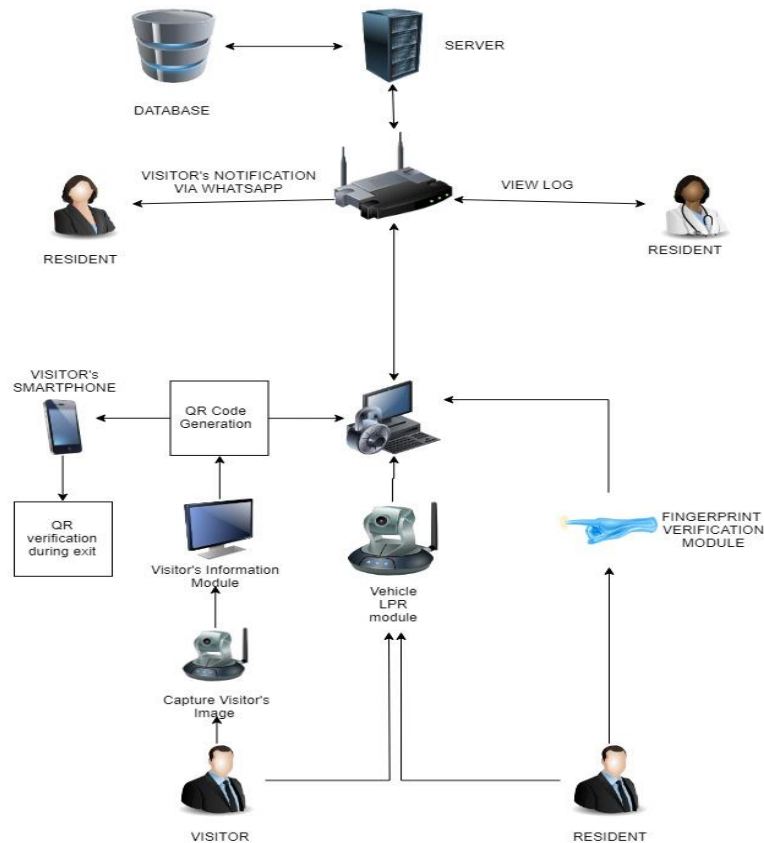


Figure 3.1: System Architecture for Smart Security System

The System will consist of mostly three parts: one vehicle license plate recognition, second Authentication of User and third is Management and communication of created data between first two sections. Vehicle license plate recognition will recognize the number plate for that user's vehicle. Authentication of User will be carried out by giving the QR code to user.

In vehicle license plate recognition, one set up camera will capture the image of vehicle and crop out the position of number plate. Then by using Optimal Character Recognition it will extract the text from license plate and store into the database.

Authentication of User contain two parts i.e. for Resident and Visitor. For Resident, firstly every resident has to register on web portal after taking accommodation in building. Then the system will give unique QR code to resident for authentication process. For visitor, our system will take personal details of visitor and on that basis, system will send unique QR code to visitor. Then visitor have to show that QR code to system during exit from building.

In Management and Communication, generated data of visitor will be sent to its respective resident by using SMS or any other means. Also, data analysis can be performed if any threats happened in the present of the system.

Sr.No	Table Name	Description	Entities
1	Resident	This table contain information about residents	Name, Flat Number, Mobile Number, Email Address, Fingerprint Information
2	Registered visitor	This table contain information about registered visitors which visits on daily basis	Name, Mobile Number, Profession, Fingerprint information
3	Visitors	This table contain information of unknown visitors	Visitor Name, Mobile number, QR information, Flat Number of visit, Reason of visit, Vehicle number, Date of visit, Entry time, Exit time, Photo of face
4	Resident Vehicles	This table contains information of resident vehicles	Vehicle Number, Flat Number
5	Contact	This table contains contact information of resident to which notification has to be send	Flat Number, Contact Information

Figure 3.2: Database Schema

The developed method can be divided in to three operating stages:

- a) Vehicle License Plate Recognition
- b) Fingerprint Verification
- c) QR Code Generation and Verification and Visitor Notification System.

#### i. Vehicle License Plate Recognition

Starting with the first module firstly a license plate recognizer is needed. For creating license plate recognition module we have used Computer Vision (CV) technology. Python supports Computer Vision technology through various libraries such as OpenCV, Scikit.image, PIL(Python Image Library) etc. From these libraries we have used OpeCV. For recognition purpose we are using python-tesseract OCR engine which is neural network based character recognition technology.

Steps –

1. Set up a Camera in static position.
2. Capture the image of vehicle.
3. Convert image into Gray scale image.
4. Create kernel matrix and apply Top-hat transformation on image.
5. Create two new kernel matrix for Open and Close Morphology Operation.
6. Apply Morphology Open and Close operation on image.
7. Apply Contour Generation and Detection on image.
8. Create rectangle contours.
9. For all no. of contours
  - a. Extract Height and Width of a contour.
  - b. Compare height and width of with specific parameters suggested for locating license plate.
  - c. Compare position of contours.
  - d. Compare aspect ratio of contours.
  - e. If comparison gets successful then return contour number.

10. Crop image using located contour.
11. Apply OCR operation on crop image.
12. Return License Plate Number.
13. Return to Main GUI screen.

## ii. Fingerprint Recognition System

In this module we are using fingerprint recognition technology for the authentication of residents during incoming and outgoing from the building. We have used 'Secugen Hamster HU20 pro' Fingerprint Scanner for recognition purposes.

- This fingerprint supports three kinds of fingerprint minutiae formats (or templates):
  - SG400: SecuGen's proprietary fingerprint minutiae format
  - ANSI378: Finger Minutiae Format for Data Exchange (ANSI-INCITS 378-2004)
  - ISO19794-2: Biometric Data Interchange Formats–Finger Minutiae Data (ISO/IEC 19794-2:2005)

Steps –

1. Set up Fingerprint Recognition device.
2. Take Resident details and fingerprint of resident for registration purpose.
3. During recognition
  - a. Take fingerprint image and convert it into template.
  - b. Compare that template with registered template
  - c. If match happens return with approval message.
4. Give entry to resident.

## iii. QR Code Generation and Verification and Visitor Notification System.

We have created two different classes for QR code creation and generation. For Creating QR code 'PyQrcode' library is being used and for recognition 'pyzbar' library is used.

Steps –

1. Start a main system
2. Take visitor personal details and capture image of visitor.
3. Generate QR code encoded with visitor's details and image.
4. Allow access to visitor in to building.
5. Generate SMS with personal details of visitor and send it to respective resident.
6. During coming out of the building, visitor will show QR code.
7. QR will be verified and security guard will compare image manually of visitor.
8. Stop.

**IV. RESULTS AND DISCUSSION**

We have tested Vehicle license plate recognition algorithm on some images taken from camera manually which is working pretty decent.

Table 4.1: Evaluation of Vehicle License Plate Recognition

INPUT IMAGE	LOCALIZED IMAGE	RECOGNIZED LICENSE PLATE NO.	EXPECTED LICENSE PLATE NO.
		MH12FY6437	MH12FY6437
		MH14GS3815	MH14GS3815
		MH12HZ8054	MH12HZ8054
		MH12NE4167	MH12NE4167
		MH29AD1948	MH29AD1948
		MH12LP6567	MH12LP6567
		MH12QY9033	MH12QY9033

		MH12LJ0667	MH12LJ0667
		MP20CC7029	MP20CC7029
	Not Localized	Not Recognized	MH12NE4167
	Not Localized	Not Recognized	MH12JZ5593
	Not Localized	Not Recognized	MH12AZ6538

- We have tested Vehicle license plate recognition algorithm on total 12 Car images, out of which we got successful result on 9 car images and unsuccessful result on 3 images.
- From which we can infer that the module gives about 85-95 % accuracy.
- Here we have used our low resolution VGA based Camera for taking input images.
- The result will be different for different cameras based on camera's image quality.

We have used Fingerprint Scanner as a Biometric Recognition technique in making easier access to the society for registered residents without any interruption.

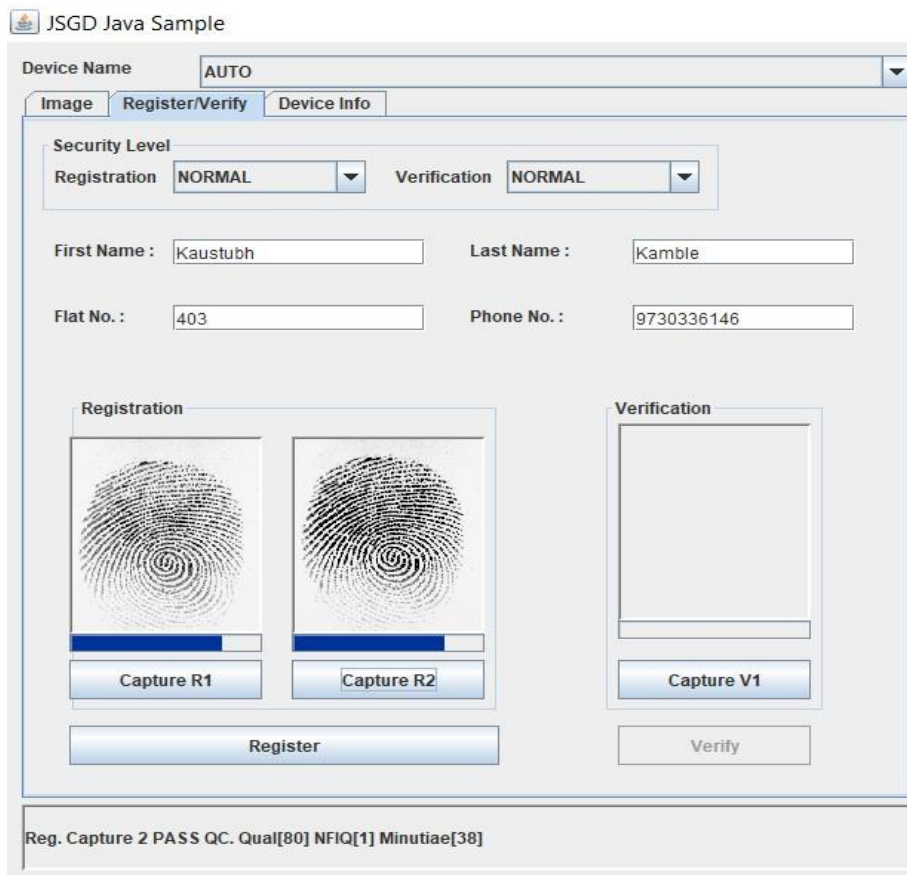


Figure: Biometric Fingerprint Registration

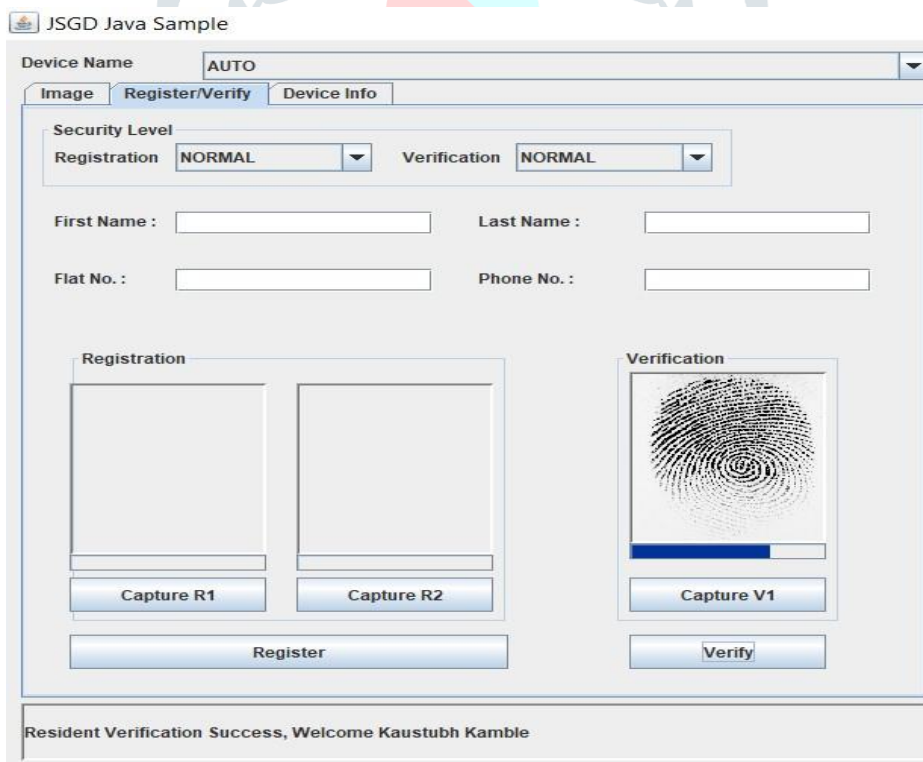


Figure: Biometric Fingerprint Verification

- We have used low resolution camera for capturing vehicle images which gives less accurate result in recognition stage. So to overcome this situation usage of high resolution camera can make better results.
- Internet Connection is needed for sending notification about visitor. Also for viewing log about visitor internet connection is must.

#### IV. CONCLUSION

In this paper we have proposed the methodology for developing Smart Security System for Buildings using Vehicle License Plate Recognition and Biometrics. This methodology is basically for low end devices having computation cost is low. The limitations of traditional security system are overcome with the help of proposed system. The building security is also improved due to inclusion of machine vision and biometric verification. In proposed system building residents can retrieve visitors information very easily as per their need. The proposed system can be integrated with CCTV system to achieve more security of building in future.

#### REFERENCES

- [1] Muh Ismail "License Plate Recognition for Moving Vehicles Case: At Night and Under Rain Condition," in 2017 IEEE Conference of Computer Vision and Pattern Recognition.
- [2] Cheng-Hung Lin, Yong-Sin Lin and Wei-Chen Liu "An Efficient License Plate Recognition System Using Convolution Neural Networks," Proceedings of IEEE International Conference on Applied System Innovation in 2018.
- [3] Randika Perera and Swapna Premasiri "Hardware Implementation of Essential Pre-processing & Morphological Operations in Image Processing," National Conference on Technology and Management (NCTM) in 2017.
- [4] Sumit Tiwari "An Introduction to QR Code Technology," International Conference in Information Technology in 2016.
- [5] Shyla Afroge, Boshir Ahmed, Firoz Mahmud "Optimal Character Recognition using Back Propagation Neural Network," 2<sup>nd</sup> International Conference on Electrical, Computer & Telecommunication Engineering (ICECTE) in 2016.

