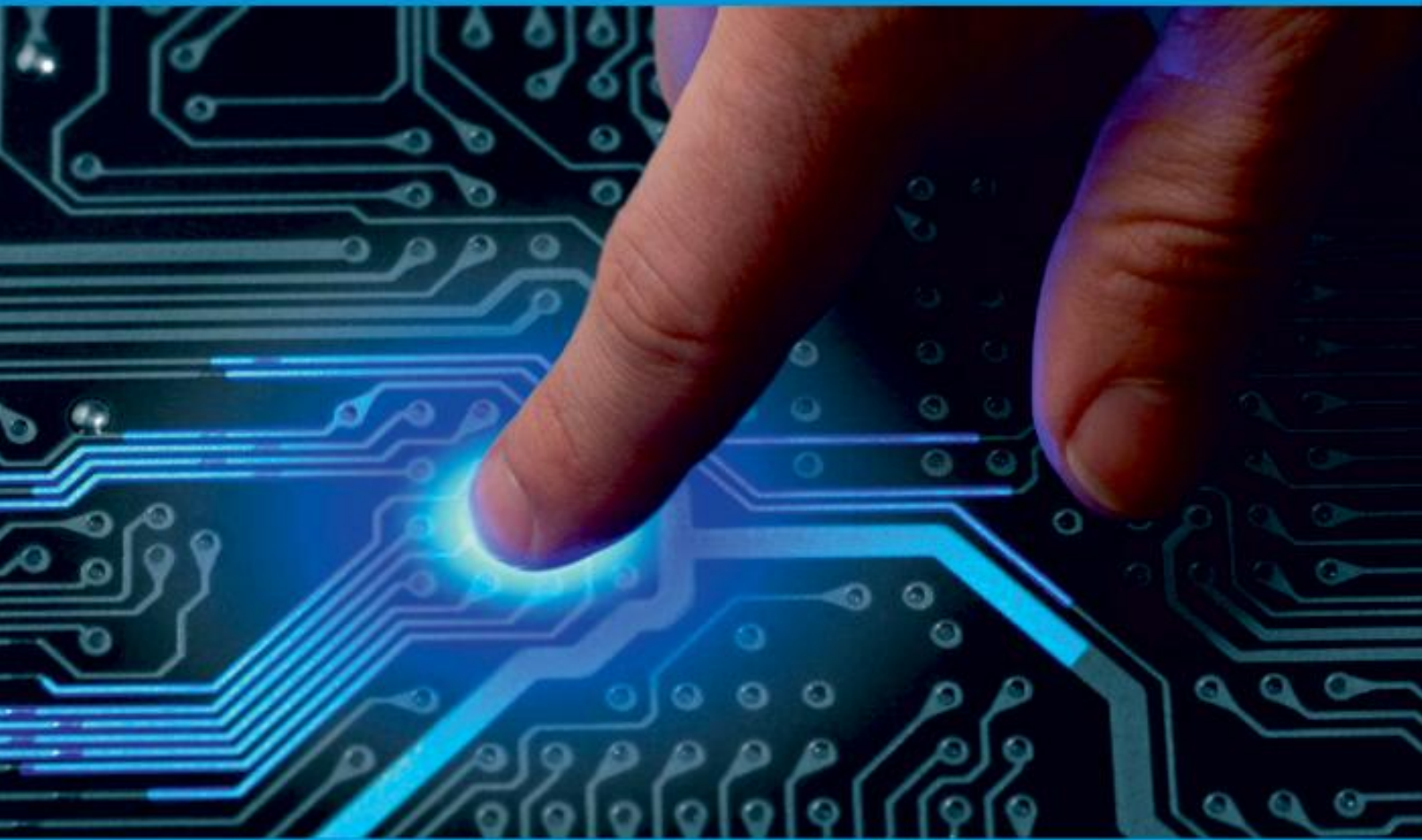




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ijircce@gmail.com



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Advanced Home Automation and Security System

R Tarun, Sagar S H, Sushma B N, Syed Zaid, Dr. R Kanagavalli

B.E Final Year, Dept. of ISE, The Oxford College of Engineering, Bengaluru, India

B.E Final Year, Dept. of ISE, The Oxford College of Engineering, Bengaluru, India

B.E Final Year, Dept. of ISE, The Oxford College of Engineering, Bengaluru, India

B.E Final Year, Dept. of ISE, The Oxford College of Engineering, Bengaluru, India

Head of the Department, Dept. of ISE, The Oxford College of Engineering, Bengaluru, India

ABSTRACT: A home automation system controls lighting, multimedia systems, and appliances. Since these devices and sensors are connected to common infrastructure, they form the Internet of Things. A home automation system links multiple controllable devices to a centralized server. These devices have a user interface for controlling and monitoring, which can be accessed by using a tablet or a mobile application, which can be accessed remotely as well. Ideally, anything that can be connected to a network can be automated and controlled remotely. Smart homes must be artificially intelligent systems that need to adapt themselves based on user actions and surroundings. These systems need to carefully analyze the user needs and the conditions of the surroundings in order to predict future actions and also minimizes user interaction. Traditional home automation systems that provide only remote access and control are not that effective in terms of being 'smart', so in this paper we put forward the use of concepts of different machine learning algorithms along with computer vision to shape together a smart learning automated system that controls lighting, sound and other devices based on the user's emotion.

KEYWORDS: Machine Learning, Home Automation, Camera Vision, Neural Network, Internet of Things.

I. INTRODUCTION

AN IN THE PRESENT SCENARIO THE CRIMES ARE INCREASING EXPONENTIALLY, ARISING A NEED OF SECURITY. SECURITY CAN ALSO BE DESCRIBED AS A CONDITION SO THAT ONE CAN DEVELOP AND PROGRESS FREELY AND WITH A FAITH THAT NO HARM MAY BE DONE. HENCE, WE ARE INTRODUCING ANY AUTOMATIC DOOR LOCK SECURITY SYSTEM AND HOME AUTOMATION FOR THE SECURITY PURPOSE. CAMERA IS NOW ENORMOUSLY BEING USED AND WITH THE DEVELOPMENT OF ITS CONTENT THAT IS USED IN VARIOUS APPLICATIONS. ONE OF SUCH IS AUTOMATIC DOOR LOCK SECURITY SYSTEM USING CAMERA.

The Internet of Things (IoT) is the interconnection of uniquely identifiable embedded computing devices within the existing Internet infrastructure. Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications (M2M) and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects), is expected to user in automation in nearly all fields, while also enabling advanced applications like a Smart Grid. Things, in the IoT, can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, or field operation devices that assist fire- fighters in search and rescue. Current market examples include thermostat systems and washer/dryers that utilize wifi for remote monitoring.

Interfacing of camera to capture live face images. Create a database of authorized person if they exist. Capturing current image, save it and compare with the database image. Interface GSM module to send alert to authorized person while unlocking the locked door in the form of SMS. The project can also be used for surveillance. For instance, it can capture the images of unidentified individuals and store it which can later be used to determine the impostors who tried to gain illegitimate access. Interface relay as an output.

And additional home automation system is used to control the home appliance like fan and light using mobile

application. With help of Wi-Fi connected for the model using TCP/IP.

The “Home Automation” concept has existed for many years. The terms “Smart Home”, “Intelligent Home” followed and has been used to introduce the concept of networking appliances and devices in the house. Home automation Systems (HASs) represents a great research opportunity in creating new fields in engineering, and Computing. HASs includes centralized control of lighting, appliances, security locks of gates and doors and other systems, to provide improved comfort, energy efficiency and security system. HASs becoming popular nowadays and enter quickly in this emerging market. However, end users, especially the disabled and elderly due to their complexity and cost, do not always accept these systems.

II. RELATED WORK

Y. JANUZAJ [1] PROPOSED REAL TIME ACCESS CONTROL FOR FACE RECOGNITION USING, RASPBERRY PI INSTEAD OF GSM SERVICES AND RELAY. THE LIMITATION OF THE WORK WAS IT COULDN’T CONTROL THE BACKGROUND LIGHT SITUATION AND AMBIENT LIGHT CONDITIONS.

H.LWIN [2] HAS PROPOSED A DOOR LOCK ACCESS SYSTEM WHICH CONSISTS OF THREE SUBSYSTEMS: TO BE SPECIFIC FACE RECOGNITION, FACE DETECTION, AND AUTOMATED DOOR ACCESS CONTROL. FACE RECOGNITION IS ACTUALIZED BY USING THE PCA (PRINCIPAL COMPONENT ANALYSIS). THE DOOR WILL OPEN ITSELF FOR THE KNOWN PERSON IN COMMAND OF THE MICROCONTROLLER AND CAUTION WILL RING FOR THE UNKNOWN PERSON. DEMERIT OF THIS SYSTEM IS INPUT IMAGES ARE TAKEN THROUGH A WEB CAMERA CONTINUOUSLY UNTIL THE ‘STOP CAMERA’ BUTTON IS PRESSED. SOMEBODY IS REQUIRED AT THE LOCATION TO CHECK UNAUTHORIZED PERSON’S IMAGES OR STATUS OF THE SYSTEM AND TAKE FURTHER APPROPRIATE ACTION. PERSONAL COMPUTER (PC) IS ASSOCIATED WITH THE MICROCONTROLLER, THE ENTIRE SYSTEM WILL NOT WORK IF PC IS CRASHED OR NON-FUNCTION.

G. SENTHILKUMAR, GOPALKRISHNA K, SATHISH KUMAR [3] PROPOSED A WORK ON EMBEDDED IMAGE CAPTURING SYSTEM USING RASPBERRY PI. IN THIS WORK, THEY CAPTURED THE IMAGE AND COMPARED IT WITH THE DATABASE BUT THE LIMITATION WAS THE SYSTEM COULDN’T WORK PROPERLY IN THE AMBIENT LIGHT CONDITION.

M. CARIKCI, [4] PROPOSED A WORK ON A FACE RECOGNITION SYSTEM BASED ON EIGEN FACE METHOD IN WHICH THEY USED EIGEN METHOD FOR FACE RECOGNITION AND EUCLIDEAN DISTANCE METHOD TO COMPARE THE IMAGE OF THE PERSON CONCERNED WITH THE IMAGES IN THE DATABASE. IT WAS VERY EFFICIENT AND FAST METHOD AND ALSO GAVE HIGH ACCURACY.

S. JOGDAND.ET.AL [5] PROPOSED A WORK ON IMPLEMENTATION OF AUTOMATED DOOR ACCESSING SYSTEM WITH FACE DESIGN AND RECOGNITION IN WHICH THEY USED VIOLA JONES METHOD FOR FACE DETECTION AND PCA (PRINCIPAL COMPONENT ANALYSIS) FOR THE COMPARISON OF IMAGES. THE LIMITATION OF THIS WORK WAS THAT IT IS NOT ROBUST AND THE EFFICIENCY IS LESS.

U. SOWMIYA.ET ALL. [6] DEVELOPED TO CONNECT ANY DOOR WITH INTERNET. IN THIS SYSTEM USER ALSO IMPLEMENTED PIR SENSOR AND CAMERA. PIR SENSOR USED FOR DETECTING PERSON AND CAMERA USED FOR CAPTURING THE VIDEO OF THE PERSON WHO COMES AT THE DOOR. THE VIDEO WAS SENT THROUGH 3G DONGLE TO AUTHORIZED PERSON. THEY HAD ALSO DISCUSSED SOME ADVANTAGES OF THIS SYSTEM. THEY HAD CONCLUDED USE OF THIS SYSTEM IN BANKS, HOSPITALS ETC. BUT THEIR PROPOSED MODEL DIDN’T PROVIDE THE FACILITY OF SENDING MESSAGES TO THE AUTHORIZEDPEOPLE.

III. PROPOSED ALGORITHM

Face Detection

- The main component of the Face Detection system is a Webcamera.
- Once person come in front of camera face will becaptured

Face Recognition

- Theproposedfacerecognitionsystemovercomescertainlimitationsoftheexisting face recognition system.
- It is based on extracting the dominating features of a set of human faces stored in the database and performing mathematical operations on the values corresponding to them.
- Hence when a new image is fed into the system for recognition the main features are extracted and computed to find the distance between the input image and the storedimages.

- Thus, some variations in the new face image to be recognized can be tolerated. When the new image of a person differs from the images of that person stored in the database, the system will be able to recognize the new face and identify who the person is.

The total system is divided into 3 modules - Database creation, Training the dataset, Testing, sending alert messages as an extension.

1. Database Creation

- a) Initialize the camera and set an alert message to grab the attention of the students.
- b) Get user id as input
- c) convert the image into gray scale, detect the face and
- d) Store it in database by using given input as label up to 20 frames.

1. Training

- a) Initialize LBPH face recognizer.
- b) Get faces and Id's from database folder to train the LBPH face recognizer.
- c) Save the trained data as xml or yml file.

2. Testing

Load Haar classifier, LBPH face recognizer and trained data from xml or yml file.

- a) Capture the image from camera,
- b) Convert it into grayscale,
- c) Detect the face in it and
- d) Predict the face using the above recognizer.

This system uses Viola Jones algorithm for face detection which uses modified Haar Cascades for detection. Raspberry Pi is the main component in the project. We will be using USB webcam to capture photos. We can access Raspberry Pi's console either by using SSH in laptop or by using Keyboard and mouse with the display device like TV connected to Pi. Firstly, the algorithm needs a lot of positive images and negative images to train the Haar cascades classifier. Positive images are images with clear faces where negative images are those without any faces.

IV. PSEUDO CODE

i. Haar Cascades:

Each feature is represented as a single value obtained from the difference of the sums of pixels in white rectangle from the sum of all pixels in the black rectangle. All different possible sizes and locations of classifier is used for calculating of plenty of features. As the number of classifiers increase the arithmetic computations seems to take a long time. To avoid this, we use the concept of Integral Image. In Image Processing Integral image is a data structure which is summed area table and algorithm for quickly and efficiently generating sum of values in a rectangular grid subset. Integral image is derived by using the formula.

Integral Image: To solve the complexity of the number of classifiers applied for calculation we use Ad boost machine learning algorithm, which is inbuilt in OpenCV library that is cascade classifier, to eliminate the redundancy of the classifiers. Any classifier which has a probability of 50% or more in detection is treated as weak classifier. The Sum of all weak

classifier gives a strong classifier which makes the decision about detection. Although it is very vague to classify with one strong classifier, we use the cascade of classifiers. Classification takes place in stages, if the selected region fails in the first stage, we discard it. We don't use the classifiers on that region which is discarded. The region which passes all the stages i.e., all strong classifiers is treated as the detected face. Detected Faces are passed to the Face recognition phase. In this phase we use Local Binary Patterns algorithm

for face recognition. Local binary patterns are simple at the same time very efficient texture operator which assigns the pixels of the image by comparing with the adjacent pixels as threshold and which results in a binary result. The detected integral image is subjected to this Local binary pattern which results in decimals are represented as histogram for every integral image. Face recognition is extremely vulnerable to the environment changes like brightness, facial expressions and position. Face pre-processing is the module which reduces the problems that makes the picture unclear to recognize the face such as less brightness and contrast problems and noise in the image and make sure the facial features always be in a constant position. In this project we use histogram equalization for face pre-processing. For efficiency we use separate pre-processing which is histogram equalization for left and right face. So histogram equalization is done three times, firstly for the whole face and the other two for side faces.

ii. Histogram of oriented gradients (HOG)

Histogram of oriented gradients (HOG) is a feature descriptor used to detect objects in computer vision and image processing. The HOG descriptor technique counts occurrences of gradient orientation in localized portions of an image - detection window, or region of interest (ROI).

Implementation of the HOG descriptor algorithm is as follows:

1. Divide the image into small connected regions called cells, and for each cell compute a histogram of gradient directions or edge orientations for the pixels within the cell.
2. Discretize each cell into angular bins according to the gradient orientation.
3. Each cell's pixel contributes weighted gradient to its corresponding angular bin.
4. Groups of adjacent cells are considered as spatial regions called blocks. The grouping of cells into a block is the basis for grouping and normalization of histograms.
5. Normalized group of histograms represents the block histogram. The set of these block histograms represent the descriptor.

OTP

If Face Didn't Match with Database, Face Intimation will be Sent to Owner of the Face with SMS or E mail alert.

DOOR LOCK

The motor turns in a clockwise direction to open the door once the information from the face through the camera matches the pattern in the data base. This is achieved by allowing current to pass through to drive the relay which activates the motor to turn the door open and grant access.

Emotion Recognition

The facial expression recognition system is trained using supervised learning approach in which it takes images of different facial expressions. The system includes the training and testing phase followed by image acquisition, face detection, image preprocessing, feature extraction and classification. Face detection and feature extraction are carried out from face images and then classified into six classes belonging to six basic expressions which are outlined below:

Image Acquisition

Images used for facial expression recognition are static images or image sequences. Images of face can be captured using camera.

Face detection

Face Detection is useful in detection of facial image. Face Detection is carried out in training dataset using Haar classifier called Viola-Jones face detector and implemented through Opencv. Haar like features encodes the difference in average intensity in different parts of the image and consists of black and white connected rectangles in which the value of the feature is the difference of sum of pixel values in black and white regions.

Image Pre-processing: Image pre-processing includes the removal of noise and normalization against the variation of pixel position or brightness.

a) Color Normalization

b) Histogram Normalization

Feature Extraction

Selection of the feature vector is the most important part in a pattern classification problem. The image of face after pre-processing is then used for extracting the important features. The inherent problems related to image classification include the scale, pose, translation and variations in illumination level .

V. RESULTS

Person image is captured and the captured image is processed by image processing and compared with the authorized image which is stored in the database. If image matches, then door opens else the owner receives the image of the person through email. Then owner can give permission through telegram app. When any gas leakage occurs, the sensor detects the gas and send message to owner . When fir accident occurs in home it detects the incident and send message to owner. When the weight of the cylinder reaches out the threshold frequency the owner will get message to refill the gas.

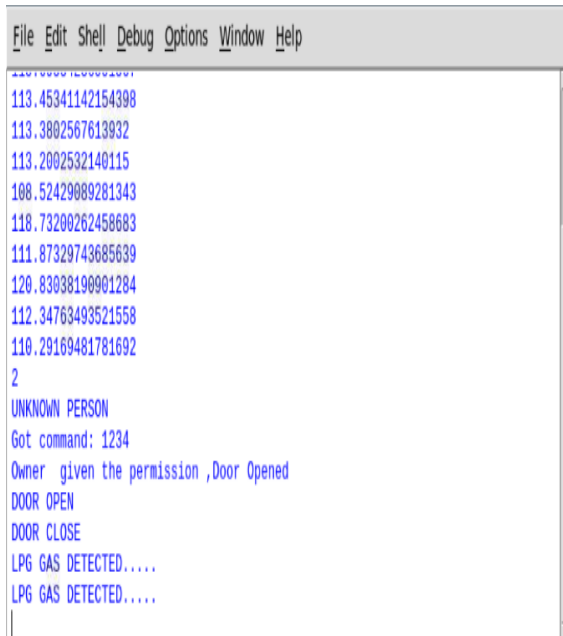


Fig 1. Camera detecting unauthorized person intimating owner.

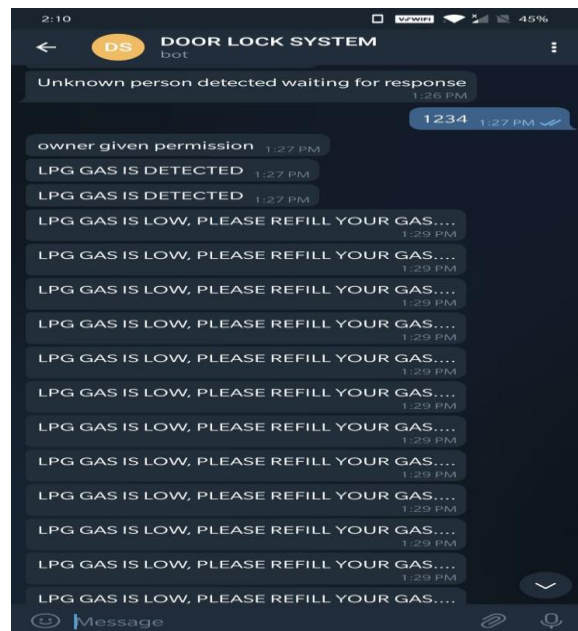


Fig 2. Owner grant permission from Telegram app

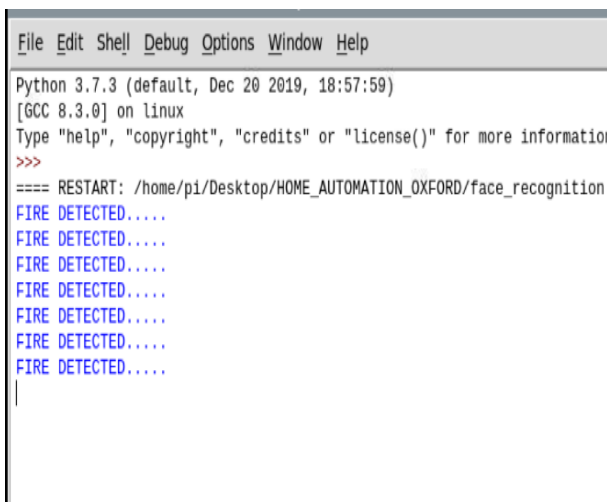


Fig 3. Fire Detection

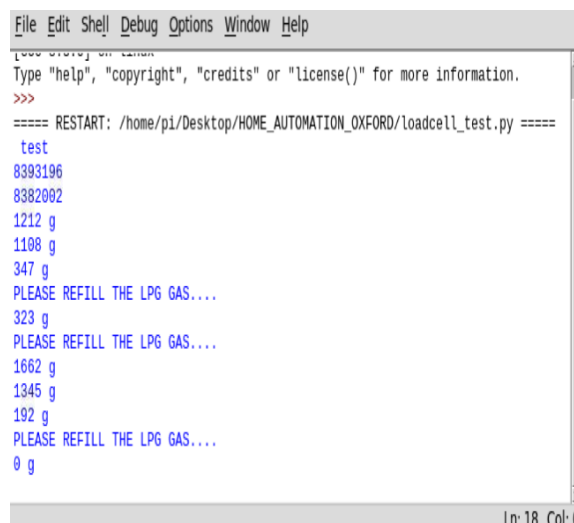


Fig 4. Gas Refill

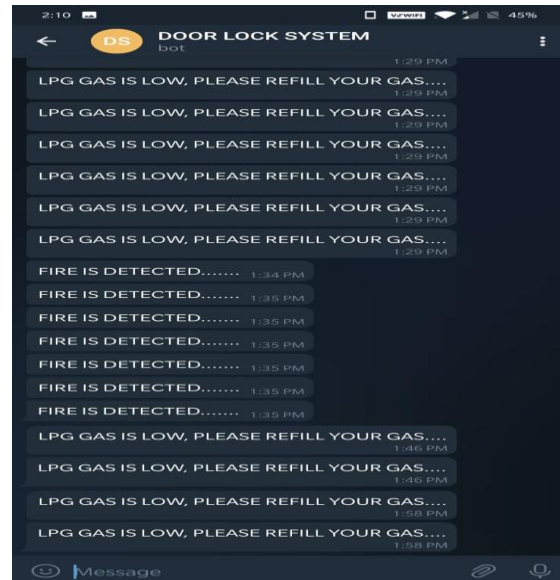


Fig 5. Notification for Fire Detection and Gas Refill in Telegram app.

VI. CONCLUSION AND FUTURE WORK

The arrangement of a facial recognition system using raspberry pi can make the system littler, lighter and work successfully utilizing lower control use, so it is more convenient than the pc-based facial recognition system. It is open source software on Linux. Also, send a security alert message to the authorized person utilities. We are also providing power backup for the smooth and continuous functioning of the system in case of power failure. The power bank is used to charge the Raspberry Pi so there is less chance to slow down the system. This development scheme is cheap, fast, and highly reliable and Raspberry pi takes less power and provides enough flexibility to suit the requirement of different people.

If a blacklisted person tries to open the door, the system will send a message to the admin using GSM module regarding the same. A real time speaking assistant can be deployed to make the system more user-friendly and efficient. Highly secure protocols such as TLS can be deployed to ensure there is no security breach.

REFERENCES

- [1] Chowdhury. M. Nooman. S, Y. Januzaj, 2013. Access Control of Door and Home Security by Raspberry Pi through Internet.
- [2] Senthikumar G. Gopalkrishnan. K. Sathish Kumar V. 2014 Embedded Image Capturing System Using Raspberry Pi System.
- [3] Çarıkçı, M. Özen, F. 2012 A Face Recognition System Based on Eigenfaces Method.
- [4] Jogdand. S, Karanjkar. M. 2015 Implementation of Automated Door Accessing System with Face Design and Recognition.
- [5] Sowmiya. U, shafiqmansoor, J. 2015 Raspberry pi based home door security through 3G dongle.
- [6] Kartik J. Srimadhavan V. 2013 SMS Alert and Embedded Network Video Monitoring Terminal.
- [7] Sahani. M., Nanda C, Sahu A, Pattnaik, B. 2015 Web Based Online Embedded Door Access Control and Home Security System Based on Face Recognition.
- [8] Mulla. M, Patil, R. 2015, Facial Image Based Security System using PCA
- [9] J. H. Lee, Y. Kim, B. K. Kim, K. Ohba, H. Kawata, A. Ohya, and S. Yuta, "Security Door System Using Human Tracking Method with Laser Range Finders," in 2007 International Conference on Mechatronics and Automation, 2007, pp.2060-2065.
- [10] C. Park, H. Park, D. Kim, and J. Cha, "A design for object tracking security system using on LED light combined CCTV," in ICTC 2011, 2011, pp.204-207.
- [11] R. Baleja, T. Novak, K. Sokansky, P. Bos, and P. Becak, "Measurement of Outdoor Lighting with a Focus on Watchdog Lighting System in the Area of Electric Station TR Čechy Střed," in 2018 VII. Lighting Conference of the Visegrad Countries (Lumen V4), 2018, pp.1-3.



- [12] K. Gill, S.-H. Yang, F. Yao, and X. Lu, "A zigbee-based home automation system," IEEE Transactions on Consumer Electronics, vol. 55,2009.
- [13] C. Gomez and J. Paradells, "Wireless home automation networks: A survey of architectures and technologies," IEEE Communications Magazine, vol. 48,2010.
- [14] D. Chowdhry, R. Paranjape, and P. Laforge, "Smart home automation system for intrusion detection," in Information Theory (CWIT), 2015 IEEE 14th Canadian Workshop on, 2015, pp.75-78.
- [15] J. García-Guzmán, E. O. Moctezuma-Monge, and F. H. Villa-Lopez, "FPGA implementation of a smart home lighting control system," in Consumer Electronics– Berlin(ICCE-Berlin),2014IEEEFourthInternationalConferenceon,2014,pp.419- 420.
- [16] E. Fernandes, J. Jung, and A. Prakash, "Security analysis of emerging smart home applications,"in2016IEEESymposiumonSecurityandPrivacy(SP),2016,pp.636- 654.



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