

IOT BASED SMART DOOR WITH DUAL SECURITY VERIFICATION

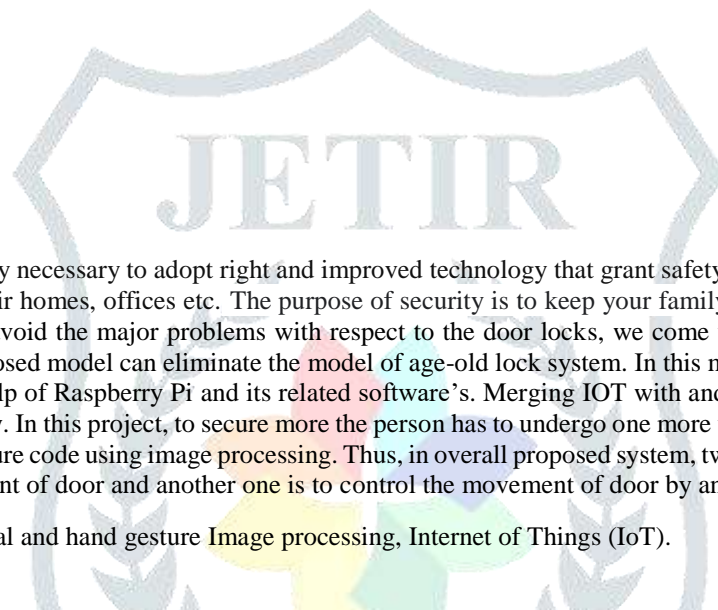
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ABSTRACT : Today, it is truly necessary to adopt right and improved technology that grant safety, connectivity, convenience and peace of mind to people in their homes, offices etc. The purpose of security is to keep your family, and properties safe from theft and other crimes. In order to avoid the major problems with respect to the door locks, we come up with smart door with double security verification. The proposed model can eliminate the model of age-old lock system. In this model controlling and movement of the door is done with the help of Raspberry Pi and its related software's. Merging IOT with android provides many advantages in terms of privacy and security. In this project, to secure more the person has to undergo one more verification technique after Face Recognition that is, Hand Gesture code using image processing. Thus, in overall proposed system, two technologies are concentrated on one is motion sensing in front of door and another one is to control the movement of door by android application.

Keywords –Raspberry pi, facial and hand gesture Image processing, Internet of Things (IoT).

INTRODUCTION:

The purpose of security is to provide freedom from any risk of danger to his or her life, property etc. Every person should feel both safe and secure in his home, office or any of his place and that is more important because both safety and security affect an individual's well-being. In this present world, every home is filled with large number of gadgets that keep the person comfortable and secure, that all connects to the internet in such a way that it rightly have us concerned for our security and privacy.

As we see in a present world the number of crimes related to theft has been increased such as, locks get picked, break a door or window and its much easier to do when we don't have complete security to the door. So, to avoid this we have come up with Smart Door lock system with dual verification technique which provides high safeguard towards the door which makes the intruder highly resistant to hack the Smart lock then the normal door locks to enter a Home. Smart locks can actually make your home assured, safer and more reliable than a normal traditional lock, and even they provide security with full amount of convenience. With the increase in problems related to safety and security, the Smart locks and Home automation has been upgraded with lot of applications. Nowadays a door is not just a medium to enter and exit the place, its more about allowing the right person to enter the place keeping away the intruders.

The security is assured by different electronic gadgets such as Smart Home, Smart Locks, Fingerprint Scanning, Facial Recognition, Hand gesture, Audio Recognition, through SMS/MMS. In our paper we have used two different verification techniques that is, Facial Recognition and Hand Gesture recognition technique based Smart doors. The first thing that pops to mind when we think about Smart door lock system is the capability to close and open the door with your mobile phone. In our paper closing and opening of the door is done with android application based on IOT. A Smart door not only just opens and closes the door but also keeps track of the surrounding environment. A log entry account is also installed in the program that makes a note of every person who visit the Home. As IOT is gaining a lot of demand in the growing world, connecting the gadgets to the internet and by operating them remotely. This is very much beneficial. The data generated is stored in the Cloud. The shared information is being processed in the cloud and then shard with another devices, This system is very beneficial for security purpose as it allows IOT to improve the concept of image processing, Raspberry Pi and Cloud networking.

RELATED WORK :

The review of the literature is based on the previous studies related to the IOT based smart door. First of all, it is necessary in today's world to provide complete security to Home Door .For our project there are two verification techniques. So, first one is Face Recognition technique and other is Hand Gesture technique. There are several techniques have been proposed in the literature

for Face recognition. Amrita Nag is focused on the Face Recognition with respect to Smart Door[1]. The recognition is done by the Haar feature-based cascade classifier is an effective method proposed by Ishita Gupta, Amrita Nag, Srinivasa Raju [7, 1, 2].

There are several technique used in Hand Gesture and one of them which is proposed by Ruchi Manish Gaurav [5]. From survey related to this we find the best Algorithm which is related to the Hand Gesture that is Convex Hull Algorithm, which provides the 92% accuracy in the image processing but for our project we have used Haar Cascade for the hand gesture recognition. The main aim of our project is to build the smart door based on IOT. So, we use [1, 2, 3] paper for our reference to build the IOT server for our project. Firstly, the face capture by the camera with the help of PIR Sensor. The recognition process is carried on by the IOT server. Once the image get recognized then it goes to the owner by the android application. To build the android application we referred the papers [11, 3, 9]. The application which is used for the controlling the Door lock.

There are many type of digital locks available in the market which is more secure. We prefer the best locking system that is a Smart lock with WIFI security [3]. For the security purpose we have Hand Gesture as a second security verification as we mentioned above. Hand Gesture recognition requires password and on that basis we have made password related to the hand gesture. This system is implemented by Rossi Passarella [6]. The recognition of the images using Raspberry Pi with the Open CV software [1]. For the authentication purpose, if the person is not recognized then it will inform to the owner through the message using android application [1, 3].

PROPOSED SYSTEM

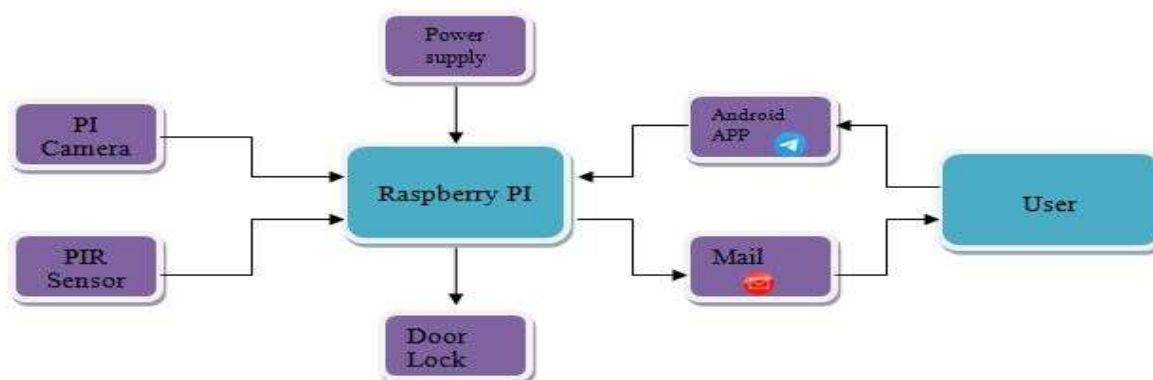
In this project we use a fast and high performer processor i.e., Raspberry pi, PIR sensor, power supply, DC motor, Raspberry pi cam, LCD display and a buzzer. All the above-mentioned components will be integrated to form a door lock system with high security. As soon as someone reaches near the door PIR sensor will activate the system and the raspberry pi cam takes the picture of the person. With the help of Haar cascade image processing raspberry pi will get to know that the authenticity of the person i.e., the Haar cascade algorithm verifies the face of the person coming to the door with the faeces stored in the system. If the person is not authentic the image of the person will go to the owner via Email or Telegram by seeing the face if the owner feels like opening the door he can do so through his phone. But if after image processing the person seems authentic then he should go through one more test i.e., pin code through hand gesture. The person should then through hand gesture show the pin to the raspberry pic cam if the pin is correct then the door will open if not the owner will then receive pic of the person through the app and if the owner feels like taking him in, he can unlock the door.

ALGORITHMS/ SOFTWARE APPLICABLE:

1)OpenCV (Open-Source Computer Vision): OpenCV (Open Source Computer Vision Library) is a machine learning software library. OpenCV was built to accelerate the use of machine perception in the commercial products. It has C++, Python, Java and MATLAB interfaces. supports Windows, Linux, Android ,Mac OS

2) Telegram Application: Telegram provides end-to-end encrypted voice and video calls. Its security is also very good when compared to wats Cloud chats and groups are encrypted between the app and the server

3)Haar cascade: Haar cascade algorithm accuracy is 89%. Firstly it converts the png/jpg image to .xml image then divide the image in matrix form. the image is then further divided into positive and negative image. With the help of positive and negative value a new value that is Haar value is got. Haar value equals to the difference of the sum all the image pixels lying in the negative area of the Haar feature and the sum of all the image pixels lying in the lighter of the haar feature.



BLOCK DIAGRAM

OVERVIEW OF SYSTEM IMPLEMENTATION

In this system we have proposed webcam, sensors and Raspberry Pi board and the cube activator along with its driver circuitry are connected together.

Camera Module: Camera module is pi camera interfacing to the raspberry pi module. It is used to capture images and send the clicked images to the raspberry pi module. Camera contains LEDs and flashes to handle that light condition that is not explicitly supplied by the environment and these light conditions are known Page 43 as ambient light conditions.

Raspberry PI Module: Raspberry pi 3 module is a small computer board. When an image is taken by an image to Create a database raspberry pi module captures many images to create a database in the system and this database is compared with the live captured images. After comparing the two images, based on whether the output is positive or negative it gives commands to GSM module.

MODULES DESCRIPTION

The proposed system contains 4 different modules: Face Detection Face Recognition OTP Door Lock.

MODULE - 1: Face Detection

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

MODULE -2: Face Recognition

- The proposed face recognition system overcomes certain limitations of the existing 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 stored images. 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 Page 44 messages as an extension.

1.Database Creation: Initialize the camera and set an alert message to grab the attention of the students. Get user id as input . convert the image into gray scale, detect the face and Store it in database by using given input as label up to 20 frames.

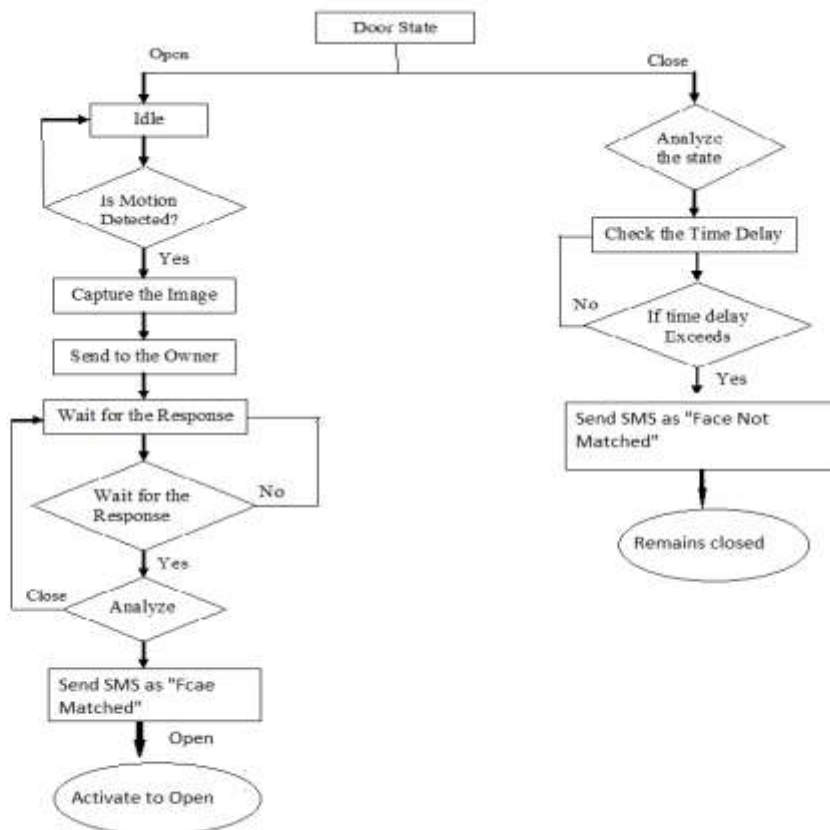
2.Training: Initialize LBPH face recognizer. Get faces and Id's from database folder to train the LBPH face recognizer. Save the trained data as xml or yml file. Load Haar classifier, LBPH face recognizer and trained data from xml or yml file. Capture the image from camera, Convert it into grey scale, Detect the face in it and 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.

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% of more in Page 45 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.

MODULE - 3: OTP If Face Didn't Match with Database, Face Intimation will be Sent to Owner of the Face with SMS or E mail alert.



OVER VIEW OF SYSTEM FLOWCHART

CONCLUSION

The paper presents a high secure dual verification door lock which is completely reliable .It will also help elder and children's in opening the door , As the ancient door lock requires push, pull etc .The project is also very help full in stopping the spread of contiguous diseases as it do not require touch to unlock the door and provide the absolute security to individual person.

REFERENCES

1. Amritha Nag, Nikhilendra JN, Mrutyunjay Kalmath "IOT BASED DOOR ACCESS CONTROL USING FACE RECOGNIZATION " 2018 3rd International Conference for Convergence in Technology (I2CT) The Gateway Hotel, XION Complex, Wakad Road, Pune, India. Apr 06-08, 2018.
2. Srinivasa Raju Rudraraju, Nagender Kumar Suryadevara, Atul Negi " FACE RECOGNIZATION IN FOG CLUSTER COMPUTING" 2019 IEEE International Conference on Signal Processing, Information, Communication & Systems(SPICSCON) 28-30 November,2019, Dhaka, Bangladesh.
3. Faiz Aman "MOTION SENSING AND IMAGE CAPTURING BASED SMART DOOR SYSTEM ON ANDROID PLATFORM" International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS-2017).
4. G.Sowjanya "DESIGN AND IMPLEMENTATION OF DOOR ACCESS CONTROL AND SECURITY SYSTEM BASED ON IOT"2016
5. Ruchi Manish Gurav" REAL TIME FINGER TRACKING AND CONTOUR DETECTION FOR GESTURE RECOGNITION USING OPENCV" 2015 International Conference on Industrial Instrumentation and Control (ICIC).
6. Rossi Passarella1 , Muhammad Fadli2 , Sutarno3 "HAND GESTURE RECOGNITION AS PASSWORD TO OPEN THE DOOR WITH CAMERA AND CONVEXITY DEFECT METHOD" The 1st International Conference on Computer Science and Engineering 2014.
7. Ishita Gupta1 , Varsha Patil2 , Chaitali Kadam3 , Shreya Dumbre "FACE DETECTION AND RECOGNITION USING RASPBERRY PI" 2016 IEEE International WIE Conference on Electrical and Computer Engineering (WIECON-ECE).
8. Bryan Berr'u-Novoa, Ricardo Gonz'alez-Valenzuela, Pedro Shiguihara-Ju'arez "PERUVIAN SIGN LANGUAGE RECOGNIZATION USING LOW RESOLUTION CAMERAS",2018.
9. Ratnawati Ibrahim "STUDY OF AUTOMATED FACE RECOGNITION SYSTEM FOR OFFICE DOOR ACCESS CONTROL APPLICATION" ,2011.

10. Mrutyunjaya Sahani, Chiranjiv Nanda, Abhijeet Kumar Sahu and Biswajeet Pattnaik “WEB-BASED ONLINE EMBEDDED DOOR ACCESS CONTROL AND HOME SECURITY SYSTEM BASED ON FACE RECOGNITION” 2015 International Conference on Circuit, Power and Computing Technologies.
11. Sudha Sharma, Mayank Bhatt, Pratyush Sharma “FACE RECOGNITION SYSTEM USING MACHINE LEARNING ALGORITHM” Proceedings of the Fifth International Conference on Communication and Electronics Systems (ICCES 2020) IEEE Conference Record # 48766; IEEE Xplore ISBN: 978-1-7281-5371-1.
12. Karthik HS , Manikandan J” EVALUATION OF RELEVANCE VECTOR MACHINE CLASSIFIER FOR A REAL-TIME FACE RECOGNITION SYSTEM” 2017 IEEE International Conference on Consumer Electronics-Asia (ICCE-Asia)
13. Ilkyu Ha, SECURITY AND USABILITY IMPROVEMENT ON A DIGITAL DOOR LOCK SYSTEM BASED ON INTERNET OF THINGS, International Journal of Security and Its Applications Vol.9, No.8 (2015), ISSN: 1738-9976.
14. Neelam Majgaonkar, Ruhina Hodekar, Priyanka Bandagale” AUTOMATIC DOOR LOCKING SYSTEM “, International Journal of Security and Its Applications Volume 4, Issue 1(2016) | ISSN: 2321-9939.
15. Fatih Erden “HAND GESTURE BASED REMOTE CONTROL SYSTEM USING INFRARED SENSORS AND A CAMERA” IEEE Transactions on Consumer Electronics (Volume: 60, Issue: 4, Nov. 2014)
16. P. Dinkova, P. Georgieva, A. Manolova and M. Milanova, "FACE RECOGNITION BASED ON SUBJECT DEPENDENT HIDDEN MARKOV MODELS," 2016 IEEE International Black Sea Conference on Communications and Networking (BlackSeaCom), Varna, 2016, pp. 1-5
17. CK Ng, M Savvides and PK Khosla, "REAL-TIME FACE VERIFICATION SYSTEM ON A CELL-PHONE USING ADVANCED CORRELATION FILTERS," Fourth IEEE Workshop on Automatic Identification Advanced Technologies (AutoID'05), 2005, pp. 57-62.
18. S. Lee, J. Park, B. Woo and H. Choi, “VIDEO DIGITAL DOORLOCK SYSTEM FOR RECOGNITION AND TRANSMISSION of Approaching Objects,” KIPS Transaction: Software and Data Engineering, vol. 3, no. 6, (2014), pp.
19. Y. Han, "A LOW-COST VISUAL MOTION DATA GLOVE AS AN INPUT DEVICE TO INTERPRET HUMAN HAND GESTURES", IEEE Trans. Consumer Electron., vol. 56, no. 2, pp. 501-509, May 2010.
20. .F. Erden, A. S. Bing and A. E. Çetin, "HAND GESTURE RECOGNITION USING TWO DIFFERENTIAL PIR SENSORS AND A CAMERA", Proc. IEEE 22nd Signal Processing and Communications Applications Conference, pp. 349-352, Apr. 2014.

