SMART HOME ANTI-THEFT DETECTION USING IOT AND AI

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Abstract–This paper addresses the problem involved incurrent socio-economic life where in automation using the techniques of IOT and Artificial intelligence (AI) take up the responsibility of providing security to our homes by providing two way authentication to the users.

The proposed system verifies the person identity by verifying the person's face as a key and also asks for inputting the right password to access the door.

The owner can even monitor and control the system remotely with the help of IOT. Artificial Intelligence provides framework for real-time decisions in terms of face detection and recognition. The model also alerts the owner by sending an email containing video clip of the intruder. If the intruder tries to breach the security by breaking the lock or damaging the system, an alarm is raised to intimate the neighbours about the activity.

Keywords: Artificial Intelligence, IOT, Raspberry pi, Face Recognition Viola-Jones algorithm , LBP(Local binary pattern) .

1. Introduction

Since digitalization and security are necessary in current socio-economic life, the design of anti-theft security system based on face detection and face verification has been proposed. Usage of IOT and AI has overcome the challenges of security breaching to a wider extent because the AI in the proposed system provides a framework for real time decisions and IOT has eased the automation process of monitoring, accessing and controlling the system remotely. Face is a multi-dimensional refined structure which needs the extraction of facial features, reduction of features and localizing characteristic features of a face image such as eyes, nose and mouth regions. The prototype model consists of raspberry pi with attached camera, IR sensor, locker, LCD display ,keypad and an internet link (Wi-Fi). The model verifies the person identity by matching face image of an intruder with the database and after verifying, the system asks to key in the correct password there by providing two way authentication safety. The person who matches with the database and key in the correct password has the accessibility to enter the home. In the meantime, when the person comes in camera range, a short video clip of his activity with an alert message is sent to the owner through mail and if the person tries to break the system, an alarm is raised to alert neighborhood.

2. Literature Survey

1.SavasB.K , Ilkin S, BecerikliY. The realization of face detection and fullness detection in medium by using Haar Cascade Classifiers[1].proposed a model which aims to detect number of faces in an image. Haarcascade classifiers were used to take instant images. The model also checks for a few classifier samples

that were captured on a dark night with an ordinary camera.

2.I.Yugashini, S.Vidhyasri, K.Gayathri Devi "Design and Implementation of Automated Door Accessing System with Face Recognition"[2].proposed a model which had three main sub systems namely face detection, face recognition, automatic door access control. The face detection and recognition process was achieved by using fast based principal component analysis(FBCA). The captured image was detected using the web camera and compared with the image in the database. GSM based alert message was sent to alert the owner.

3. Zhang, H.; Li, Q.; Sun, Z.; Liu, Y. Combining Data-Driven and Model-Driven Methods for Robust Facial Landmark Detection[3]. This model proposes a robust approach for facial landmark detection combining both data and model driven approaches. Fully convolutional network was used to trained to compute response maps of facial landmarks. The proposed method was able to produce satisfying results on detection of face images with partial occlusions.

4.S L Suma, Sarika Raga. "Real Time Face Recognition of Human Faces by using LBPH and Viola Jones Algorithm"[4]. The proposed model executes in two levels, such as face detection and face recognition. Viola Jones algorithm was used for face detection because of its high precision and real time permit rate.

5. Ayman A. Wazwaz, Amir O. Herbawi, Mohammad J. Teeti, Sajed Y.Hmeed. "Raspberry-Pi and Computers- Based Face Detection and Recognition System"[5]. The proposed system can analyze, detect and recognize human faces using Boosted cascade algorithm and LBP(Local Binary Patterns).

3. OBJECTIVES

The objective of the project is:

- To develop an automated face recognition system to access and control the door.
- To yield a good recognition rate of 85 to 95% by using Haar feature-based cascade classifier.
- To monitor and control the system remotely by the owner.

4. PROBLEM STATEMENT

The primary aim of the proposed work is to develop an automated model which has a capability of detecting human faces using Haar cascade classifier (viola-Jones algorithm) which is organized in Open CV by python language and local binary pattern algorithm to recognize the face images.

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6. METHODOLOGY

The following is the process used to create this model.

The proposed methodology deploys progresses of images captured through live streaming. The

methodology deploys four procedures such as face acquisition, pre- processing, face detection using Haar cascade classifier, feature extraction or face recognition using LBP(local binary pattern).

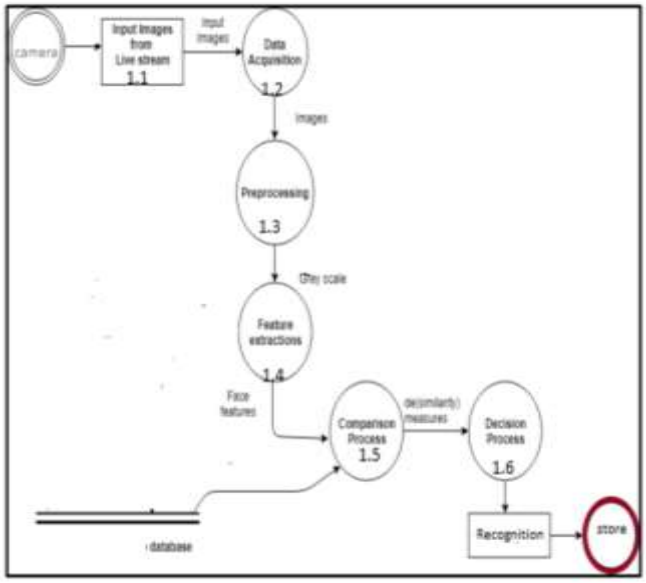

Figure 6 Data flow involved in methodology of proposed model

6.1. FACE DETECTION

The phases of face recognition involves three main modules such as Face Detection, Feature Extraction and Face recognition by comparison.

Viola-Jones algorithm is used to detect human faces from an image.

The algorithm has four stages that make it a real time face detector. The stages are -Haar- like features, Integral image, AdaBoost training and cascading classifier.

6.1.1. HAAR -LIKE FEATURES

The input image captured by camera consists of portions other than face blob. So a face blob is extracted from its surroundings by discarding areas other than faces in the image. The properties that are common to human faces such as- eyes region tends to be more darker than upper cheeks and nose bridge is brighter than other regions in the face. These features are matched using Haar-features. Algorithm looks for Haar-feature of a face like edge feature, line feature, four rectangle feature. Feature are numerical values that are extracted from face images that distinguish from each face. Face detection process takes the image and converts in to 24X24 window and smears each haar-feature to that window pixel by pixel.

6.1.2. INTEGRAL IMAGE

The set of features extracted are quite large and hence changed in to integral image. Using integral image, Haar-like feature will provide fast computation by making each pixel value equal to sum of all pixels above it and to the left of it. Hence a feature vector is collected from an integral image. In the next step these feature vectors are used to train the classifiers using adaboost training.

1	1	1
1	1	1
1	1	1

Input image

1	2	3
2	4	6
3	6	9

Integral image

Figure 6.1.2 Integral image

6.1.3 ADABOOST TRAINING

AdaBoost is a boosting algorithm which combines weak classifiers by reducing training error.The viola jones uses a variant of AdaBoost to select a small set of features and train the classifier. Single AdaBoost classifier consists of weighted sum of many weak classifiers where each of them are threshold on each Haar-like

rectangular feature. Thus reduces the features by making the computation simpler.

6.1.4. CASCADE CLASSIFIER

Cascade classifier is used to boost face detection by determining whether a sub window is defined as a face or not a face and rejects non faces. The classifier rejects more non-face regions thereby reducing several steps of processing.

6.2 FACE RECOGNITION

After a face is detected, next step is to extract the features using local binary pattern algorithm. The face blob is divided in to cells of 16x16 each and each pixel in the cell is compared with it's eight neighbours. If the intensity of centre pixel is lesser than it's neighbor, it is denoted with 0 else with 1 there by getting a binary number for each pixel like 11101001. So with 8 surrounding pixels, will have 2^8 combinations referred as LBP as shown in figure 6.2.

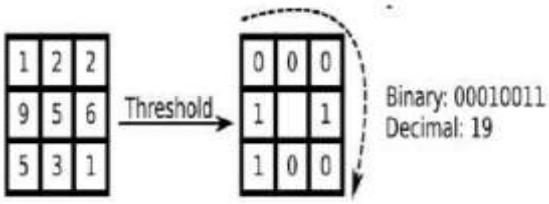

Figure 6.2 LBP operator

Histogram of these labels are used as texture descriptor that has description of face which is compared with the database and if the identity matches, face is recognised.

6.3 HARDWARE DESIGN

The Raspberry pi is the central module of the whole embedded image processing system. Raspberry pi has main processing chip unit, memory, power supply that is VGA display, Ethernet and USB ports and pi camera as shown in figure 6.2(a & b)

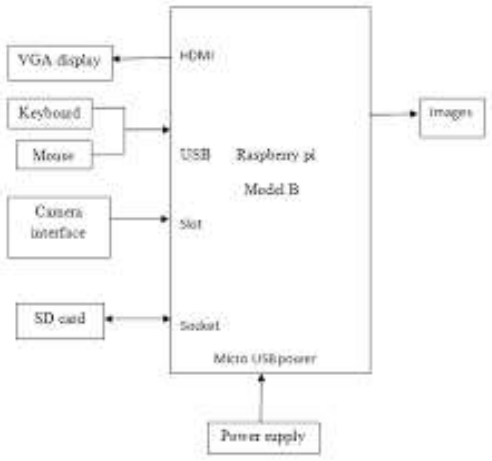

Figure 6.2 Raspberry pi block diagram

Figure 6.2 (a) Raspberry pi model B+

Figure 6.2 (b) Raspberry pi camera interface

7. RESULTS

The face recognition results of the experiment conducted are presented below:

Figure 7 recognition module

Figure 7 image shows both detection and recognition of single face. The recognition results are found to be correct for frontal angle of the face.

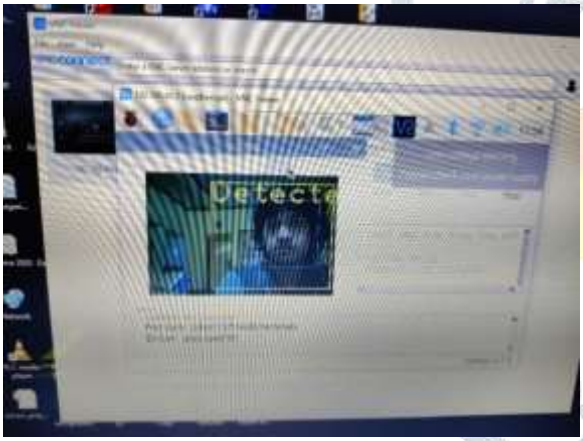

Figure 7.1(a) Face unknown result

Figure 7.1(a) shows detection and recognition for an unknown face. The recognition is found to be correct.

Figure 7.1 (b & c) shows detection and recognition for an unknown face. The recognition is found to be correct and if the person is trying to break a lock email is sent to the owner raising an alarm.

Figure 7.1(b) Face unknown result and alerted owner through email

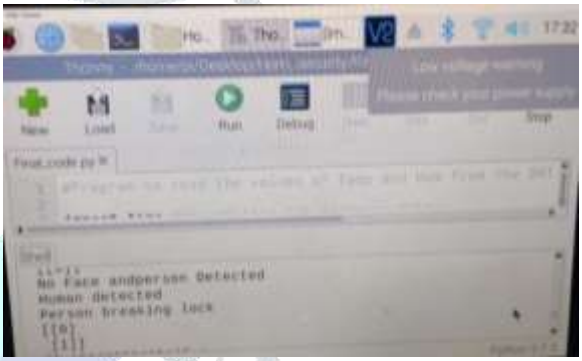

Figure 7.1(c)Face unknown result and trying to break lock

8. CONCLUSION

The proposed automated security scheme is low-cost and low power. The utilization of IOT in the proposed system is efficient and enabled for real-time applications. The +accuracy is about 95% in proposed system. System is based on IOT that the owner can monitor and control his house by sitting from far away his house. The utilizing of IoT in this system, provides remote control and monitoring.

10. REFERENCES

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[3] Zhang, H.; Li, Q.; Sun, Z.; Liu, Y. Combining Data-Driven and Model-Driven Methods for Robust Facial Landmark Detection. IEEE Trans. Inf. Forensics Secur. 2018.

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