A Novel Method for Home Security by Face Recognition System to Visually Impaired

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Abstract : The World Health Organization estimated that about 285 million people are suffering from visual disability, of whom 39 million are blind, resulting in 0.7% of the world population. Computer vision techniques and image analysis can help visually-impaired people to over come their disability. In this paper it is proposed to detect the face of a visitor at the door. The methodology will detect the faces and recognize the persons robustly and discriminated between the trusted(known) and un-trusted(unknown) faces. This technique is used for security purpose of visually disabled individual present alone at the home. This technique will make a decision whether to allow the trusted or to alert the guardian about the un-trusted .
An attempt is made in this paper to develop a home security system by face recognition to aid visually impaired using a proper microcontroller(Raspberry pi 3 model b). The information provided to the guardian is composed of the name of the person identified. This information is provided by means of a text or speech.

Keywords — ***Face recognition, HAAR transformation, IOT, Rasberry PI***

Introduction

Face Detection is a process of identifying the presence of people face within digital images and Face Recognition is a Biometric Technology to Recognize the person. A Face Recognition method is a method that automatically identifies or verifies the persons whosoever appears before the camera is the requirement of the visually impaired person who is alone at home. The OPENCV library that is used to formulate a given image of a scene in order to identify or verify one or more persons in the scene using a stored database of faces. The algorithm detects the face by extracting its features after capturing a image if someone appears before the camera. After the extraction, it matches the captured images with data base . In this system whenever a person or persons comes before the camera the image is captures and a decision box is created for all the faces. After that features are extracted from each face and caparison is made with the faces in the database. A message is sent as a security alert to the authorized person if unauthorized person appears before the camera. Tools that we used widely applied in current applications. Python is used as the main programming language & Linux based operating system is used, one also can use C, JAVA or Perl. On being successful, with further optimizations and improvements, the system may be implemented in real time systems requiring user authentication such as attendance monitoring systems, ATM security, Network security, In Bank locker, Home automation etc.,

2.1 Existing system

- In the existing system, if the system recognizes the face, it displays the name on the screen else prints unknown. [1-3]
- It does not alert the guardian that some unknown person is trying to intrude in to the home.[1,2]
- In the existing system, it takes more time to recognize the person who is at the camera and compare them with trusted faces, whereas in proposed system, the result will be quick saying that someone unknown had entered your home through SMS. [1,2,3]
- The existing system recognizes one face at a time only. It is the drawback when a group of people appear in front of the camera.

2.2 Proposed System

It is proposed to provide a high security system using face recognition by Microcontroller (Raspberry Pi 3 model board) and send an alert to the guardian ,this will increase the security .The proposed work is as follows:
1) Interfacing of camera module to capture live Face image.
2) Create a database of authorized people.
3) Capture current face, save it and compare with data base image.
4) Interface GSM module to send security alert to Authorized person while unlocking the locked door.
5) Interface relay as an output module.
6) When a group of people is present before the camera it captures all their faces and separately identifies thwm as known or unknown.
The proposed system consists of both hardware units and software. A general block diagram of the system is as shown below Fig 1.

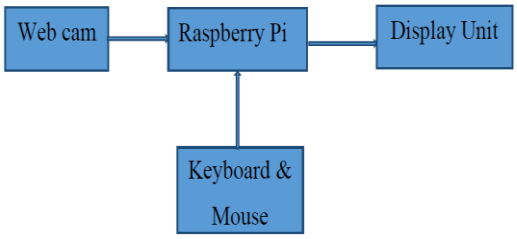

Fig.1 Block diagram of the proposed system.

3. Architecture

3.1 Raspberry pi

A proper microcontroller is selected as per requirements of the system. All the proposed requirements are met by a readymade system, Raspberry Pi. It is a complete Linux based computer and can provide all the expected abilities that implies, at a low power consumption. Raspberry Pi was selected due the following advantages over other processors like Low power consumption, No moving ports, Small form factor, Status lights ,Expansion Capabilities, Built-in HDMI capable graphics, Affordable cost, Multiple uses, Huge community support

3.2 Algorithm for creating training data

Step1: Capture the images of the person in multiple directions as $I_w = \{I_{w1}, I_{w2,\ldots}, I_{wn}\}$ (n should be as large as possible for best results. To decrease the time complexity n should as less as possible ,In this paper we have selected n value large as accuracy is preferred).

Step2 Extraction of the features from the captured faces is done using HAAR transformations. The HAAR transform is the HAAR functions $h_k(z)$, which are defined in the closed interval $[0,1]$ .The order k of the function is uniquely decomposed into two integers *p,q*

$$k = 2^p = q - 1,\ k = 0,1\ldots\ldots,L-1,\ and\ L = 2^n$$

Where

$0 \le p \le n-1, 0 \le q \le 2^p$ for $p \neq 0$ and $q = 0$ or 1 for $p = 0$

Step3: Digitize the features and create set of vectors called numpy arrays with different data sets

Step4: Store the numpy arrays in the database called .YML file. YAML stand for "YAML Ain't Markup Language".YML file type is primarily associated with 'Javascript' by YAML. It uses a text file and organizes it into a format which is Human readable.It is commonly used for configuration files, but could be used in many applications, where data is being stored or transmitted. File name extension: .yaml, YAML natively encodes scalars (such as strings, integers and floats), lists and associative arrays(also known as hashes or dictionaries). These data types are based on the Perl programming language. YAML is easily readable by Humans. It matches the native data structures of agile languages. Its data is portable between programming languages. It is expressive and extensible. It is easy to implement and use. Its files should end in .yaml and it is Case Sensitive

3.3 Algorithm for the Face recognition

Step1: Capture the images of the person in multiple directions as $Ix=\{I_{x1}, I_{x2,\ldots}, I_{xn}\}$

Step2 Extraction of the features from the captured faces is done using HAAR transformations.

Step3: Digitize the features and create numpy arrays with different data sets

Step4: Compare the present numpy arrays with stored data in .YML file. Here we find the Euclidean distance between { Iw, Ix} using local binary patterns histogram algorithm. If distance between { Iw, Ix} is less than the threshold (which is less than 70 % confidence, Where confidence is the distance between the features of trained data set with currently acquired set) then declare the identity as known otherwise unknown.

3.4 Algorithm for Alerting

Step1: If the captured face matches with the trained data set, a voice message is sent to the visually impaired mentioning the names of the person(s) arrived.

Step2: Visually impaired announces to the to open the door through voice assistant(google) or otherwise .

Step3: If an unknown is at the door it sends the image of the unknown person to the guardian via E-mail and also alerts the guardian through a text message in his phone. The voice SMS is also sent to visually impaired for sending an attention to guardian. The above two messages will give an affirmation about the unknown.

4.Implementation

The above algorithms are coded in python due to its properties like It's a high level built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for rapid

application development as well as for a use as a scripting or glue language to connect existing components together. It is easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. It supports modules and packages, which encourages program modularity and program reuse. It is an interpreted, object-oriented programming language similar to PERL, that has gained popularity because of its clear syntax and readability. It is relatively easy to learn and portable. A notable feature of Python is its indenting of source statements to make the code easier to read We can use C or C++ language instead of python. Python is available for all major operating systems, Windows, Linux/Unix, MacOS X, most likely your mobile phone OS, etc.

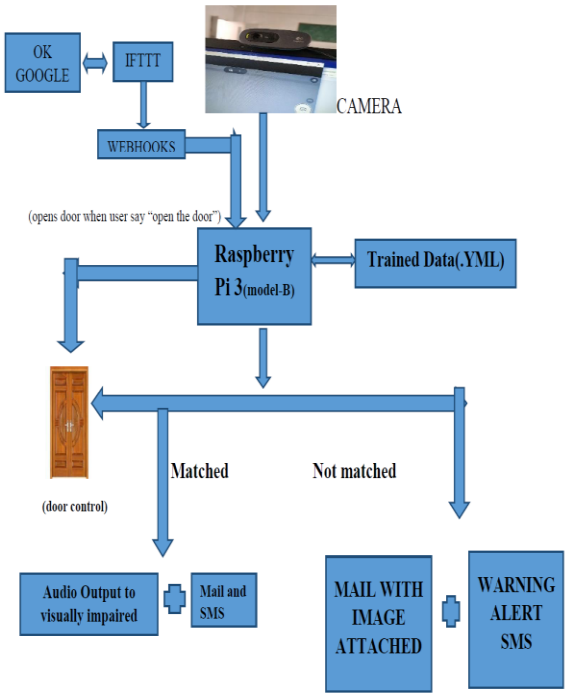

Fig. 2: Working block diagram of face recognition syatem for visually impaired

5. Results and Discussions:

Fig 3.Recognition of faces

Fig.4. sending mail alert

Fig:5. sending sms alert

6. Conclusion:

In this paper a robust method that provides a complete security to the visually impaired individual by recognizing the visitors appearing in front of door. The same work can be extended to other applications like attendance monitoring system, patient recognition arriving in hospital, etc., The algorithm can be improved to decrease the time and space complexities.

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