

ADVANCED SMART HOME SECURITY ALERT SYSTEM

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I. INTRODUCTION

Abstract—Smart home is a collaboration of technology and services through a network for a better quality living. In that home security plays a major role and it becomes the important section of our lives. This paper focuses on the origination and execution of continuous home security framework that totally deals with the security parameter of the home. To execute this a credit card sized computer such as a raspberry pi 3 model B which is a latest and worldwide used programming board which does a function what a computer does with Broadcom BCM2837 64bit ARMv7 quad-core processor running at 1.2Ghz. The latest raspberry pi 3 model B comes with built-in Bluetooth and wifi module. Raspberry Pi camera with NoIR module is used to provide better results in the night time. PIR sensor is utilized to detect movements. With any unusual movements, the pi cam captures and detects the face of the stranger using the latest OpenCV 3.3.0 associated with the classifiers and sends a message via utilizing telegram application. Using telegram bot the camera can be controlled remotely to activate and deactivate. Alongside a door lock is made. So this hardware detects the intruder's faces and alerts the user with the telegram messages and also functions as a lock for the security purpose of the home.

Keywords— *facial recognition; Raspberry Pi 3; camera module; door lock; automation; security;*

The home automation system is a computer-based application that has the ability to connect different electronic devices for the sake of monitoring and controlling the home appliances. The home automation system is the field that has grabbed attention in both the academic and business fields. Recently, electronic door lock systems are the most popular security systems that are being installed in many residential homes and business places and in ATM's. The key reason behind such systems lies in the reliability of the system in which only the authorized persons can gain the authority to access the electronic doors throughout a secure system that has an interactive interface. Smart home in order to detect an intruder by utilizing a small PIR module and raspberry pi for minimising delay during the process of e-mail alerts [1]. At present webpage is provided to the end user with username and password in order to allow the entry of only authorized users. After login, the door is controlled and watched live streaming and captured manually [2]. New authentication devices evolved in this modern world in that biometric authentication plays a major role in today's personal identification in that facial recognition plays an important role in accessing the locks in a smartphone the same can be implemented in same physical door locks as well. Since the process of face verification is a binary classification problem that it works on a pair of input faces, there are two main elements which can verify the approach: face representation and face matching [3]. In case of stranger approaches the home then the surveillance

The camera captures the stranger's face and delivers to the user.

A. The Internet of Things.

IoT is based on the combinations of the internet, wireless network, and computing. As of late, the Internet of Things is one of the mainly used technology together benefit a little country. IoT connects the physical things like vehicles, buildings, and various devices with embedded intelligent sensors and empowers these objects to replace and collect data. Wireless Sensor Networks is the most essential, which are the centre of the Internet of Things. A Wireless Sensor Network (WSN) interconnects sensors, in order to obtain data, by a server or unique scheme to work and maybe, computerize everyday jobs in one position. The best definition for IoT is that it is an interconnection of different and ubiquitous objects among themselves via the Internet. The aim of the IoT is to be linked the whole world through the building of diverse intelligent areas to computerize, facilitate and improve our routine life. These days, IoT turns into a part of all part of our lifetime. IoT applications not only enhance the convenience of our lifetime. Besides, it allows us too much control through simplify style work days and task of personals. The application areas of IoT are given in Fig. 1



Fig 1. Applications of IoT

B. Computer Vision

Open CV is Open source pc vision Programming with an effective library of picture preparing apparatuses. C++ and python dialects are utilized to compose the library and Open CV is good with Linux, Windows and Mac OS X. Open CV being a free programming streamlines the code for essential picture handling framework. The secured environment is inescapable for ensuring significant lives and resources. Individual's and property security is pivotal. Entryway security or passage entryway security is important to anticipate additionally issues in the controlled region. A customary checking gadget makes utilization of costly hardware, includes high power utilization, and requires consistent plate get to which clearly requires colossal space. The installed arrangements beat these deficiencies and give live encourages from webcam working on the cloud without the requirement for a PC. Calculations are added to the inserted frameworks to increase their effectiveness, by making utilization of the open source libraries, the development location calculations permit Raspberry Pi to distinguish development; the protest discovery calculations identify true elements, for example, face, auto, and pictures. The upgraded security highlights like live encourage scrambling. Continuous warnings and distributed storage can't be utilized as a part of a routine surveillance camera. Raspberry Pi, is an efficient equipment piece consolidated with the inbuilt camera module, costs less when contrasted and routine surveillance camera models. Raspberry Pi is joined with Open CV libraries, contains a few modules making it the most intelligent observing framework. This paper highlights the movement identification accomplishments, keeps a track on people utilization of Raspberry Pi camera module, PIR sensor and stores them in the database and used meanwhile.

II. RELATED WORK

The system proposed by [4] was a tracking approach can be influenced in many ways. Some of these factors include: environment (indoor, outdoor), object type (person, vehicle), light exposure (day, night, twilight, cloudy, raining, sunny), type of camera (fixed, pan-tilt-zoom, Omnidirectional), camera size (single, multiple), purpose of tracking (behaviour analysis, people counting, traffic monitoring), and the list is endless. Based on the above-stated factors a lot of methods have been proposed by various people and some of them are, an automatic system for obtaining high-resolution images of surveillance objects has been proposed. The system as soon as sees a particular face automatically starts detecting faces and processes it with the facial recognition technology. The system proposed by [5] tracks the target with the help of a single pan-tilt-zoom (PTZ) camera while trying to zoom in for the image of the face. It relies on an efficient strategy which is helpful in the localization of the target to guide the camera to get a close-up of the required target. The normal CCTV cameras were used only for recording and storing the data in a large secondary storage device and it does not recognise the faces of the stranger if they wore a mask or in different looks [6]. Hence the need to develop algorithms for tasks such as detection, tracking and recognition of objects using a distributed network of cameras has galvanized. Here the nature of image sensors provides quite a handful of challenges for data association across various types of cameras. First, the nature of these problems falls under the context of visual sensor networks. Then as to how the real world constraints can be used in the favour to tackle these complex challenges. Examples of these real-world constraints are the presence of a 3D model where persistence of motion across cameras and colour properties are illustrated. The prime focus of this work is to highlight the effective use of the geometric complexities induced by the systems used for imaging to obtain distributed algorithms for detection, tracking and recognition [6],[7].

III. PROPOSED WORK

The proposed system is to design a model which is efficient to catch intruders. Since many CCTV cameras were mounted around the home and in the neighbour's house, this may not suits well in real time information the information has to be stored and then retrieved so the surveillance camera is made efficiently built with the help of the Raspberry-Pi chipset. The chipset is very smart and can be used according to one's need, but it needs to be programmed first. Along with the chipset, a camera module is required in this case a pi camera is attached to it. This camera with NoIR (8MP) is capable of taking high definition photographs when these both combined make up an effective surveillance system. There can be scepticism about why we are not using the currently existing IP cameras. Well, the obvious answer to that question is Quality of the image. The camera that is integrated on the chip is an HD camera (8MP) which is comparatively cheaper than the available surveillance cameras in the market more over the current surveillance cameras costs nearly Rs.50000 in the market and cannot be programmed to one's needs, whereas the final build of this project will cost a maximum of Rs.7500 and would be a more efficient and feasible choice. To further set up the camera and interact with it a WI-FI module which is a built-in feature of the raspberry pi 3. Through this, the live video feed can be seen on a local authorized computer and the image database can be managed. The entire set up can be kept in a camera enclosure that can be bought easily to make it look like a typical surveillance camera. Now a little work is required before the camera is ready to be put into action. At present this setup is just a toy, so the code needs to embed into the chipset with the help of an SD card to bring the novelty to life. The database is made up of the pics of the authorized persons. When a person appears near the door and presses the doorbell the camera

captures the face and compares it with the images that were captured before in the database. If the image matches with the currently captured image then the door unlocks if it fails the captured face is sent to the user via telegram application. If any unusual motion is detected then the surveillance mode is activated automatically and sends the required data to the user. Block diagram of the proposed system is shown below in fig 2

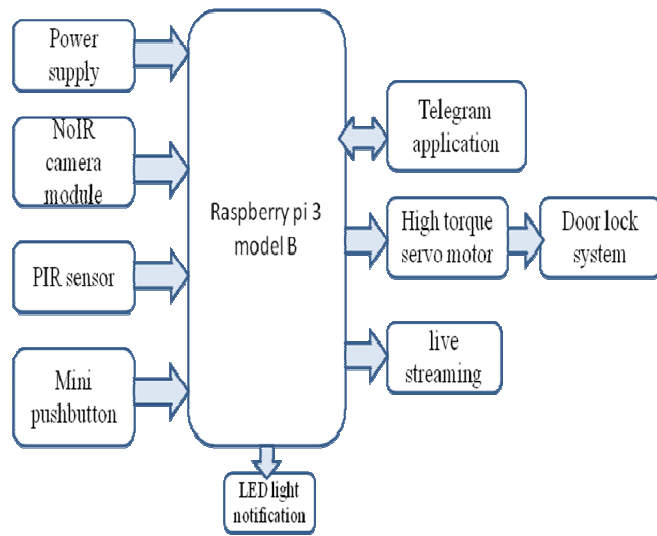


Fig 2. The proposed system block diagram

III. IMPLEMENTATION OF THE PROPOSED WORK

In this section, the surveillance system shall be made as mentioned above. Before starting this, a few components are needed.

A. Required components

Raspberry Pi 3 model B: It is a small computer sized board which is considered as a heart of the system which collects the captured images and compares with the database and sends the data to the user.

Raspberry Pi NoIR camera: the pi camera is used to capture the faces in the day as well as in night

time and this camera module comes with an 8MP resolution and with no infrared technology so it has the ability to capture the pictures even in low light.

SD card: 32GB memory card is more than enough for this proposed system which has the functioning of raspbian os and a dataset of the stored images.

B. Initial setup and implementation

First, the OS for the system needs to be downloaded and installed on the 32GB SD card. Raspberry Pi runs on Raspbian OS, a variant of the Debian operating system. It can be downloaded from the raspberry pi's official website. By default, a lot of the required tools and libraries are preinstalled. After this, the SD card is inserted into the raspberry pi board and is connected to the monitor and installs necessary libraries like OpenCV to detect and recognize faces, python imaging library to handle them. OpenCV library offers a lot of algorithms to detect and identify the faces. Here, the code is written in two sections. First one is to capture faces and create a database and another section is to fetch the image which is used for identifying or comparing the images in the database. The two parts are written in two separate python files. First, one is run only when a person's face needs to be entered in the database and the second one is called by the program only when motion is detected. The database is used to train the system for the positive faces. It is advised to take pictures of multiple facial expressions of each person to increase the accuracy. This is linked to an XML file and the path for the database is written in a text document which is accessed from the python code. Facial features are extracted for the comparison with the help of the Haar feature-based cascade classifier that is present in the OpenCV library [8]. Now a pushbutton is placed instead of doorbell which acts as a switch which is connected to

the raspberry pi 3 board. When this switch is pressed it captures the visitor's face and compares it with the database stored in the SD card if it matches it unlocks if it is not the picture is sent to the user via telegram. The flow chart for the proposed system is shown in fig 3.

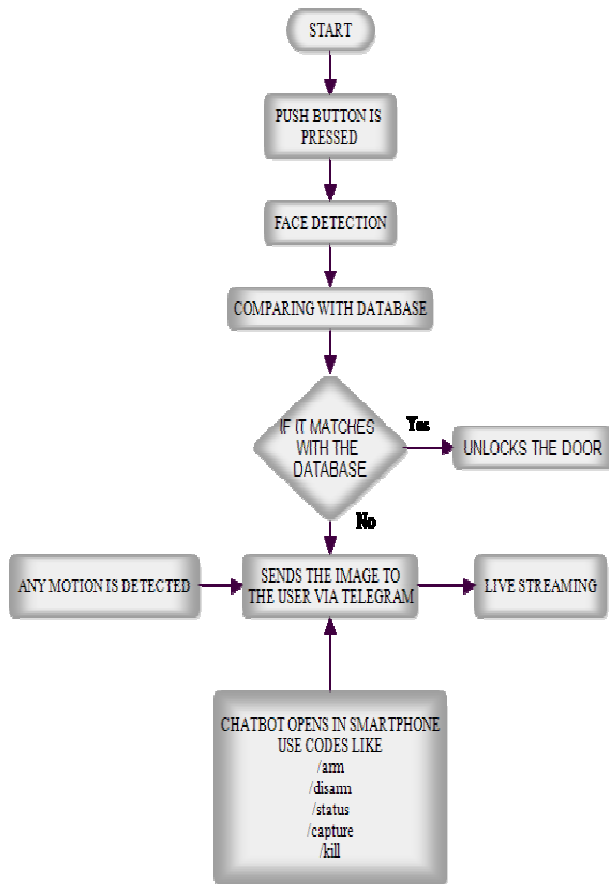


Fig 3. Flowchart for the proposed system

The database of the stored faces by the user is shown in figure 4.



Fig 4. Database of the stored faces

The door is mounted with a DC 12V solenoid lock for the effective function. The solenoid lock is shown in fig 5.



Fig 5. DC 12V solenoid lock

Next telegram bot is created using the link [9]. In that after signing in to the telegram apk in smartphone search for “Bot Father”. Bot Father is an openly sourced bot provided by the telegram. Create your own bot with username and chatID it sends you the token for the bot you created to use that token in your program.

IV. EXPERIMENTAL RESULTS

Smartphone application incorporated with the proposed system to improve a smart motion detecting camera security system and find human faces for houses and offices. Other than the hardware configuration the software’s necessary should also be installed The PICAMERA has been effectively grabbing the pictures when any motion is discovered through PIR motion sensor and face detection is executed. The system was capable to effectively discover the faces in the take pictures. The algorithm has been used to entice the pictures. Fig 6 shows the telegram messages when motion is detected



Fig 6. Telegram Chatbot message

V. CONCLUSION

The real-time surveillance of the house is necessary for security application. A Smartphone is the core gadget of the system that is used via the user to get notifications with the captured pictures. With Computer Vision, we could make simpler the use of the Internet of Things in our daily time and we could build a new path to contact us with our environment. A low-cost authentication system based on Raspberry pi 3 system and face recognition makes home automation system more secure and cost-efficient. This technology can surely make a change in the society to go down the percentage of crimes. Both NFC, RFID can be used in securing home but implementation cost and availability of supply hardware requirements are not up to the mark. But the system based on Raspberry Pi system is a low cost and efficient device for such purposes.

VI. REFERENCES

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