



Face Recognition Security System using Raspberry Pi

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ABSTRACT

The home and industries security system and for the automation has become vital for every kind house and industries. Previously, most doors can be open by using traditional ways, such as keys, security cards, password or pattern. However, incidents such as a key loss have led to much worrying cases such as robbery and identity fraud. This has become a significant issue. To overcome this problem, face recognition using deep learning technique was introduced and Internet of Thing (IoT) also been used to perform efficient door access control system. Raspberry Pi is a programmable small computer board and used as the main controller for face recognition, youth system and locking system. The camera is used to capture images of the person in front of the door. IoT system enables the user to control the door access.

1. INTRODUCTION

Raspberry Pi, developed by Raspberry Pi Foundation in association with Broadcom, is a series of small single-board computers and perhaps the most inspiring computer available today. From the moment you see the shiny green circuit board of Raspberry Pi, it invites you to tinker with it, play with it, start programming, and create your own software with it. Earlier, the Raspberry Pi was used to teach basic computer science in schools but later, because of its low cost and open design, the model became far more popular than anticipated. It is widely used to make gaming devices, fitness gadgets, weather stations, and much more. But apart from that, it is used by

thousands of people of all ages who want to take their first step in computer science. It is one of the best-selling British computers and most of the boards are made in the Sony factory in Pencoed, Wales.

2. LITERATURE REVIEW

The idea of home automation has been revolving around for around for some time. It's very recent that actual smart homes have come into existence. Keeping in mind the advantages related to home automation research and development projects already started from a long time back but due to the absence of standard networking of the home appliances nobody could

move forward with this concept. The major roadblock was removed in 1992 with the development of the consumer electronic bus by Electronics Industries Association of America. The CEBus standard includes specification for a layered network architecture based on open system interconnection model with network layer protocols for the physical, Data Link, Network layer and application layer [1].

A proposed scheme by Cross & Douligeris states that fiber optics might be the best medium for home automation network because with fiber, the limitations of the home automation system can be reduced and capabilities can be increased to include many more functions, leading to complete home integration. They observed that although CEBus includes fiber optics as one of the physical media but it is not specifying the configuration of the fiber optic network. After that they designed a fiber optics network which offered various advantages such as (i) increased bandwidth, (ii) immunity to electromagnetic noise, (iii) ease of installation, and (iv) safety from electric shock hazards. There were a few drawbacks as well that the cost was high and as fiber optics cannot carry direct current, they had to use an alternate source of energy [2-3].

In 2006 Mario Kolberg and Evan H. Magill mentioned the control of complex networked appliances. Presently computer interface is most used to configure and remotely control these appliances. However, the authors discussed that this will be unsuitable for the target audience who are not that much familiar with the use of computers. Therefore, they proposed Anoto-enabled pen and paper as a suitable alternative as users are highly familiar with pen and paper and they will find it suitable for control. In the suggested system data is transferred to the service provider through Bluetooth communication and mobile processed and sent to the user's home. Using this approach appliance can be controlled in the home and outside the home [4].

Android based home automation makes the system more flexible and provides attractive user interface compared to other home automation systems. In this system mobile devices are integrated into home automation systems. A novel architecture for a home automation system is proposed using the relatively new communication technologies. The system consists of mainly three components is a Wi-Fi module, raspberry pi board and relay circuits. Wi-Fi is used as the communication channel between android phone and the raspberry pi board [5].

3. METHOD USED FOR FACE RECOGNITION METHODOLOGY

This project will design face recognition for real-time use. It is integrated with IoT to perform for home security system. A deep learning

technique is used in this project. In order to ensure the expected result are obtained, several major steps need to be conducted such as data collections, implementing, testing, and troubleshooting. These steps are used to analyze the data and output. With these steps, this project is able to be evaluated.

A. FaceFirst

First, Face First is a software that provides a fully automated, user friendly, turnkey mobile and live-video surveillance facial recognition system. This software generates an alert whenever a face is recognized; and this occurs when the match of the input face with a face in the database is above a user defined probability. The advantage of Face First system is the availability to work in low resolution environments enabling real-world performance.

B. MorphoTrak

Second, Morpho Trak provides biometric and identity management solutions to a broad array of markets including law enforcement, border control, driver licenses, civil identification, and facility/IT security. Morpho Trak is part of the world's largest biometric company and leading innovator in large fingerprint identification systems, facial and iris recognition, as well as secure credentials.

C. Cross Match Technologies

Third, Cross Match Technologies is a leading global provider of biometric identity management systems, applications and enabling technologies to governments, law enforcement agencies and businesses around the world. Offerings include biometric technologies capable of wireless, mobile or stationary use that encompass facial recognition systems and other systems.

D. Face recognition in Raspberry Pi

Define The first research on face recognition goes way back in 1950 in the field of psychology. The actual work of automatic machine recognition of faces really started in 1970. From all the research done, there two types of face recognition method which are the image-based face recognition and video-based recognition. Video-based face recognition is the process of finding 3D images from its 2D while the imagebased recognition method, is the process by which human train the machine using a camera by showing the camera sets of still images. A Face Recognition System is a framework which consequently recognizes and additionally checks the identity of a person from digital images or a video outline from a video source. Many researchers choose to use embedded device called as Raspberry Pi for training and identification purpose. The fundamental reasons why they have picked this particular component because it has high handling limit, low cost, and its capacity adjusts in various programming modes. By using

Raspberry Pi, it helps to resolve the limitation of PC such as its weight, size and high-power consumption. Raspberry Pi is a device that can divide the software part into three parts which are recording images, training and face recognition. According to as that deployed the used of Raspberry Pi for image capturing system, the system becomes littler, lighter and has lower power utilization. So, it is more convenient compared to PC-based face recognition system.

E. Raspberry Pi Configuration

- Change the hostname: The default name is raspberry pi. You can also change it to the name, which you want to use on the network.
- Boot: You can choose from the two options and control whether Raspberry Pi boots into the desktop or CLI i.e., command line interface.
- Auto Login: With the help of this option, you can set whether the user should automatically log in or not.
- Network at Boot: By choosing this option, you can set whether the pi user is automatically logged in or not.
- Splash screen: You can enable or disable it. On enabling, it will display the graphical splash screen that shows when Raspberry Pi is booting.
- Resolution: With the help of this option, you can configure the resolution of your screen.
- Under scan: There are two options, enable or disable. It is used to change the size of the displayed screen image to optimally fill the screen. If you see a black border around the screen, you should disable the under scan. Whereas, you should enable the under scan, if your desktop does not fit your screen. There are three other tabs namely Interfaces, Performance, and Localization.
- The job of interface tab is to enable or disable various connection options on your Raspberry Pi.
- You can enable the Pi camera from the Interface tab.
- You can also set up a secure connection between computers by using SSH (short for Secure Shell) option. If you want to remote access your Pi with a graphical interface then, you can enable Real VNC software from this tab. SPI, I2C, Serial, 1-wire, and Remote GPIO are some other interfaces you can use.

There is another tab called Performance, which will give you access to the options for overclocking and changing the GPU memory.

The localization tab, as the name implies, enable us to set:

- The character set used in our language.

- Our time zone.
- The keyboard setup as per our choice.
- Our Wi-Fi country.



Figure 1: Raspberry Pi

F. Uses of Raspberry Pi

1. Like a desktop computer, you can do almost anything with the Raspberry Pi. You can start and manage programs with its graphical windows desktop. It also has the shell for accepting text commands. We can use the Raspberry Pi computer for the following:
2. Playing games
3. Browsing the internet
4. Word processing
5. Spreadsheets
6. Editing photos
7. Paying bills online
8. Managing your accounts.
9. The best use of Raspberry Pi is to learn how a computer works. You can also learn how to make electronic projects or programs with it. It comes with two programming languages, Scratch and Python. Through GPIO (general purpose input output) pins, Raspberry Pi can be connected to other circuits, so that you can control the other devices of your choice.

G. IoT In Face Recognition System

After IoT has been applied in face recognition in many applications such as unmanned arial vehicle, smart classroom, home security system, smart house, smart surveillance and many more applications. The previous implementation of IoT in face recognition are using conventional method such local binary pattern, neural network, support vector machine, and k nearest neighbor. However, in this research deep learning was being used.

- How does facial recognition work?

Step 1: Face detection. The camera detects and locates the image of a face, either alone or in a crowd.

Step 2: Face analysis. Next, an image of the face is captured and analyzed.

Step 3: Converting the image to data.

Step 4: Finding a match.

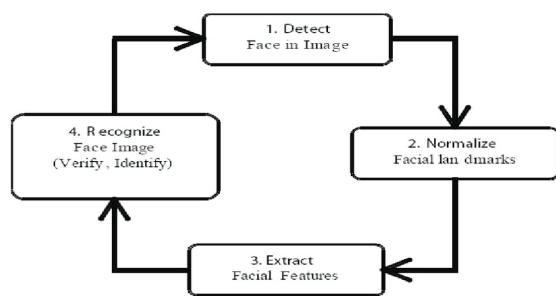


Figure 2: Flow of the Facial Expression Recognition System

H. Authorization

Face recognition is tested on two types which are by testing image and real-time to determine the system accuracy. For testing image, there are ten images that are not in the database are tested for each label which are authorized and unknown person. The tested image will have labeled the image with names for authorized person while unknown for unauthorized person.



Figure 3: Step 1: Face detection

4. RESULT AND ANALYSIS

Headings, or heads, are organizational devices that guide the reader through your paper. There are two types: component heads and text heads.

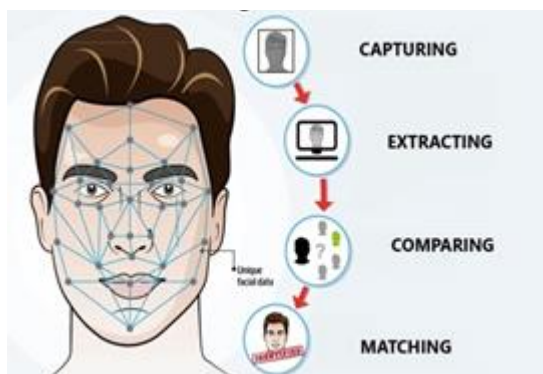


Figure 4: Converting the image to data, and Component heads identify the different components of your paper and are not topically subordinate to each other. Examples include Acknowledgments and References and, for these, the correct style to use is "Heading 5". Use "figure caption" for your Figure captions, and "table head" for your table title. Run-in heads, such as "Abstract", will require you to apply a style (in this case, italic) in addition to the style provided by the drop-down menu to differentiate the head from the text.

CONCLUSION

As a conclusion, security system by using face recognition combined with IoT is successfully done. The face recognition is able to recognize the face and able to send notification to a user when an unknown being has been detected through IoT. On the other hand, this project is this project still has a big room of improvement to be done, especially in the efficiency of the image processing part. Due to the module used which is Raspberry Pi 3, the processing time of the coding took a long time so process the image taken and take action. By using another better module, this project can be improved greatly.

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