

Secured access using Cognitive Services on Raspberry Pi

Rosch Goes, Dr. Suchithra Nair

MSc Information Technology, Jain University

Bengaluru, India

Head, Dept. of MSc Information Technology, Jain University

Bengaluru, India

Abstract:

The issue of Security is very paramount in any organization. Most security systems have a variety of components which can include finger print scanners, retina scan, rfid tag detectors as well as a keypad that allows users to input pins to gain access. These components can either be hardwired, which requires a contractor to drill and run wires throughout the house, or wireless, which allows for easy installation and replacement. And among them face recognition is the one which is attracting a lot of attention in society of security access. Few confidential Areas like bank vaults, critical server locations etc. need to be secured, and is possible through facial recognition system. In this paper an explanation on creating a low-cost stand-alone device is showcased using Facial Recognition technology to process and identify authorized personnel. The project is developed using Microsoft's cognitive service. The implementation of the project is done using Raspberry Pi.

Keywords: Facial Recognition, Raspberry Pie, Microsoft Cognitive Service

I - Introduction

Internet of Things (IoT) is an ecosystem of physical objects connected together that are accessible through the internet. Raspberry Pi is a single board computer developed, and acts as a crucial component of the IoT ecosystem. It has the ability of collecting and transferring information over the network just as a normal computer. It communicates with the help of an IP address once it is connected to the network. This embedded technology helps the Pi to connect over the network. IoT platforms can help reduce cost along with improved efficiency and better productivity. The sensors are easily accessible once connected to the Raspberry Pi.

Human face acts as a potential method of authentication. Humans can recognize many faces at a glance even after years of separation. But training a system to understand and detect faces is a difficult task. Various additions to the face like change in hairstyles, wearing of glasses, or having facial hair have made it difficult for identifying faces making facial recognition a very active research area.

In this project, biometric traits of humans are matched to the existing data and according to the matching identification results, the human face is traced. Facial features are extracted using the algorithm used by Microsoft Face Api. Face recognition is been used in various places for security purposes like bank vaults, critical server locations etc., A major addition of face recognition is also being implemented in Facebook, making it easier to identify faces to tag.

II - Literature Survey

There exist many systems that can control home appliances. Each system has its own unique feature.

According to R. Chellappa[1], in his paper on Human and Machine recognition of faces, he starts with detection of face patterns. Then normalizing it to get geometrical and illumination changes, the final grasp would be that of getting the facial landmarks, the algorithm is the main source where in the landmarks get

generated. Model based schemas are then generated along with post process results.

In a paper by Jun-Yong Zhua[2], new techniques were proposed which would consider the effects of spectral wavelength which was ignored and coming across the limitations on processing face images under different spectral wavelengths. The authors, through this paper came up with 3 folds namely, incorporating LMSN-LoG filter to eliminate the lighting effect, proposing an effective post-processing strategy and theoretical analysis on the illumination invariant properties

Ivana Chingovska, in their paper deals with an overview of spoofing attacks and countermeasures for face recognition systems focusing on VIS in 2D and 3D. the paper covers how the existing types of attacks and report on bypassing many face recognition.in order to reduce the risk.

Student attendance system[4] was done for classroom where a method for student attendance system in classroom with face recognition technique by combined power of DCT- Discrete cosine Transform and Discrete Wavelet Transforms (DWT) in order to extract the features of student's face followed by Radial Basis Function(RBF) for separating the facial objects.

Face recognition systems by Fontaine, Xavier[5] mainly designed to handle many images captured under controlled situations, real world images present varying oriented conditions. the authors propose a method consisting of performing a novel alignment process followed by classifying using sparse representation. They present recognition rates on a difficult dataset that represents real world faces.

This paper on Securing the Internet of Things[6], discusses that each physical object has a virtual component that will produce and consume services .Such deep interconnection will bring unprecedented convenience and economy, but it will also require different approaches to ensure its safety and ethical use. The Internet and its users are already under continuous attack, and a growing economy-replete with business models that undermine the Internet's ethical use-is fully focused on exploiting the current version's foundational weaknesses.

III - Existing System

1) Monitored systems:

monitored systems are one among the commonly used alarm systems with a lot of advantages as well as disadvantages. It mostly communicates over telephone lines once anything gets triggered. The disadvantages of these systems are that the communication lines caqn easily be located and disrupted. Cell phones can be made used of in this type of systems.

2) Unmonitored Systems:

On trigger, loud sounds are created to gain attention. It works the same way as fire alarms. It has an advantage of not spending lot of amount on monitoring fees as well as disadvantages that you need to rely on someone to be listening to the sound so that he can notify you.

3) Wireless Alarm Systems:

these systems are easily available at stores. And can be installed without much knowledge

IV - Proposed system

A Universal Windows Platform (UWP) app coded using C# which will run on Windows 10 IoT Core on Raspberry P 3. Passive Infrared (PIR) motion sensor will be used to detect when someone enters the room. A speaker that is connected will be used to announce the detection while the webcam will be used to capture images. The images that are captured will be sent to Microsoft cognitive Services that will work on performing image analysis.

V - Hardware and Software requirement

1) Hardware :

- a) Raspberry Pi 3 – used to connect all devices. In the case of this project I have connected motion sensor, camera and speaker.
- b) HDMI Cable – the connection initially needs to be done using a screen which is connected to the raspberry pi using an HDMI cable.
- c) Motion sensor – this sensor is used to detect motion, so that the camera can be triggered to click a picture

on detection of motion.

d) Web cam – Any camera that is companionable with raspberry pi can be used. This webcam will click pictures that will be used for analysis.

d) Speaker – A speaker is used to give an audio output message. In case the user is authorized, the speaker is used to welcome the authorized user.

e) Jumper cables – Used for connection purposes.

f) SD card – The Raspberry pi doesn't have internal memory, so the operating system needs to be loaded from the micro SD card.

2) Software:

a) Windows 10 IoT – An operating system from Microsoft that can be installed and used on Raspberry pi. All connections I.e. (Bluetooth, Wi-Fi as well as the other components that are connected to the Raspberry pi can interact with the hardware.

b) Visual Studio Community edition – the entire program is coded using C#, It becomes easy to communicate to Face Api using this edition. Also a subscription of face recognition API will be needed so that the keys are generated.

VI - Design and System Architecture

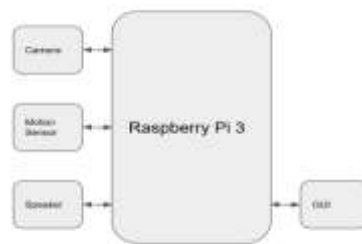


fig 1 – Block Diagram

In the fig 1, camera interface acts as a medium that captures images. Raspberry Pi 3 has an inbuilt adapter for Wi-Fi, so there is no need of connecting an external module to get on the network. The motion sensor on detect of motion will click a picture, the picture will be compared with the whitelisted pictures using Microsoft's Face Api.

VII - Flowchart



fig 2 – Flow Chart

VIII – Conclusion

This project thus adds intelligence to your security system using Cognitive Services that Microsoft provides. To detecting images and welcoming known people and capturing photos of unknown people.

IX - References:

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