Rajshahi University of Engineering & Technology, Rajshahi

Department of Electronics and Telecommunication Engineering
Project Report

Project Title: Facial Recognition Based Entry Logging and Intrusion Detection with Web Alerts and Panel.

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CERTIFICATE

This is to certify that the project entitled "Facial Recognition Based Entry Logging and Intrusion Detection with Web Alerts and Panel" by Mahir Labib Chowdhury, Roll No. 1604006 has been carried out under my supervision. To the best of my knowledge, this project work is an original one and was not submitted anywhere for any degree or diploma.

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Declaration

This is to certify that this project work is my own work and I have not submitted elsewhere for the award of any degree or diploma.

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Abstract

In the modern world the concept of a smart home and smart facilities are not a distant dream anymore. Ideally, using the smart features offered by the modern era we want to monitor our home or facilities in detail. Not only we want our home or facilities to be secure from the intruders and prevent the theft or damage of our belongings we also want to keep tabs on who is entering and leaving the home or facility at what times. This can be useful for identifying missing elements to solving serious crimes.

Simple 'Access control keypads' and 'Key fobs' alone are not secure enough anymore. Since 'Key fobs' and passwords can easily be stolen. I propose a 'Two Factor Authentication System' for access to the home or facility using a combination of both 'Previous knowledge' (such as passwords) or 'Belongings' (such as key fob) and a 'Biometric Vector' (such as Facial Data). This will ensure the person having the right key is also the right person with the adequate clearance or permission to enter the home or facility. There is one more thing to note, often 'The chain is as strong as itś weakest link', so we have to think about other entry point than the main door. We can add sensors to windows and other potential entry point for intrusion detection.

We have achieved this project goals with a combination of single board computers and micro controllers as the main processing side of the project. Networking elements and data collection points (i.e. cameras and sensors) were also integral part of this project.

Key words: Raspberry Pi, Home Automation, Smart Home, Intrusion Detection, Home Security, Face Recognition, Visitor Monitoring, Entry Logging

Acknowledgement

Chapter 1

Introduction

Humans by nature are curious and comfort seeking. We have created technologies to have more control over our lives and make it more easier. Modern technologies have given us the power to do things that was unthinkable just a few years ago. Our home is the safest place to us and we want to keep it protected at any cost. Having 24 hours a day and 7 days a week monitoring on our home keeps our mind free from the tension of a burglar entering our home.

This project aims to have constant monitoring of a home or facility, logging who is entering and leaving at what times and have intrusion alert when someone tries to break in from windows and such. We'll be introducing 'Two Factor Authentication' to our home doors and have full control over the whole system from any where of the world over the internet.

1.1 Motivation

Being worried when away from our beloved home/facility is not a new phenomena. We're always very anxious about our precious belongings whenever they leave our line of sight. This prevents us form concentrating on the present. While intrusion detection systems are readily available on the market, they are built on top of propitiator technologies and should not be trusted with personal data. Also, they run the risk of begin out of service due to their reliance on the major cloud services providers.

1.2 Objectives

1. To entry log people entering and leaving

2. To make sure having awareness of someone breaking in

3. To have a second factor of authentication

4. To avoid being vulnerable by loosing a key

1.3 Report Outline

In chapter 1 the importance of this project along with the motivation behind this project with the objectives has has been discussed.

Chapter 2

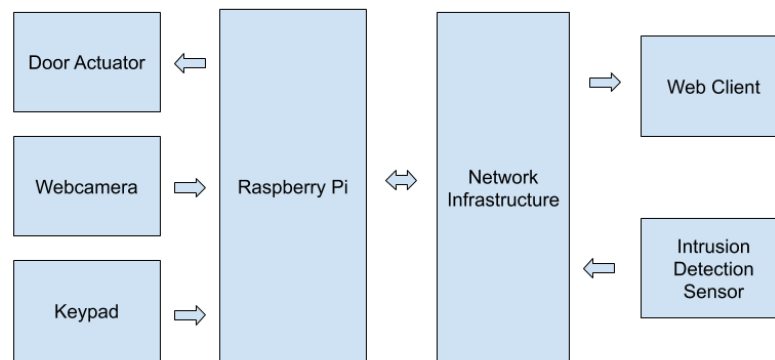# Background and Preliminaries

2.1   Block Diagram

Figure 2.1: Block Diagram of Facial Recognition Based Entry Logging and Intrusion Detection

The proposed system is a combination of interrupt based signal from the sensors and pooling based data from the camera. The block diagram shows how the Raspberry Pi can communicate with the various part of the the system. The intrusion detection sensors are connected by wireless means with the Raspberry Pi. The Networking Infrastructure exposes the Raspberry Pi to the outside world through a secure channel.
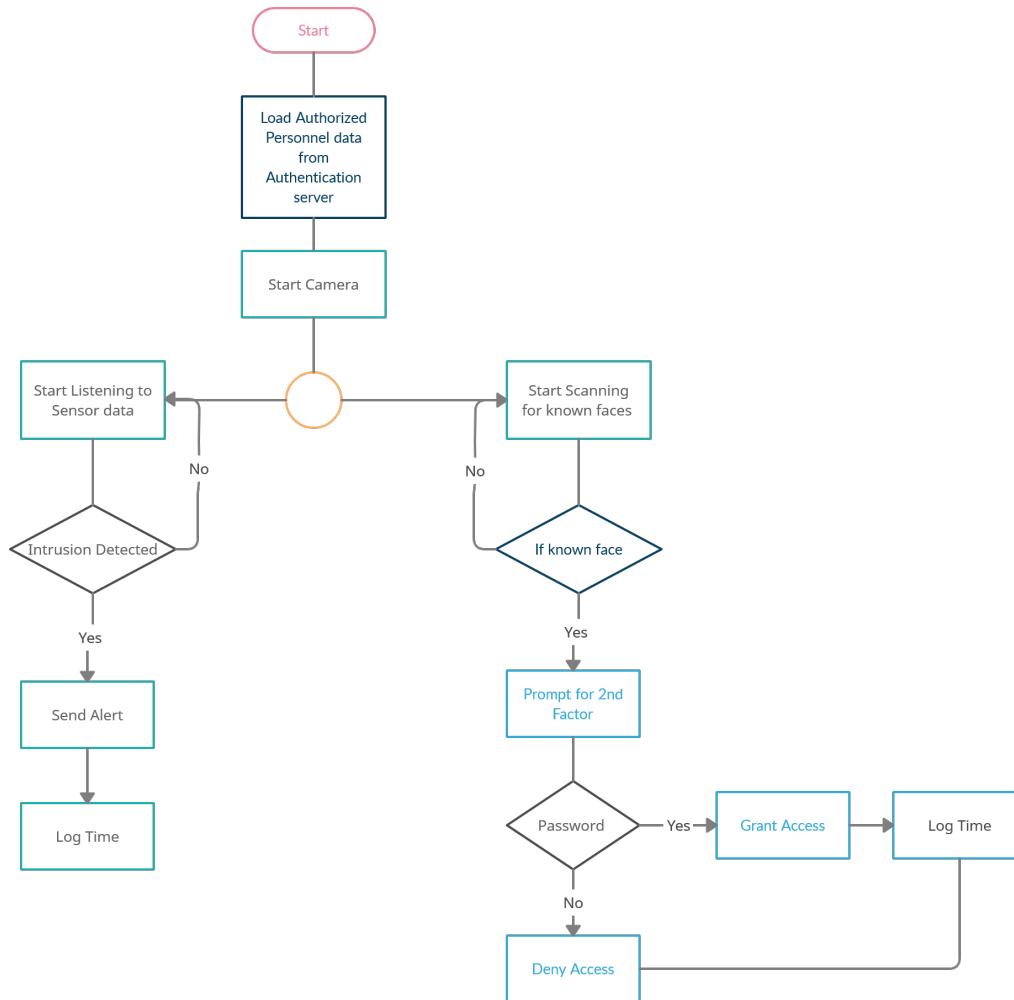
2.2 Flow Chart

Figure 2.2: Flow Chart of Facial Recognition Based Entry Logging and Intrusion Detection

2.3 Required Components

1. Raspberry Pi (x1)

2. Micro SD Card (x1)

3. Web camera (x1)

4. Keypad (x1)

5. ESP8266 (x1)

6. Magnetic Contact switch (x1)

7. WiFi Router (x1)

8. Power Adapter [5V-2A] (x2)

9. Wires

2.4 Description of Components

2.4.1 Raspberry Pi

Figure 2.3: Raspberry Pi 3B+

Raspberry Pi is the worlds first small single board computer. It has invented the form factor that it still dominates. This small computer has a ARM CPU and GPU with on board robust Networking, the board is also very low power consuming. These characteristics make this board the perfect choice for home Automation and IOT based projects.

Specification:

- CPU Clock Speed: 1.2GHz

- RAM: 1GB

- WiFi: 2.4GHz

- GPIO: 40pins

- Power: 20W

- USB: 4x USB 2.0

2.4.2   Micro SD Card

Figure 2.4: Micro SD Card

Micro SD card is another modern marvel of technology. It's one of the smallest and most reliable data storage medium. For running a Operating system in the Raspberry Pi, we need to boot from the SD card.

Specification:

- Dimensions: $15 * 11 * 1$mm

- Speed Class: 10

- Seq. Write: 10MB/s

- Seq. Read: 15MB/s

2.4.3   Web Camera

Figure 2.5: USB Web Camera

A web camera is essentially a USB camera that can be connected to any computer including the Raspberry Pi. In our project this camera will be used to detect the facial features of the users face.

Specification:

- Resolution: 720p

- USB: USB 3.0

- Focus: Infinite/Fixed

- Mic: Yes

- Framerate: 30FPS

- FOV: 60∘

2.4.4   Keypad

Figure 2.6: Keypad

Keypad can be used to input password to the device. It's a cheap and effective input device. Other than taking the input from the user, this same keyboard can be used to configure the device when first setting up.

Specification:

- Matrix Config: 4X4

- Max Voltage: 24V

- Max Current: 30mA

- Very thin

- Adhesive backing

- Operating Temperature: 0C to 50C
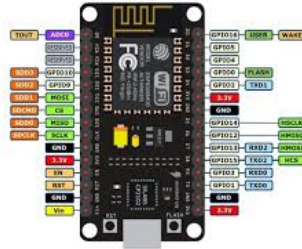
2.4.5 ESP8266

Figure 2.7: ESP8266

A single board micro controller board with on board WiFi capabilities and very low power consumption. Being a micro controller it has very good interface potential and robust connectivity/expandability.

Specification:

- Wi-fi: 802.11 b/g/n, Wi-Fi Direct, soft-AP

- Flash: 4MB

- CPU: 80MHz

- Standby power: 1.0mW

2.4.6 Magnetic Contact Switch

Figure 2.8: Magnetic Contact Switch

A switch that closes contacts when magnets are moved away from the device. This will be responsible for waking up the micro controller and sending the signal.

2.4.7 Wi-Fi Router

Figure 2.9: Wi-Fi Router

Router will be the central part of the Networking Infrastructure. This router will connect the devices internally then will be used to interface with the internet. The firewall on the router will be responsible for securing it from outside threat.

Specification:

- Wi-Fi: 2.4GHz

- Mode: 802.11 b/g/n

- Channel: 11

- Power: 20W

- Uplink: 100Mbps

2.4.8 Power Adapter

Figure 2.10: Power Adapter

Power adapter will be used to power the Raspberry Pi and the ESP8266.

Specification:

- Power: 20W

- Voltage: 5V

- Current: 2A

2.4.9 Wires

Figure 2.11: Wires

Wires will be used to connect the different parts

2.5 Required Software Stack

1. Visual Studio Code

2. EasyEDA

3. OpenCV

2.6 Description of Software Stack

2.6.1 Visual Studio Code

Visual Studio Code is a text editor that can be used to write code/text. This is a very flexible and light weight text editor. All codes and text including this report has been written with Visual Studio Code.

2.6.2 EasyEDA

EasyEDA is a EDA or Electronics Design Automation tool. It can be used to design circuits and run simulations.

2.6.3 OpenCV

OpenCV is a C powered image processing library. It can be used to process both still images and video stream directly from camera. We'll be using it's stream analysis capabilities to find out faces in the FOV of the camera.