



Facial Recognition and Automatic Self Unlocking Door

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Outline



Introduction

Brief explanation of how to project came to mind.



Project Process

Procedure, Hardware, Software & Implementation.



Test

Testing the project after it was implemented.



Future Enhancements

Facial Recognition 2.0

Introduction

- ▶ Home owners are always looking for a way to keep their homes secure.
- ▶ With the advances in technology and Internet of things home security providers and home owners look forward to incorporate these latest advances to better protect their home at a low cost and efficient way.
- ▶ In this project we explore the possibility of self-unlocking doors by incorporating facial recognition software. We enable the IOT (Internet Of things) feature by utilizing Raspberry Pi.



Some terms to ruminate

- ▶ **Internet Of things** refers to the billions of physical devices around the world that are now connected to the internet, collecting and sharing data. Low Cost processors like Raspberry Pi , Arduino and wireless network make it possible to do undertake such projects like the one discussed here.
- ▶ **Biometric Applications** find their roots in the 14th Century when the Chinese used fingerprints to create ink on parchment as a form of identification. The first semi-automated system for face recognition was developed in the 1960's. Modern state of the art technologies now have the ability to recognize a person's face even in a streaming video.



What is the project about?

- ▶ Our project utilizes a raspberry Pi installed with Windows IOS to enable the door to automatically open through facial recognition technology. The camera is connected to the raspberry Pi and a circuit is established with the door lock. The face recognition software is an Oxford API which is hosted on Microsoft Azure Cloud.
- ▶ The application is developed using C# and this adds the list of authorized users to a database and ensures only the people in the list are allowed to enter the house.
- ▶ The Microsoft Oxford project, which is used for facial recognition in this project is set of SDK's and API's which allow the developers to build intelligent applications without the need to know machine learning.



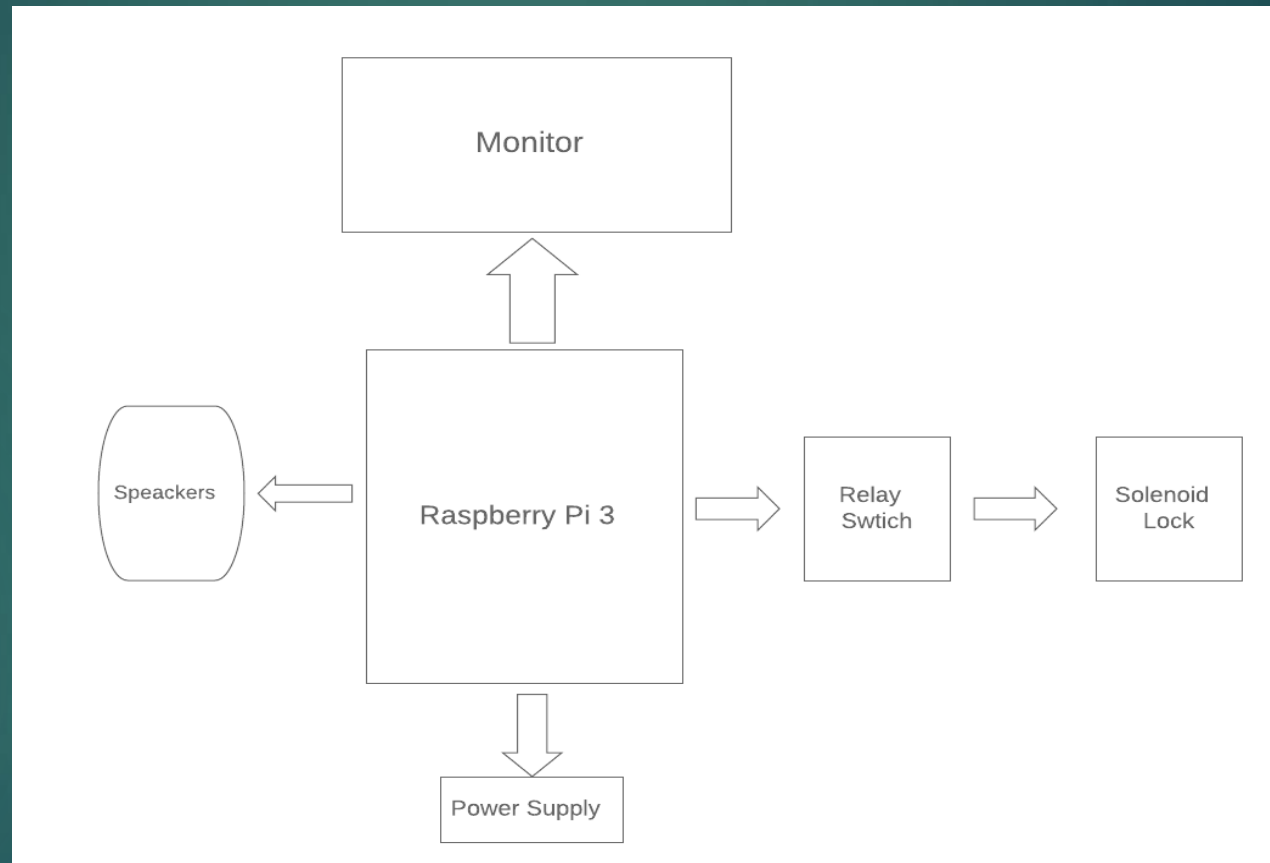
Hardware

- ▶ Raspberry Pi 3 Model B+
- ▶ Sainsmart 2- Channel Relay Module.
- ▶ Solenoid Lock
- ▶ Push Button
- ▶ 12 Volts Power Supply
- ▶ Microsoft Life Cam HD-3000
- ▶ Connecting Wires
- ▶ Breadboard
- ▶ Mouse & Keyboard
- ▶ Monitor
- ▶ HDMI Cable
- ▶ Audio Speakers

Software

- ▶ Microsoft Visual Studio 2017
- ▶ Backend in C#
- ▶ Microsoft Azure
- ▶ Microsoft Facial Recognition API
- ▶ Window 10 IOT
- ▶ Windows 10 IOT Device Manager

Data Flow

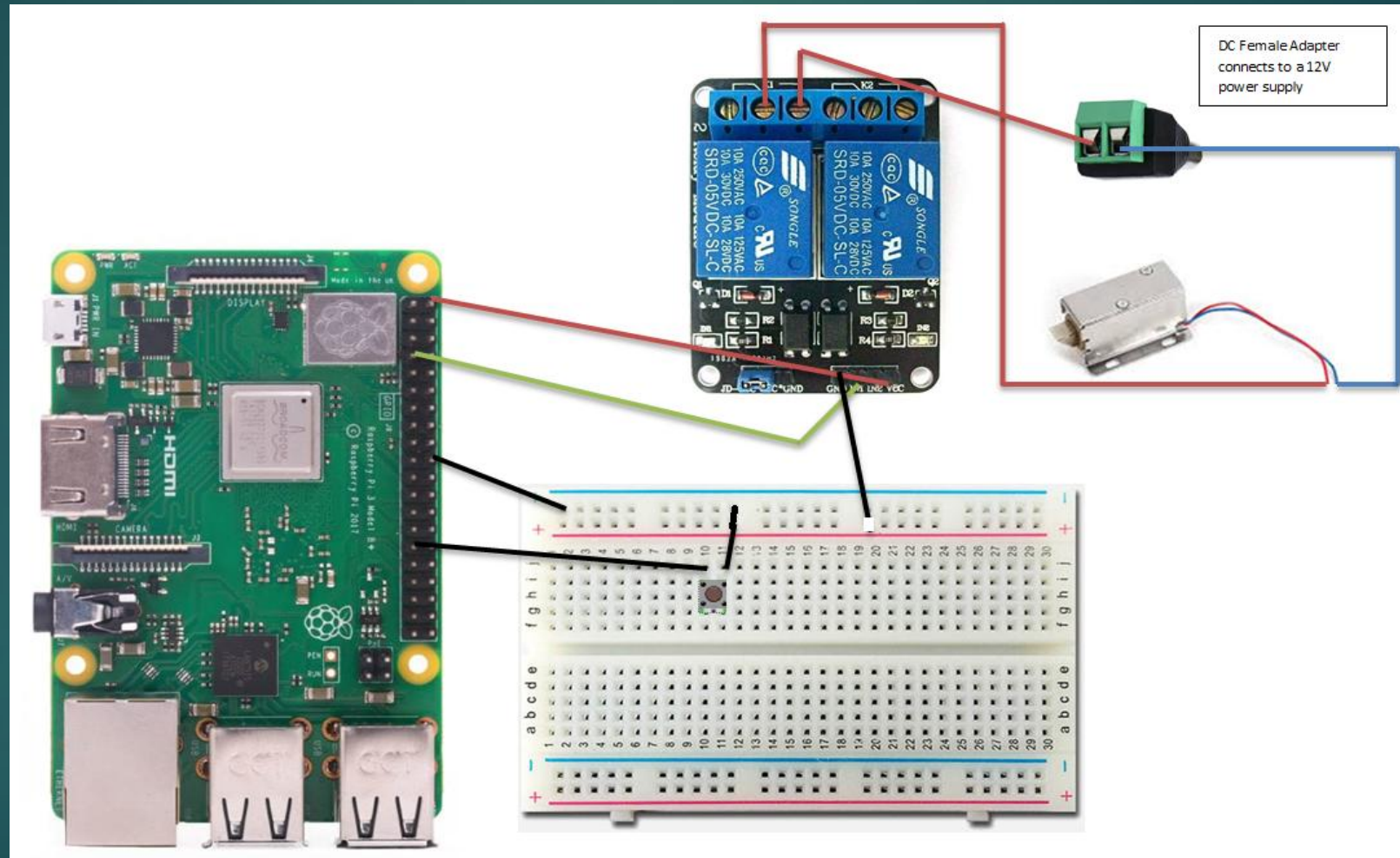


Raspberry Pi 3 Pin Mapping



Alternate Function					Alternate Function
	3.3V PWR	1		2	5V PWR
I2C1 SDA	GPIO 2	3		4	5V PWR
I2C1 SCL	GPIO 3	5		6	GND
	GPIO 4	7		8	UART0 TX
	GND	9		10	UART0 RX
	GPIO 17	11		12	GPIO 18
	GPIO 27	13		14	GND
	GPIO 22	15		16	GPIO 23
	3.3V PWR	17		18	GPIO 24
SPI0 MOSI	GPIO 10	19		20	GND
SPI0 MISO	GPIO 9	21		22	GPIO 25
SPI0 SCLK	GPIO 11	23		24	GPIO 8
	GND	25		26	GPIO 7
	Reserved	27		28	Reserved
	GPIO 5	29		30	GND
	GPIO 6	31		32	GPIO 12
	GPIO 13	33		34	GND
SPI1 MISO	GPIO 19	35		36	GPIO 16
	GPIO 26	37		38	GPIO 20
	GND	39		40	GPIO 21
					SPI0 CS0
					SPI0 CS1
					SPI1 CS0
					SPI1 MOSI
					SPI1 SCLK

Circuit Diagram

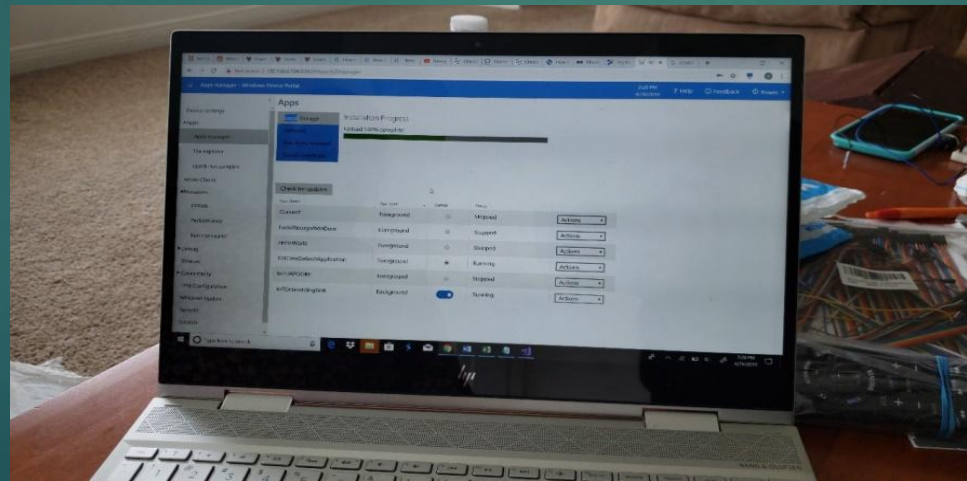


How does it work?

- ▶ To start with we need to Raspberry Pi 3 set up with Windows 10 IOT. The code was written using Windows Visual studio 2017 in a language C#.
- ▶ The code was then packaged (ARM) and then deployed in the Raspberry Pi using Windows Device Portal.
- ▶ The windows device portal helps configure and manage device remotely over a network. It is a webserver on Raspberry Pi that can be connected via PC.

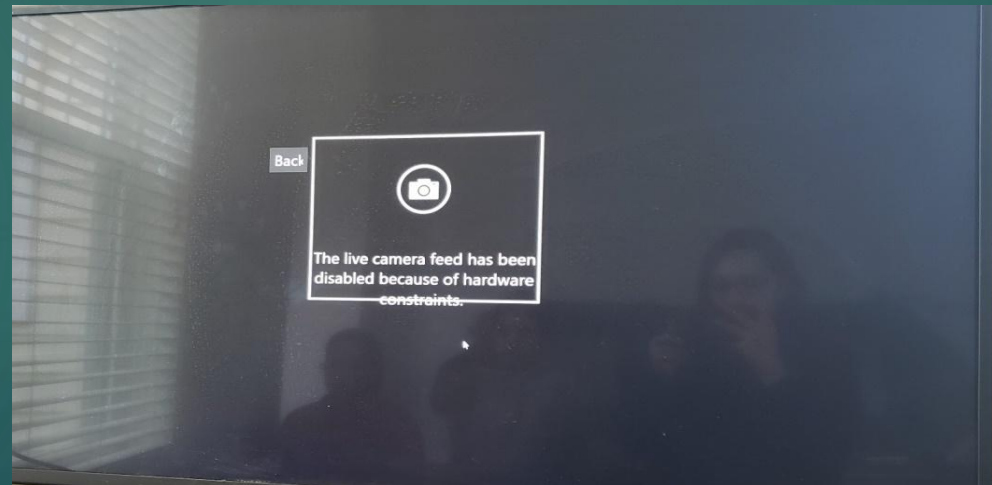
Set up Windows-device portal

- ▶ Enable developer Mode and Device Portal in Raspberry Pi (Configured in Settings app)
- ▶ Connect Raspberry Pi and PC through a local network.
- ▶ Navigate to the Device Portal page in the browser.



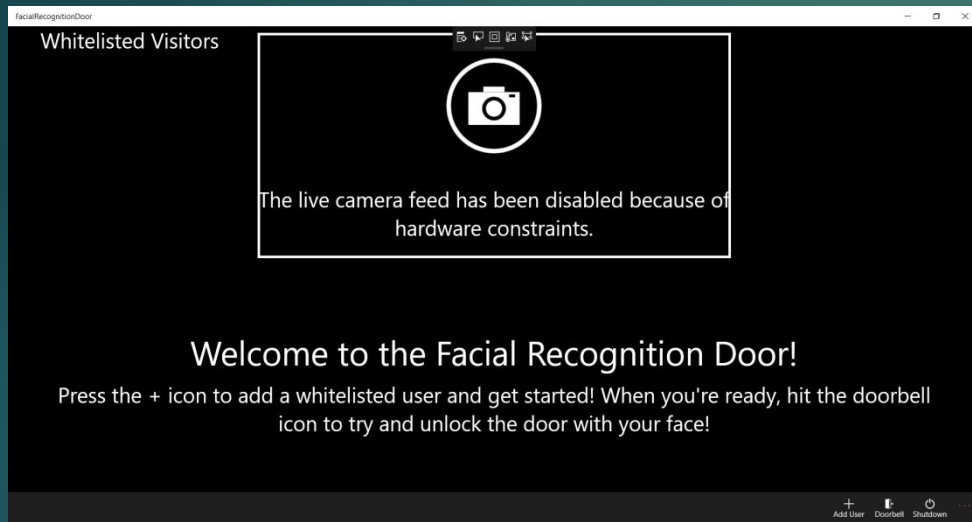
Adding the users to Whitelisted Database

- ▶ The Raspberry Pi is attached with the Camera. The application has an add user button which is used to take the photo of the person. After the photo is confirmed authenticated person is added to the whitelisted list on the left-hand side of the application developed.



Shows the application once it started

Adding the Users to Whitelisted Database



Shows the application with the “add user” button which is used to add the users to the Whitelisted Visitors on the left corner.



Shows the application connected to the door with the Whitelisted users.

Accessing the door based on facial recognition

- ▶ On pressing the push button or the doorbell in the application the Camera captured the picture of the person trying to access the door.
- ▶ It sends to Microsoft Face API interfaced to the application through Microsoft Azure cloud .
- ▶ The face is identified and matched with the whitelisted user database created by utilizing the steps above.
- ▶ If the face is matched the person gets an audio feedback “Welcome to the facial recognition door user. I will open the door for you”. The door then opens for 10 seconds.
- ▶ If the photograph does not match the person gets an audio feedback stating “Sorry, I don’t recognize you so I can’t open the door”.

Steps to Deploy Systems

- ▶ The device will function with an application and display an interactive UI. This will enable the application call the API's to access the hardware and perform facial recognition. The application's front end is deployed on Microsoft Visual Studio and API'S are called through it.

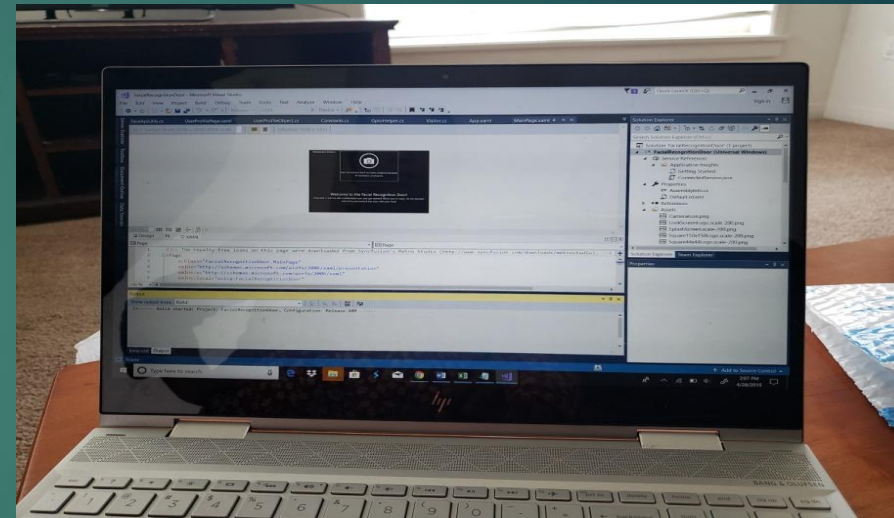
Steps:

- ▶ 1. Connect the Raspberry Pi 3 to the power source (using a phone charger). Install windows 10 in a Micro SD card and transfer it to Raspberry pi.
- ▶ 2. Enable Windows device Portal on the Laptop.
- ▶ 3. Connect the Raspberry Pi to the peripherals (camera, monitor, keyboard and mouse)
- ▶ 4. Download Visual Studio 2017 and deploy the code generated using language C#.
- ▶ 5. The deployed app was then packaged and installed in the Raspberry Pi 3 using Window Device Portal. The application is interfaced with the API on Microsoft Azure.
- ▶ The facial recognition works on the principle of neural networks and requires high computing resources to compute the results.

Steps to Deploy Systems

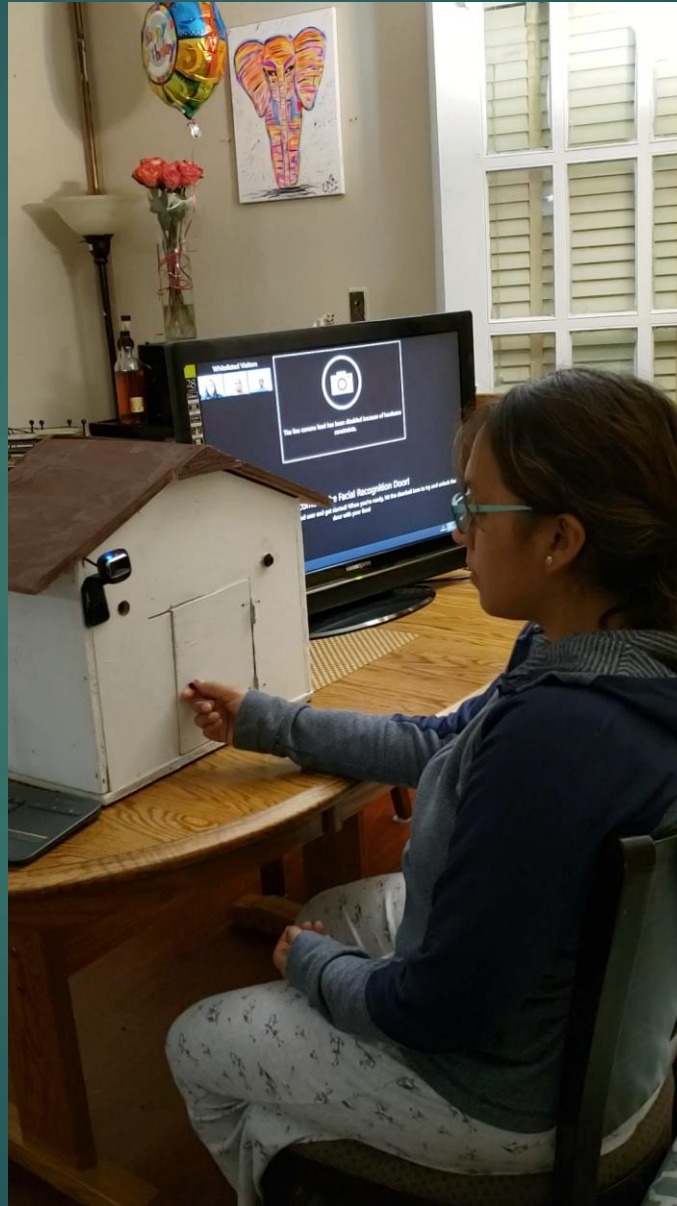


Shows the Raspberry Pi 3 with Windows 10 IOS



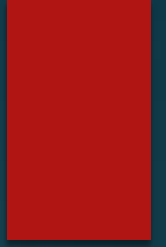
Shows the packing of the code

Demo



Future Enhancement

- ▶ In case the internet connection doesn't work we will need back up system. The backup system could be key pad or physical key. This would also ensure two way authentication and provide better security.
- ▶ The ability to control the door locks by your mobile device.
- ▶ Utilize live video and audio feed.
- ▶ Alternate power source like a rechargeable battery can be added. This would be helpful in case of blackouts.



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