# PERSON RECOGNITION FOR ACCESS LOGGING

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***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 project an explanation on creating a low-cost stand-alone device is showcased using Facial Recognition technology to process and identify authorized personnel. The implementation of the project is done using Raspberry Pi. The project uses FaceNet FRT (facial recognition technology) which takes a deep-learning approach to increase facial recognition accuracy. When face is recognized by Pi it will send SMS to the authorized person using GSM module. Security system design is cost effective, reliable and highly accurate.**

***Keywords*— RFID, Facenet FRT, GSM module, Raspberry Pi.**

## I. INTRODUCTION

Most security systems rely on access control within a secured area. Usually this access control will manifest itself in the form of gate guards or key card technology. Effective implementation of these systems comes with the overhead of complex record management as well as significant investment in personnel or key/badge technology. An effective key card system may also be compromised in the event that a card is lost or stolen. However, biometric identifiers tied to a particular individual's physiological characteristics do not have the same potential for misuse or exploitation. An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers. Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result. The embedded based "person recognition" using Raspberry pi microprocessor is an exclusive project which is used to detect the person. We can use this project for high security.

## II. PROPOSED SYSTEM

The goal of the current project is to develop an independent, lightweight system for access monitoring and logging utilizing modern FRT. The envisioned system includes a hardware/software system to monitor access at various entry and exit points as well as provide a full visual display of the activity. Rather than maintaining a database of users, the system dynamically populates a new registry of users daily. The purpose of this dynamic population of a database is to ensure that the system may be used for general purpose access monitoring to keep track of all individuals in a given facility. The software is currently implemented in hardware on a low-power processor which simulates actual "in-door" operation while being relatively compact and mobile for various testing applications. A web-based platform for visualization was also developed and works alongside the hardware system to provide real-time updates on access information as well as the system status. The current project expands upon an earlier lightweight prototype through its implementation of a more modern facial recognition system.

## III. WORKING OF THE PROJECT

This chapter briefly explains about the Hardware Implementation of the project. It discusses the design and working of the design with the help of block diagram in detail. It explains the features of Raspberry pi processor. It also explains the various modules used in this project. The implementation of the project design can be divided in two parts.

- Hardware implementation
- Firmware implementation

Hardware implementation deals in drawing the schematic on the plane paper according to the application, testing the schematic design over the breadboard using the various IC's to find if the design meets the objective, carrying out the PCB layout of the schematic tested on breadboard, finally preparing the board and testing the designed hardware. In the present work, we have used the python software (IDLE editor) development tool to write and compile the source code. The firmware implementation is explained in the next chapter. The project design and principle are explained in this chapter using the block diagram. The block diagram of the design is as shown in Fig 3.1. It consists of power supply unit, Raspberry Pi processor, USB camera, GSM modem, and LCD. The brief description of each unit is explained as follows

### Block Diagram:

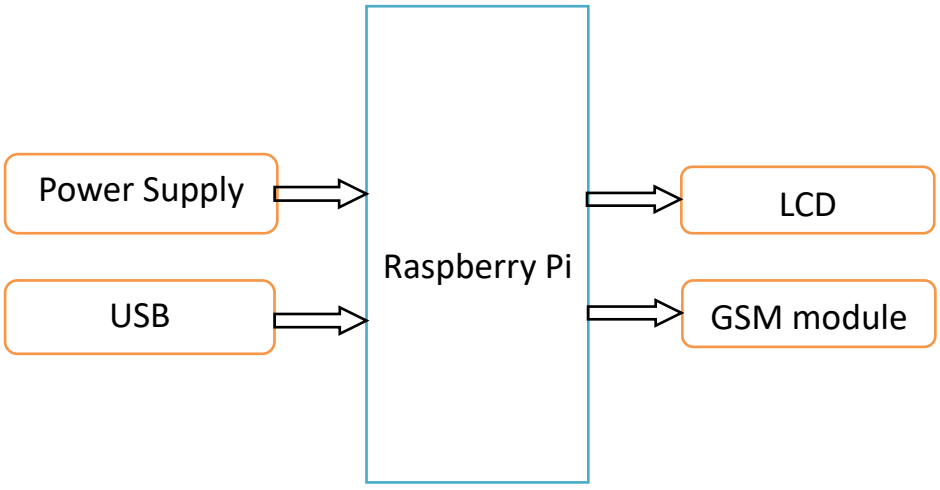


**Fig.1 Block Diagram**

## Face Recognition:

Face Recognition is getting increasingly popular and most of us are already using it without even realizing it. Be it a simple. Facebook Tag suggestion or Snapshot Filter or advanced airport security surveillance, Face Recognition has already worked its magic in it. China has started using Face Recognition in schools to monitor student's attendance and behaviours. Retail Stores have started using Face Recognition to categorize their customers and isolate people with history of fraud. With a lot more changes underway, there is no doubt that this technology would be seen everywhere in the near future. In this project, we implement **Face Recognition system using the Opens Library on Raspberry Pi**. The advantage of installing this system on portable Raspberry Pi is that you can install it anywhere to work it as surveillance system. This project involves **two python scripts**, one is a **Trainer program** which will analyse a set of photos of a particular person and create a dataset (ML File). The second program is the **Recognizer program** which detects a face and then uses this file to recognize the face and mention the person name. Both the programs that we will discuss here are for Raspberry Pi (Linux), but will also work on Windows Computers with very slight changes. We are using the OpenCV Library to detect and recognize faces. So make sure you to install OpenCV Library on Pi. Also Power your Pi with a 2A adapter and connect it to a display monitor via HDMI cable.

How Face Recognition Works with OpenCV

Before we start, it is important to understand that Face Detection and Face Recognition are two different things. In Face Detection only the Face of a person is detected the software will have no Idea who that Person is. In Face Recognition the software will not only detect the face but will also recognize the person. Now, it should be clear that we need to perform Face Detection before performing Face Recognition. A video feed from a webcam is nothing more than a long sequence of still images being updated one after the other. And each of these images is just a collection of pixels of different values put together in its respective position. We are using the OpenCV library it very simple to perform face Recognition.

Face Detection using Cascade Classifiers in OpenCV

Only if we are able to detect a face we will able to recognize it or remember it. To detect an object such as face OpenCV uses something called Classifiers. These Classifiers are pre-trained set of data (ML File) which can be used to detect a particular object in our case a face. Apart from detecting Face, Classifiers can detect other objects like nose, eyes, Vehicle License Plate, Smile etc.

Face Recognition Project Folder

Our project folder will consist of two python program called the face_trainer.py and face recog.py. A folder called Face Images which consist sample images of the persons who has to be recognized. And finally a trainer file called "face-trainner.yml" which will be generated using the Face_Trainner.py program based on the Images present inside the Face Images Folder.

## IV. RASPBERRY PI AND OTHER MODULES

The Raspberry Pi is a credit-card sized computer that plugs into your TV and a keyboard. It is a capable little computer which can be used in electronics projects, and for many of the things that your desktop PC does, like spreadsheets, word-processing and games. It also plays high-definition video. We want to see it being used by kids all over the world to learn how computers work, how to manipulate the electronic world around them, and how to program. The Raspberry Pi is a low cost, **credit-card sized computer** that plugs into a computer monitor or TV, and uses a standard keyboard and mouse.

It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games.

**THE MODEL B**

The following list details some of the improvements over the Model B.

- Current monitors on the USB ports mean the B+ now supports hot plugging.
- Current limiter on the 5V for HDMI means HDMI cable powered VGA converters will now all work
- 14 more GPIO pins
- EEPROM readout support for the new HAT expansion boards
- Higher drive capacity for analog audio out, from a separate regulator, which means a better audio DAC quality.
- No more back powering problems, due to the USB current limiters which also inhibit back flow, together with the "ideal power diode"
- Composite output moved to 3.5mm jack
- Connectors now moved to two sides of the board rather than the four of the original device.
- Ethernet LED's moved to the Ethernet connector
- 4 squarely positioned mounting holes for more rigid attachment to cases etc.

The power circuit changes also means a reduction in power requirements of between 0.5W and 1W.
The compute module is intended for industrial applications, it is a cut down device which simply include the BCM2835, 512MB of SDRAM and a 4GB eMMC flash memory, in a small form factor. This connects to a base board using a repurposed 200 pin DDR2 SODIMM connector. Note the device is NOT SODIMM compatible, it just repurposes the connector. All the BCM2835 features are exposed via the SODIMM connector, including twin camera and LCD ports, whilst the Model A or B/B+ only have one of each.

The compute module is expected to be used by companies wishing to shortcut the development process of new product, meaning only a baseboard needs to be developed, with appropriate peripherals, with the Compute Module providing the CPU, memory and storage along with tested and reliable software.

**Fig2: Raspberry Pi -3 Model B**

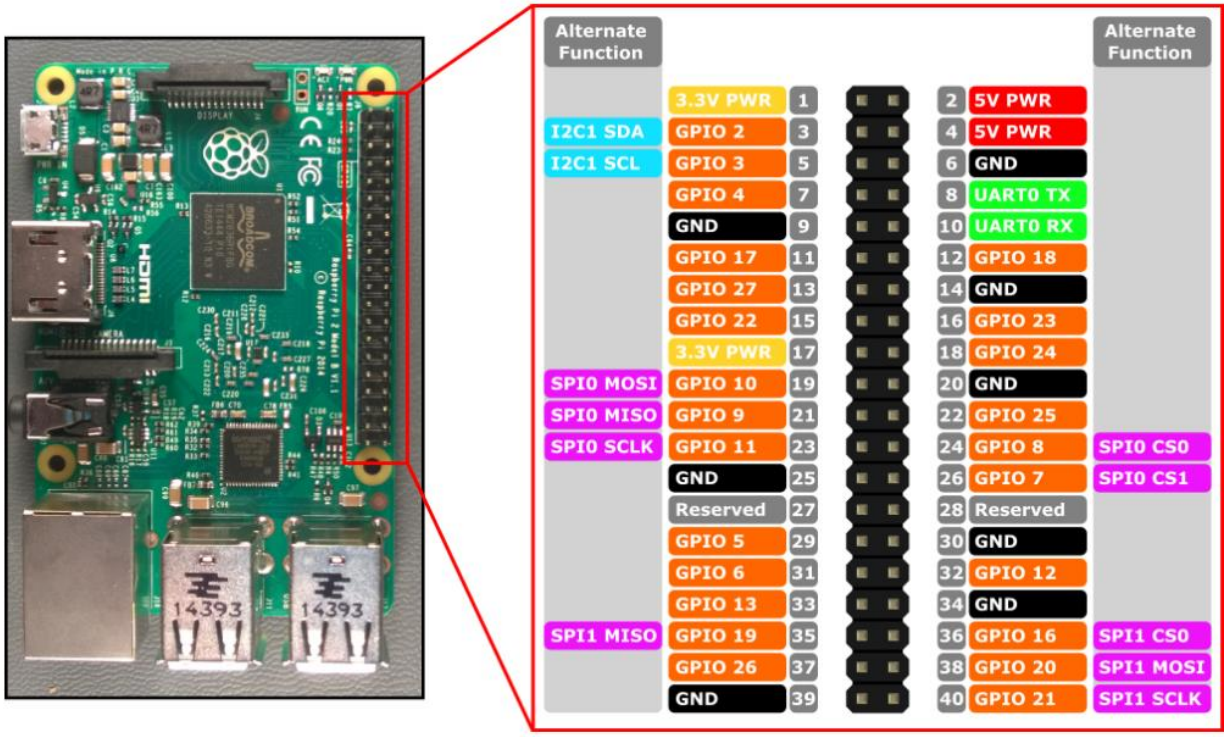


**Fig3: Raspberry Pi -3 Model B Pin diagram**

The BCM2836 device has two UARTS. On mini UART and PL011 UART. This section describes the PL011 UART. For details of the mini UART see 2.2 Mini UART.

The PL011 UART is a Universal Asynchronous Receiver/Transmitter. This is the ARM UART (PL011) implementation. The UART performs serial-to-parallel conversion on data characters received from an external peripheral device or modem, and parallel-to-serial conversion on data characters received from the Advanced Peripheral Bus (APB).

The ARM PL011 UART has some optional functionality which can be included or left out.

The following functionality is not supported:

- Infrared Data Association (IrDA)
- Serial InfraRed (SIR) protocol Encoder/Decoder (ENDEC)
- Direct Memory Access (DMA).

The UART provides:

- Separate 16x8 transmit and 16x12 receive FIFO memory.
- Programmable baud rate generator.
- Standard asynchronous communication bits (start, stop and parity). These are added prior to transmission and removed on reception.

INSTALLING OPERATING SYSTEM IMAGES

How to install a Raspberry Pi Operating System image on an SD card. You will need another computer with an SD card reader to install the image. We recommend most users download NOOBS which is designed to be very easy to use. However more advanced users looking to install a particular image should use this guide.

DOWNLOAD THE IMAGE

Official images for recommended Operating Systems are available to download from the Raspberry Pi website: raspberrypi.org/downloads. Alternative distributions are available from third party vendors.

WRITING AN IMAGE TO THE SD CARD

With the image file of the distribution of your choice, you need to use an image writing tool to install it on your SD card.SMS

GSM (Global System for Mobile communication) is a digital mobile telephone system that is widely used in Europe and other parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band. It supports voice calls and data transfer speeds of up to 9.6 kbit/s, together with the transmission of SMS (Short Message Service).

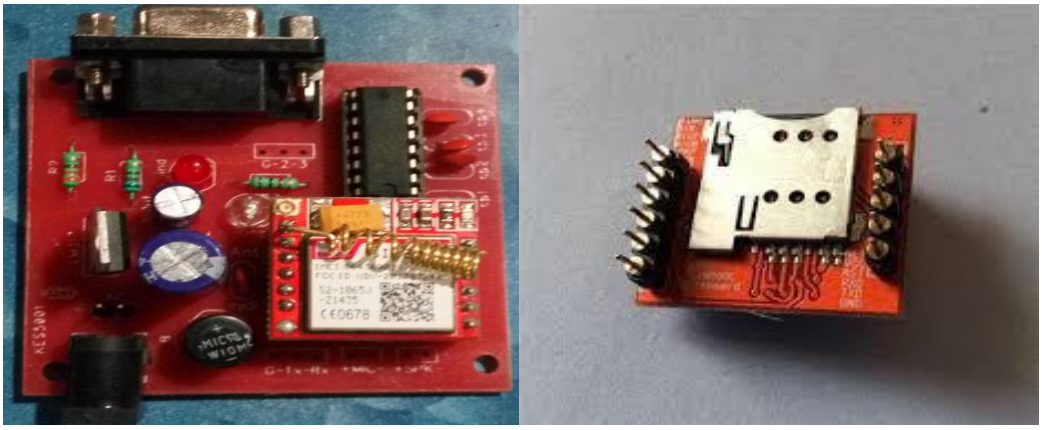

**Fig4: GSM Module**

**Table1**

| | |
|---|---|
| 1 | **Insert SIM card:** Press the yellow pin to remove the tray from the SIM cardholder. After Properly fixing the SIM card in the tray, insert the tray in the slot provided. |
| 2 | **Connect Antenna:** Screw the RF antenna if not already connected. |
| 3 | **Connect RS232 Cable to PC/MCU:** (Cable provided for RS232 communication).Default baud rate is 115200 with 8-N-1, no hardware handshaking. |
| 4 | **Connect the power Supply** (12V 1A) to the power input of board. Polarity should be Center +ve and outer –ve DC jack. |
| 5 | **Network Led** indicating various status of GSM module eg. Power on, network registration & GPRS connectivity. |
| 6 | After the Modem registers the network, led will blink in step of 3 seconds. At this stage you can start using Modem for your application. |
| 7 | AT commands can be sent to control GSM Modem. |

**Optical character recognition** or **optical character reader** (**OCR**)

OCR is the electronic or mechanical conversion of images of typed, handwritten or printed text into machine-encoded text, whether from a scanned document, a photo of a document, a scene-photo (for example the text on signs and billboards in a landscape photo) or from subtitle text superimposed on an image (for example from a television broadcast). Widely used as a form of data entry from printed paper data records – whether passport documents, invoices, bank statements, computerized receipts, business cards, mail, printouts of static-data, or any suitable documentation – it is a common method of digitizing printed texts so that they can be electronically edited, searched, stored more compactly, displayed on-line, and used in machine processes such as cognitive computing, machine translation, (extracted) text-to-speech, key data and text mining. OCR is a field of research in pattern recognition, artificial intelligence and computer vision. Early versions needed to be trained with images of each character, and worked on one font at a time. Advanced systems capable of producing a high degree of recognition accuracy for most fonts are now common, and with support for a variety of digital image file format inputs. Some systems are capable of reproducing formatted output that closely approximates the original page including images, columns, and other non-textual components.

**LCD screen:**

LCD screen consists of two lines with 16 characters each. Each character consists of 5x7 dot matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. For that reason, variable voltage 0-Vdd is applied on pin marked as Vee. Trimmer potentiometer is usually used for that purpose. Some versions of displays have built in backlight (blue or green diodes). When used during operating, a resistor for current limitation should be used (like with any LE diode).

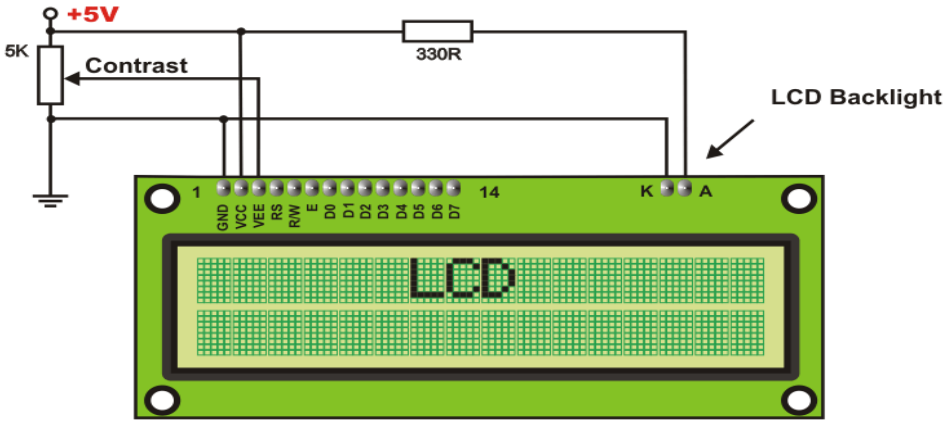


**Fig:5 LCD SCREEN**

## V. IMPLEMENTATION OF THE DESIGN & RESULTS

Python is an interpreter, object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding; make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed. The system can be used in several places like banks, hospitals, labs and other sophisticated automated systems, which dramatically reduce the hazard of unauthorized entry. Evidence can be given to the security department if any robbery issue occurs. The design of the face recognition system using Raspberry pi can make the smaller, lighter and with lower power consumption, so it is more convenient than the PC-based face recognition system. Because of the open source code, it is freer to do software development on Linux. The system was programmed using Python programming language. We will simply create a data-set, where we will store images for each id, a group of photos that are used for face detection. The prototype includes various low-power devices including a Raspberry Pi, Camera and GSM module. The tested image will have labeled the image with names for authorized person while unknown for unauthorized person. Real-time face recognition is performed using web camera. An authorized person can be recognized through the system and vice versa.

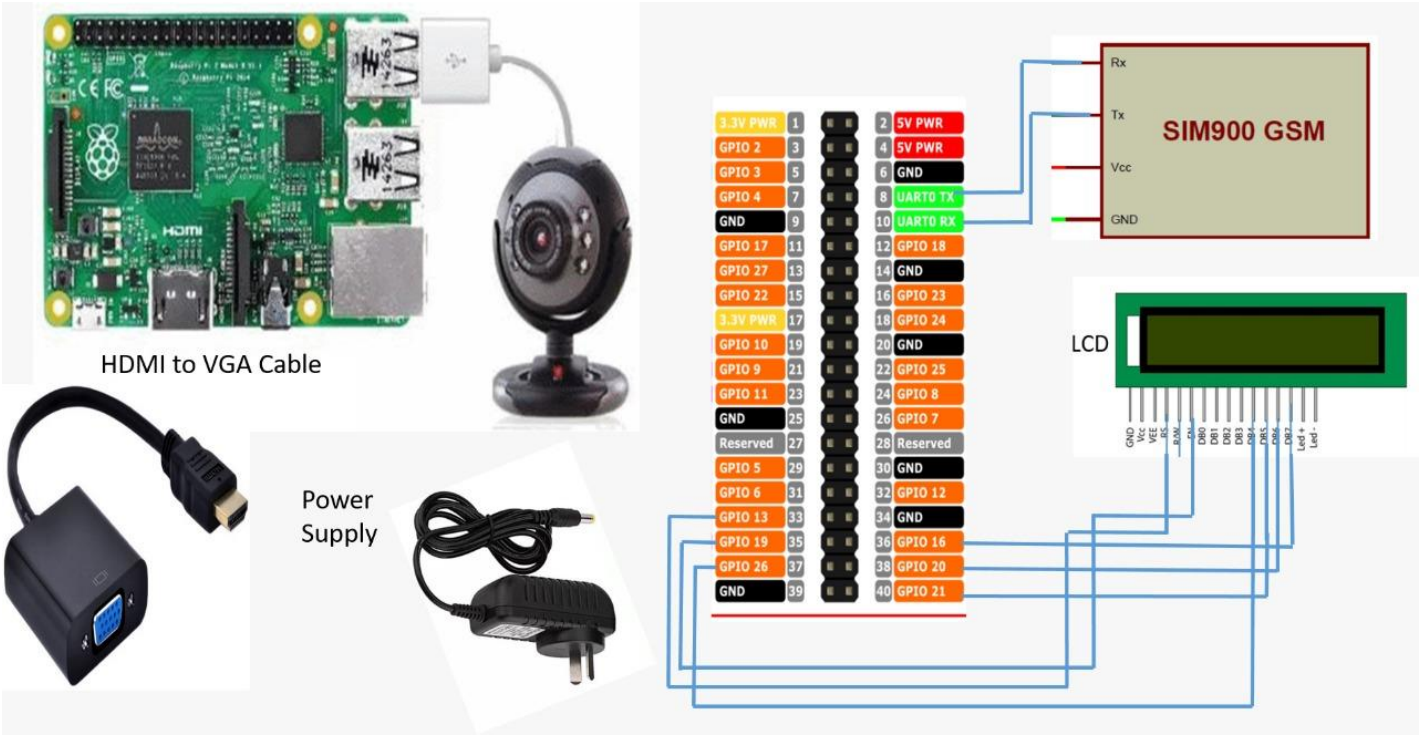


**Fig 6: Schematic diagram**

## CONCLUSION

As a conclusion, security system by using face recognition is successfully done. This project is done with Open Source Computer Vision Library (OpenCV). OpenCV was designed for computational efficiency and with a strong focus on real-time applications. The face recognition is able to recognize the face and able to send notification to a user. One interesting direction for future work is to collect the data from the owner's Smartphone such as captured images and videos and to train the network automatically. Another direction for future work is to detect fake-face by using gait speed and eye tracking

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