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Two-Layer Authentication System for Vehicles

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Abstract: *Majority of the time, the automobiles used in crimes are stolen and can trick us into believing they are from services like Ola or Uber. We must enhance the number of car access systems to prevent such thefts and the crimes that go along with them. There are numerous authentication methods available on the market, including voice requests, drawing patterns, RF vehicle keys, biometric sensors, etc. One of the most significant and effective forms of authentication is face recognition. Thus, the goal of the proposed system is to use a dual verification method to verify drivers. Utilizing a biometric device in the car is how the first step of the authentication process is carried out. If it is completed successfully, the second step, which is the facial recognition module, will be activated to take a photo of the driver. To provide a facial recognition module, the system combines a Raspberry Pi 3a+ module and a Pi camera. The r307s module is used to offer biometric authentication.*

Keywords*:* Raspberry Pi 3a+ module, Pi Camera, r307s fingerprint module

I. INTRODUCTION

In existing systems, Various tracking methods, including real-time tracking and arrival time prediction, automatic transport instructions, and Google Maps integration, are used in the current system. Any monitoring system that incorporates Radio Frequency Identification will perform better overall and at a lower cost. The vehicle is tracked using GPS or GSM technology. However, as opposed to GPS, GSM is used by the majority of alarm systems. It is crucial, especially for women working night hours who take cabs to get around. Additionally, it is crucial for parents of kids who go on field trips or industrial tours to be able to readily monitor their kids' bus drivers. Traditional car security systems are expensive because they require a lot of sensors. Most prototype versions employ PIC microcontrollers, which will be used to regulate every process. However, if such systems don't constantly check driver identification, it could result in car thefts, phony switch-ups of designated drivers, driving for longer than allowed for a single driver, etc. The majority of systems use biometric authentication since it is a trusted and widely used technique. To make sure the right driver starts the car or to detect authentication failure, smart card-based biometric authentication is utilized. Avoiding accidents improves vehicle security and assures safe driving. Using image processing in real-time apps to protect the car from theft is another authentication method. The image is taken by the system using a camera, and it is then compared with the database image using the Viola-Jones algorithm.For the face recognition step, the Haar cascade technique is applied. Instead of looking for an exact pattern based on Euclidean distance and trustworthiness to be utilized with large samples of data, the extracted image will be further upgraded to differentiate many of the attributes. The authorization stage in the latter method entails defining a threshold value that will be compared with an established Euclidean distance. If it exceeds the threshold level, authentication fails and an unknown individual is produced. The monitoring side system will be advised of the same via an SMS message sent via the GSM operating modem.

Existing systems have very few apparent limitations. A few examples include the challenge of retracing a fingerprint from a distance, the utilization of high-end cameras to ensure accurate facial recognition with little to no delay, and the affordability of GPS tracking systems. The suggested system gets over the drawbacks mentioned above.

The suggested system consists of a PI camera for facial recognition and an R307s fingerprint scanner and a sensor for biometric authentication. In the beginning, the database will only contain information on verified driver personnel. The driver's information should be entered into the device that is installed in the car at the time the vehicle is taken out for a drive.

Upon successful completion of the authentication process, the vehicle engine will start. The driver's fingerprint is first entered into the biometric device. The Pi camera will begin the facial recognition stage if the fingerprint matches the

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internal database. The driver's face must match the internal database for authentication to be successful. If it does, a relay switch will turn on. Anytime there is a mismatch in authentication, a buzzer alert will sound to indicate an unauthorized driver, and the engine will immediately stop.

II. BLOCK DIAGRAM OF PROPOSED SYSTEM

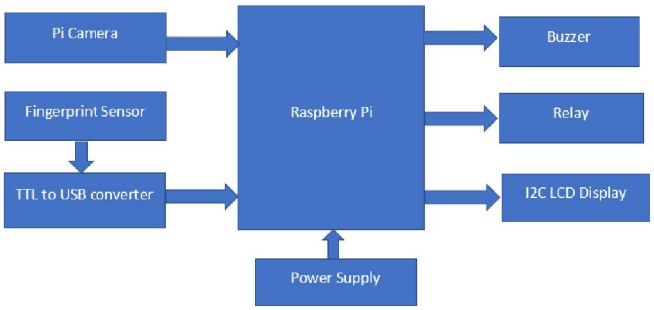

Fig. 1. Proposed System of Two-layer Authentication System for vehicles

In brief: The procedure is that the driver should provide his fingerprint before starting the car, and if it matches, the facial recognition module will begin automatically verifying the person's identity. The relay will turn on if the two results in complete authentication. The two-step authentication will resume as soon as the driver changes, and the process will proceed.

III. HARDWARE DESCRIPTION

For the proposed system we have selected Raspberry pi 3a+, Raspberry Pi camera module, Fingerprint module R307s, Relay,Buzzer, I2C LCD Display and TTL to USB Converter.

3.1 Raspberry PI 3a+

The below Fig. Raspberry Pi is a very economic and compact-sized processor that plugs into a computer monitor or TV and uses a standard keyboard and mouse. It works with program languages like Scratch and Python. This Raspberry Pi is embedded with an Ethernet chip ENC28J60 to get connected to the internet. For the Pi 3 model, the CPU speed ranges from 700 MHzto 1.2 GHz, with onboard memory ranging from 256MB to1GB RAMS. It supports SD cards in either the SDHC or Micro SDHC sizes. Most boards have between 1 and 4 USB slots, HDMI and composite video output, and a 3.5mm phone jack for audio. A few of the features are Bluetooth of 4.2/BLE with high-speed Ethernet up to 300 Mbps, and power over Ethernet capability.

Features

• 1GB LPDDR2 SRAM

• Dual-band 2.4GHz and 5GHz wireless LAN

Fig.3.1.Raspberrypi 3a+[1]

3.2 Finger Print Module R307s

The fingerprint module shown in Figure was used with UART and interfaced with the PC. The user's data that is stored in the module will be used to identify the person. Its working features are asfollows:

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1. Integrated image collection and on-chip algorithm
as a single unit. 2. Fingerprint readers can be embedded into avariety of end products.3. Advantage in terms of low power consumption, low cost, small size, and excellent performance.4.The application can be extended to optical technology, withcompact module manufacturing techniques.

Features

- Fingerprint sensor type: Optical
- Verification Speed: 0.3 sec
- Scanning Speed: 0.5 sec
- Storage capacity: 250
- Matching Method: 1: N
- Voltage:3.6-6.0 VDC

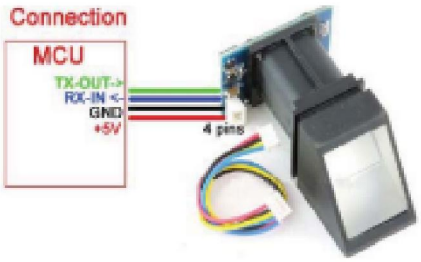

Fig 3.2Fingerprint Module R307s [2]

3.3 Raspberry PI camera

The Raspberry Pi camera module often required to capture high-definition videos and still photographs. It consists of a circuit board of size 25x20x9mm which is connected to Pi through Camera serial interface (CSI) bus connector via a flexible ribbon cable. One of the features of the camera is the five-megapixel resolution with a fixed focus lens.

Features

- Compatibility between Pi models A and B
- 5MP Omni vision 5647 Camera Module
- Still Picture Resolution: 2592 x 1944
- Weight 3g
- Fully Compatible with many Raspberry Pi cases)

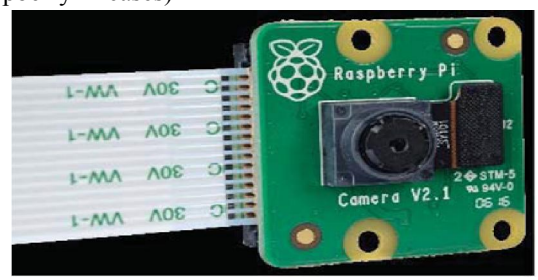

Fig 3.3.Raspberry Pi camera[3]

3.4 Relay

A relay is an electrically operated switch. Most relay circuits use an electromagnet to mechanical switch, some other principles can be also used, like solid-state relays. This relay circuit is operated over electrically switch which allows switching on or off a circuit using voltage or current which is higher than a microcontroller handling capacity. The function of the relay is to protect each circuit from each other. There are three connections for each channel in the module and these are NO COM and NC.

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Fig 3.4. Relay[4]

3.5 Buzzer

An audio signalling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

Fig 3.5 Buzzer[5]

3.6 TTL to USB Converter

FT232RL USB to TTL 3.3V 5V Serial Adapter Module is a basic breakout board for the FTDI FT232RL USB to serial IC.The major difference with this board is that it brings out the DTR pin as opposed to the RTS pin of the FTDI cable. The DTR pin allows an Arduino target to auto-reset when a new Sketch is downloaded. This is a really nice feature to have and allows a sketch to be downloaded without having to hit the reset button. This board will auto reset any Arduino board that has the reset pin brought out to a 6-pin connector. The pins labelled BLK and GRN correspond to the coloured wires on the FTDI cable. The black wire on the FTDI cable is GND, green is CTS. Use these BLK and GRN pins to align the FTDI basic board with your Arduino target. This board has TX and RX LEDs that make it a bit better to use over the FTDI cable. You can actually see serial traffic on the LEDs to verify if the board is working.

Fig 3.6 TTL to USB Converter [6]

3.7. I2C LCD Display

The LCD modules that we are using are powered by the PCF8574 CMOS silicon circuit. This module provides most microcontrollers with a two-line bidirectional bus Inter-Integrated Circuit (I2C). This makes your microcontroller use only two wires (SDA/SCL) when communicating with any device that uses this module.

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Fig 3.7.I2C LCD [7]

IV. SOFTWARE DESCRIPTION

For the proposed system we require the following software:

- Proteus 8.13
- Python 3
- Rasbian OS
- Pycharm Community
- VNC Server

Installing the VNC Viewer Software for Raspberry Pi VNC viewer shown in Fig.11, is used to access the target computer from the host device. It is required to know the IP address of the target (remote) computer wherever it is present. Raspberry presents a text menu containing various options. There are two ways to connect raspberry pi with VNC Viewer, establishing a direct connection or establishing a cloud connection.

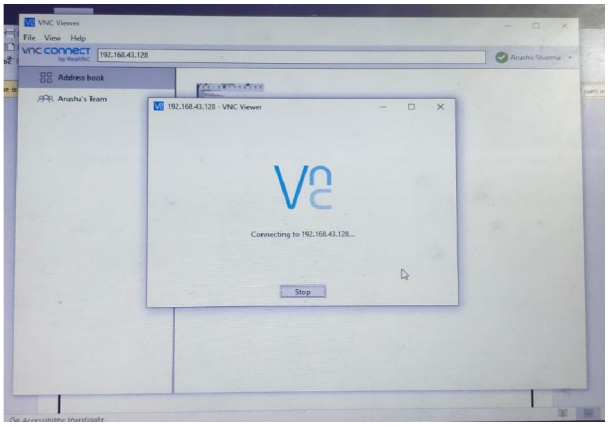

Fig. 11. Address of Advanced IP Scanner to establish a connection.

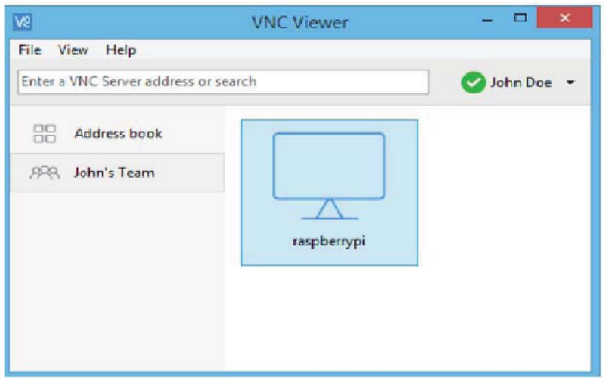

Fig. 12. New File Creation

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V. RESULT

This section gives the detailed procedure to obtain necessary results and are as follows:

Invoking Raspberry Pi through VNC Viewer

Initially to enable the hotspot in the PC using network registered mobile, use the Advanced IP scanner to scanthe IP address of the Raspberry Pi. Using the obtained IP address view Raspberry Pi through the VNC viewer. Then go to the file in the menu bar to get a new connection through which username and password will be entered.

Authentication Step

Once the connection phase is completed, the authentication process starts with the fingerprint module and followed by a face recognition module. If the two are matched with the database values then it is identified as a valid person, and relay will turn on in response to that. Using the two modules face recognition and biometric device, the person will be recognized with his name or pre-defined number in the frame and the relay will be turned on. This authentication step is essential to proceed further.

Authentication violation Indication

In case of an unauthorized person tries to grab the vehicle, the moment the driver keeps his finger on the biometric device, the buzzer will ring to alert the monitoring system.

VI. CONCLUSION

Due to the system's double verification, the threat is exponentially decreased. The procedure is expedited and made more real-time by using a single-vehicle controller. As cars are kept considerably safer, the number of crimes that typically require a theft car will likewise decline. The server's performance can be enhanced. By applying the HOG (Histograms of Oriented Gradients) algorithm to extract the key features, facial recognition may be completed considerably more quickly. Once the authentication steps start the fingerprint and face recognition processes are performed one by one. If both the levels of authentication are successfully completed the relay turns on and the authentication is complete else the buzzer will ring to alert of a threat.

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