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FACE RECOGNITION-BASED INTELLIGENT CAR ANTI-THEFT SYSTEM USING RASPBERRY PI AND GSM MODULE

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ABSTRACT:

Now-a-days number of vehicles can be seen on roads. Most people in this modern age prefer to have at least one vehicle for themselves or their family. With the invention of strong stealing techniques, owners are in fear of having their vehicles being stolen from common parking lot or from outside their home. Face Recognition concept is one of the successful and important applications of image analysis. It's a holistic approach towards the technology and has potential applications in various areas such as Biometrics, Information society, Smart cards, Access control etc. This concept of facial recognition can be used for vehicle security as well. The use of vehicle is must for everyone. At the same time, protection from theft is also very important. Prevention of vehicle theft can be done remotely by an authorized person. This can be done by recognizing the face of the authorized person to unlock the engines. In case of any theft, the system will not let the engines start and it will send a Mail in the pre-installed system of the vehicle. The main advantage of the application is the wider range of transmission and reception over the internet which will help to notify the authorized person being anywhere in the world.

I.INTRODUCTION :

In this world, everyone and every industry likes to keep in pace with the advancement in the technology. Automobile industry is also not behind in this aspect. Nowadays almost everyone has a car. As purchasing a car is a big investment,
people are really concerned about the advanced technologies in automobile industry. Therefore, automobile companies have witnessed a major boost in their technological aspects by introducing automation in the vehicles to provide user friendly and advance features to their customers. As far as vehicle security is concerned many options are available depending upon the technology being adopted. Many auto theft alarms and devices are installed in cars but they didn't prove to be a solution to the customer's problems. GSM based car/vehicle security system is one of the possible technology solution and it is designed by several groups to identify the car/vehicle location upon getting it stolen. However, the issues in locking/unlocking and switching ON and OFF the car engine upon losing the keyless remote of the car are untouched. It is quite common that a person faces many difficulties in locking and unlocking the car upon losing the keyless remote of the car. Therefore, to tackle these issues an electronic system is developed and discussed in this paper. This system is basically using GSM technology to implement different features in a car. Through this system different operations like locking/unlocking and switching ON and OFF of
the car can be performed just by sending a text message from user (specific) mobile number to the GSM modem install e din the car. Sending SMS with specific template can perform different operations of the car. With the development and applications of many Raspberry pi techniques, car security system design and analysis are constantly improving. Many new techniques, such as biometric recognition technique, image processing technique, communication technique and so on, have been integrated into car security systems [1] [2]. At the same time, the amount of accident of cars still remains high, specially, lost. On practicable car security system should be efficient, robust and reliable. Traditional car security systems rely on many sensor sand cost a lot. When one car is really lost, no more feedback could be valid to help people to find it back. We put forward the face detection technique to be applied in car security system because this kind of technique is effective and fast. Face detection techniques have been heavily studied in recent years, and it is an important computer vision problem with applications to surveillance, multimedia processing, and consumer products. Many new face detection techniques have been developed to achieve higher detection rate and faster. Since Viola [3] introduced an boosted cascade of simple classifiers using Haar like features capable of detecting facesin real-time with both high detection rate and very low false
positive rates, which is considered to be one of the fastest systems in 2001, much of the recent work on face detection following Viola-Jones has explored alternative boosting algorithms such as Float-Boost [4], Gentle Boost [5], and Asymmetric Ada Boost [6]. Most of those techniques were tested on PC platforms with several stand face or non-face

II.LITERATURE SURVEY:

1. Vehicle Security Systems using Face Recognition based on Internet of Things
Author: Ahmed Elngar -March 2020

This paper presents a proposal for the development of a vehicle guard and alarm system using biometric authentication based on IoT technology. Whereas, for vehicle security issues; the proposed system VSS − IoT gives only full access for authorized vehicle's driver based on the interface of a Raspberry Pi 3 Model B + development board, Pi camera, PIR sensor, and smart-phone.

2. A Novel Technique for Vehicle Theft Detection System Using MQTT on IoT

Author: K. Aishwarya -March 2020

We aimed to design a low-cost, real-time, robust security system for vehicles. The main purpose of this project is to notify the vehicle owner, when the vehicle is moved/theft from the parking area and to monitor the movement of the vehicle in real time. Raspberry Pi 3 board connected with SIM908 GPS module will be placed in the vehicle.

3. Theft Detection and Controlling System of a Vehicle Using GSM

Author:- M. Uday Kumar Naidu-October 2017

This system uses GSM system, a Buzzer and solenoid valve to cutoff the fuel supply for the engine from the carburetor. If anyone starts the ignition of the engine the microcontroller sends the signal to send the SMS to the owner, if theft detected by the owner, then he simply sends the SMS to stop the vehicle from his mobile then ignition, fuel supply system gets off and buzzer gives a loud sound.

4. Vehicle Theft Tracking, Detecting and Locking System Using Open CV

Author:- S. Mohana sundaram-March 2019

The face recognition technology is used here. In this face recognition and detection in real time by using Open CV Python Module. Face recognition may solve many problems. Vehicle locking & detection system (or) device is installed in the vehicle. By using mobile application to recognize the face and compares face within their data to checked whether, that user is an automated owner (or) not. If the conditions are true, unlock the vehicle. Otherwise, the vehicle has been locked. If any person trying to break (or) damaging the device, it will automatically be sending the message and call to the responsible person.

III. DESIGN OF HARDWARE

It discusses the circuit diagram of each module in detail.

RASPBERRY PI:

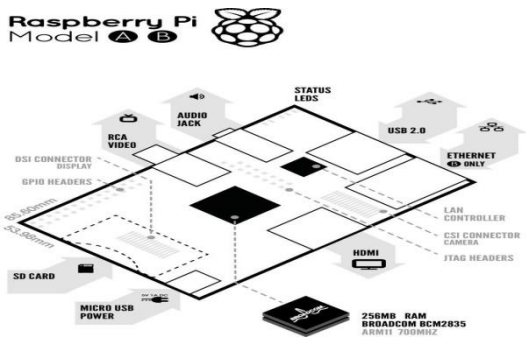
Raspberry Pi is a credit-card sized computer manufactured and designed in the United Kingdom by the Raspberry Pi foundation with the intention of teaching basic computer science to school students and every other person interested in computer hardware, programming and DIY-Do-it Yourself projects.

The RaspberryPi is manufacturdin three board configurations through licensed manufacturing deals with Newark element 14(Premier Farnell), RS Components andEgoman.These companies sell the Raspberry Pi online. Egoman produces a version for distribution solely in China and Taiwan, which can be distinguished from other Pi's by their red coloring and lack of FCC/CE marks. The hardware is the same across all manufacturers.

The Raspberry Pi has a Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZF-S 700 MHz processor, Video Core IV GPU and was originally shipped with 256 megabytes of RAM, later upgraded (Model B & Model B+) to 512 MB. It does not include a built-in hard disk or solid-state drive, but it uses an SD card for booting and persistent storage, with the Model B+ using a Micro SD.

The Foundation provides Debia and Arch Linux ARM distributions for download. Tools are available for Python as the main programming language, with support for BBC BASIC (via the RISC OS image or the Brandy Basic clone for Linux), C, Java and Perl.

HARDWARE LAYOUT:



DESCRIPTION OF THE COMPONENT ON THE RASPBERRY PI:

The Raspberry Pi has a Broadcom BCM2835 System on Chip module. It has a ARM1176JZF-S processor. The Broadcom SoC used in the Raspberry Pi is equivalent to a chip used in an old smartphone. While operating at 700 MHz by default, the Raspberry Pi provides a real world performance roughly equivalent to the 0.041GFLOPS. The Raspberry Pi chip operating at 700 MHz by default, will not become hot enough to need a heatsink or special cooling.

2) Power source:

The Pi is a device which consumes 700mA or 3W or power. It is powered by a Micro USB charger or the GPIO header. Any good smartphone charger will do the work of powering the Pi.

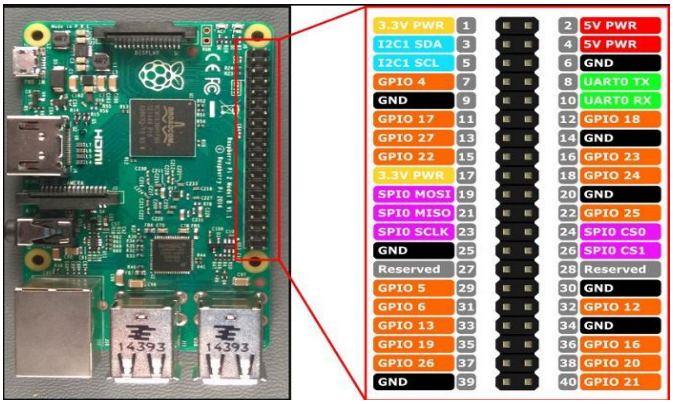
3) SD Card:

The Raspberry Pi does not have any onboard storage available. The operating system is loaded on a SD card which is inserted on the SD card slot on the Raspberry Pi. The operating system can be loaded on the card using a card reader on any computer.

4) GPIO:

General-purpose input/output (GPIO) is a generic pin on an integrated circuit whose behaviour, including whether it is an input or output pin, can be controlled by the user at run time. GPIO pins have no special purpose defined, and go unused by default. The idea is that sometimes the system designer building a full system that uses the chip might find it useful to have a handful of additional digital control lines, and having these available from the chip can save the hassle of having to arrange additional circuitry.

The production Raspberry Pi board has a 26-pin 2.54 mm expansion header, marked as P1, arranged in a 2x13 strip. They provide 8 GPIO pins plus access to I²C, SPI, UART), as well as +3.3 V, +5 V and GND supply lines. Pin one is the pin in the first column and on the bottom row.



5) DSI connector:

The Display Serial Interface (DSI) is a specification by the Mobile Industry Processor Interface (MIPI) Alliance aimed at reducing the cost of display controllers in a mobile device. It is commonly targeted at LCD and similar display technologies. It defines a serial bus and a communication protocol between the host and the device. A DSI compatible LCD screen can be connected through the DSI connector, although it may require additional drivers to drive the display.

6) RCA Video:

RCA Video outputs (PAL and NTSC) are available on all models of Raspberry Pi. Any television or screen with a RCA jack can be connected with the RPi.

RCA Video Connector

7) Audio Jack:

A standard 3.5 mm TRS connector is available on the RPi for stereo audio output. Any headphone or 3.5mm audio cable can be connected directly. Although this jack cannot be used for taking audio input, USB mics or USB sound cards can be used.

8) Status LEDs:

There are 5 status LEDs on the RPi that show the status of various activities. They are “OK” ,"ACT" ,,“POWER” (PWR),Full Duplex ("FDX"),“LNK” (Link/Activity), “10M/100” which are shown in figure below.

9) USB 2.0 Port:

USB 2.0 ports are the means to connect accessories such as mouse or keyboard to the Raspberry Pi. There is 1 port on Model A, 2 on Model B and 4 on Mo del B+. The number of ports can be increased by using an external powered USB hub which is available as a standard Pi accessory.

10) Ethernet:

Ethernet port is available on Model B and B+. It can be connected to a network or internet using a standard LAN cable on the Ethernet port. The Ethernet ports are controlled by Microchip LAN9512 LAN controller chip.

11) CSI connector:

CSI – Camera Serial Interface is a serial interface designed by MIPI (Mobile Industry Processor Interface) alliance aimed at interfacing digital cameras with a mobile processor. The RPi foundation provides a camera specially made for the Pi which can be connected with the Pi using the CSI connector.

12) JTAG headers:

JTAG is an acronym for ‘Joint Test Action Group', an organization that started back in the mid 1980's to address test point access issues on PCB with surface mount devices. The organization devised a method of access to device pins via a serial port that became known as the TAP (Test Access Port). In 1990 the method became a recognized international standard (IEEE Std 1149.1). Many thousands of devices now include this standardized port as a feature to allow test and design engineers to access pins.

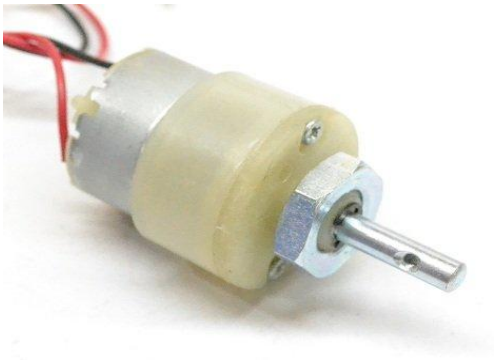
13) HDMI:

HDMI –High Definition Multimedia Interface
HDMI 1.3 a type A port is provided on the RPi to connect with HDMI screens

DC MOTOR:

A machine that converts D.C power into mechanical power is known as a d.c. motor.

Its operation is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force.



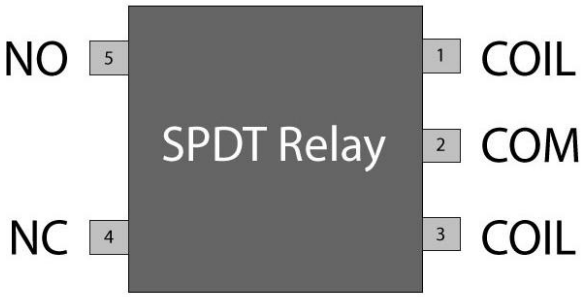
Relay:

What is a relay?

A relay is an electromagnetic switch that is used to turn on and turn off a circuit by a low power signal, or where several circuits must be controlled by one signal.

Most of the high end industrial application devices have relays for their effective working. Relays are simple switches which are operated both electrically and mechanically. Relays consist of an electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they differ according to their applications. Most of the devices have the application of relays.

Pin Diagram:



Why is a relay used?

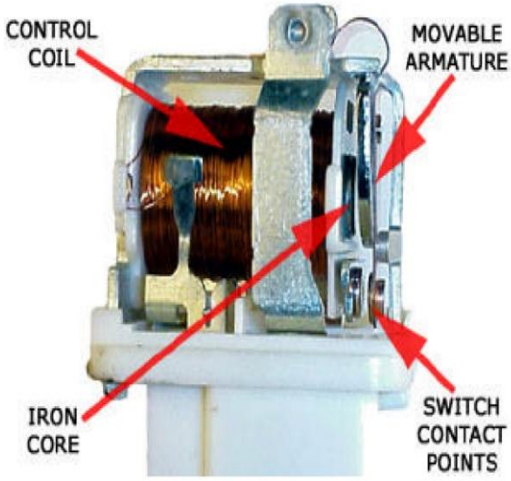
The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits. The application of relays started during the invention of telephones. They played an important role in switching calls in telephone exchanges. They were also used in long distance telegraphy. They were used to switch the signal coming from one source to another destination. After the invention of computers they were also used to perform Boolean and other logical operations. The high end applications of relays require high power to be driven by electric motors and so on. Such relays are called contactors.

Relay Design

There are only four main parts in a relay. They are

- Electromagnet
- Movable Armature
- Switch point contacts

The figures given below show the actual design of a simple relay.



Relay Construction

IGNITION KEY:

An ignition key is a crucial component in automotive technology used to start the engine of a vehicle.

Traditionally, ignition keys were physical metal keys that were inserted into the ignition switch to enable the vehicle's electrical and fuel systems, allowing the engine to be started.

However, modern vehicles often utilize keyless ignition systems

WEB CAMERA:

A webcam is a video camera that feeds or streams an image or video in real time to or through a computer network, such as the Internet. Webcams are typically small cameras that sit on a desk, attach to a user's monitor, or are built into the hardware. Webcams can be used during a video chat session involving two or more people, with conversations that include live audio and video.

Webcam software enables users to record a video or stream the video on the Internet. As video streaming over the Internet requires much bandwidth, such streams usually use compressed formats. The maximum resolution of a webcam is also lower than most handheld video cameras, as higher resolutions would be reduced during transmission. The lower resolution enables webcams to be relatively inexpensive compared to most video cameras, but the effect is adequate for video chat sessions

GSM MODULE:

GSM is a mobile communication modem; it is stands for global system for mobile communication (GSM). The idea of GSM was developed at Bell Laboratories in 1970. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands.

GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates.

There are various cell sizes in a GSM system such as macro, micro, pico and umbrella cells. Each cell varies as per the implementation domain. There are five different cell sizes in a GSM network macro, micro, pico and umbrella cells. The coverage area of each cell varies according to the implementation environment.

Time Division Multiple Access

TDMA technique relies on assigning different time slots to each user on the same frequency. It can easily adapt to data transmission and voice communication and can carry 64kbps to 120Mbps of data rate.

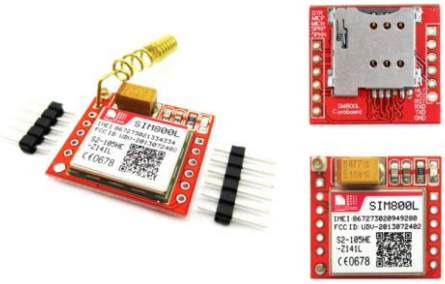
GSM Architecture

A GSM network consists of the following components:

- **A Mobile Station:** It is the mobile phone which consists of the transceiver, the display and the processor and is controlled by a SIM card operating over the network.
- **Base Station Subsystem:** It acts as an interface between the mobile station and the network subsystem. It consists of the Base Transceiver Station which contains the radio transceivers and handles the protocols for communication with mobiles. It also consists of the Base Station Controller which controls the Base Transceiver station and acts
- interface between the mobile station and mobile switching centre.

GSM MODEUM:

A GSM modem is a device which can be either a mobile phone or a modem device which can be used to make a computer or any other processor communicate over a network. A GSM modem requires a SIM card to be operated and operates over a network range subscribed by the network operator. It can be connected to a computer through serial, USB or Bluetooth connection.



GPS:

Positioning System (GPS) is a satellite-based system that uses satellites and ground stations Global to measure and compute its position on Earth. GPS is also known as Navigation System with Time and Ranging (NAVSTAR) GPS.
GPS receiver needs to receive data from at least 4 satellites for accuracy purpose. GPS receiver does not transmit any information to the satellites. This GPS receiver is used in many applications like smartphones, Cabs, Fleet management etc.

Buzzer:

A buzzer or beeper is an audio signaling device, which may be mechanical, electrom include alarm devices, timers and confirmation of user input such as a mouse clicl transducers, DC power supply, widely used in computers, printers, copiers, alarms, elec and other electronic products for sound devices. Active buzzer 5V Rated power can be sensor expansion module and the board in combination, can complete a simple circuit. .

IV. PROJECT DESCRIPTION:

BLOCK DIAGRAM:

Working:

Hardware Setup:
Connect the camera module to the Raspberry Pi board.
Connect the GSM module to the Raspberry Pi board.
Ensure the Raspberry Pi is powered properly.

Software Setup:
Install the necessary software libraries and packages on the Raspberry Pi, including Open CV for face detection and recognition.
Write the face recognition algorithm using Python.
Set up the GSM module to send SMS alerts using Python libraries or AT commands.

Face Recognition Database:
Create a database of authorized faces by capturing images of authorized users and storing them on the Raspberry Pi.
Ensure the face recognition algorithm can compare captured faces with the faces stored in the database.

Integration:
Integrate the face recognition algorithm with the camera module to capture and process images in real-time.
Implement the logic for controlling the car locking mechanism based on the authorization result.
Integrate the GSM module to send SMS alerts to the owner's phone in case of unauthorized access attempts.

Testing and Deployment:
Test the system thoroughly to ensure proper functioning of face recognition, GSM alerting, and car locking mechanism.
Deploy the system in the car and ensure all components are securely installed and properly connected.
Conduct real-world tests to validate the effectiveness of the anti-theft system.

Maintenance and Updates:
Regularly update the face recognition database with new authorized faces as needed.
Perform maintenance checks on the hardware components to ensure they are functioning correctly.
Update the software as necessary to address any bugs or improve system performance.

Drawbacks of Existing System :

Limited Recognition Range: The recognition range of the system may be limited, requiring individuals to be in close proximity to the car for recognition to occur. This could pose a security risk if someone can gain access to the vehicle by bypassing the recognition range.
Processing Power Requirements: Face recognition algorithms can be computationally intensive, especially when running on hardware like the Raspberry Pi. This may lead to slower response times or system crashes if the hardware cannot handle the processing requirements efficiently.
Dependency on Internet Connectivity: Face recognition systems often rely on internet connectivity for accessing cloud-based databases or for remote monitoring. A lack of reliable internet connectivity could affect the system's performance or render it completely non-functional.

PROPOSED SYSTEM:

The DC motor, coupled with the 5V relay, forms an ignition control mechanism, allowing the system to physically control the vehicle's ignition based on the facial recognition results.
This innovative approach enhances security by ensuring that only authorized users can start the vehicle.
Meanwhile, the GPS module, connected to the Raspberry Pi, facilitates real-time tracking of the vehicle's location, enabling owners to monitor their vehicle's remotely.
The GSM module enhances communication capabilities, enabling the system to send alert messages in the form of SMS or calls to the vehicle owner's registered mobile device. This immediate notification system ensures prompt action in case of unauthorized access attempts, thereby increasing the chances of vehicle recovery.
The LCD display acts as a user interface, providing real-time information such as system status, authentication results, or alert messages, allowing users to stay informed and take appropriate action.

V.CONCLUSION

Vehicle theft detection is very important for the society where transportation is essential. From the given system in this work safety can be achieved and it is also system with very less maintenance cost. Using this system work for theft detection future applications can be developed and it is vital for IoT oriented system applications.

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