Smart Car Security System

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Abstract— In this current world where technology is growing up day by day and scientific researchers are presenting new era of discoveries, the need for security is also increasing in all areas. At present, the vehicle usage is basic necessity for everyone. Simultaneously, protecting the vehicle against theft is also very important. Traditional vehicle security system depends on many sensors and cost is also high. When the vehicle is stolen, no more response or alternative could be available to help the owner of the vehicle to find it back.

The implementation of such feature in vehicles has become a very necessary task in order to provide the customer with a vehicle security. So, this project mainly focuses on a method to provide safety in and out of the car. The security to the car can be provided by image processing as a face identification and detection system using raspberry pi. A database is created by taking the picture owner and his/her family members. A minimum of ten photos of each family member is taken.

***Keywords*—RaspberryPi,ImageProcessing,Vehicle Security, Database, Face Identification, Face Detection.**

I. Introduction

In this modern age, there is rapid increase in number of vehicles and so there is the number of car theft attempts. Thus, the protection of vehicles from theft becomes important due to insecure environment. Real time vehicle security system based on computer vision provides a solution to this problem. The proposed vehicle system performs image processing based real time user authentication using 'Face Detection' and Recognition Techniques and R-pi based control system fixed on board with the vehicle working.

In many applications, such as driver face monitoring, face recognition, video surveillance, human computer interface or image database management human face detection is an important and complex process. The complexity of the face detection algorithms is due to the variations in illumination, background, visual angle and facial expressions and the implementation is not easy.

So in order to do better Image Processing we are using PCA (Principal Component Analysis) Algorithm. Basically, this algorithm is based on an eigenfaces approach which represents a PCA method in which a small set of significant features are used to describe the variation between face images. These faces are a set of vectors known as Eigen values or principal components.

The aim is to use a genuine open source platform to design a car security system, where the possible threats can be sensed through the interfaced IOT board. The open source development is a reliable means of designing and developing projects in this modern era. For this we will use a Raspberry Pi development board, a common sensor shield that fits on the Raspberry Pi board and a Smartphone to implement the idea.

The goal is to have a device that can help the user to secure its vehicle and also to get the vehicle back if it gets stolen which is being implemented using the proposed system.

II. Background

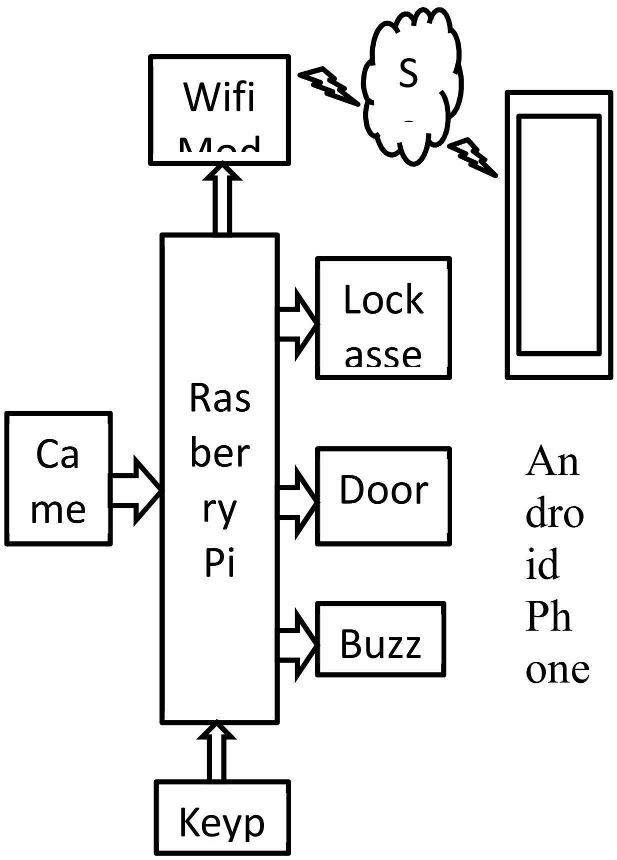
There are many devices available in the market to give you good antitheft solution. [1] Some of easy install and cheap solution is mechanical immobilizers like steering wheel lock, hood lock, tire lock, gear shift lock, ignition/steering wheel column lock and brake pedal lock. There is electronic version of immobilizers available which can lock the ignition system or fuel system until special key combination (using some keypad) or combination of various pedals are entered. Mechanical immobilizers are cheap but not so good solution when car key is stolen, while good electronic immobilizers are available with higher price with extra installation and maintenance charge .

Upcoming technology where machine to machine communication is possible by deploying the intelligent sensors on machine for smart interaction. Internet of things (IoT) gives a wide scope in many application domains where number of smart gadgets per person is increasing exponentially with time. [2] The automobile sector is also one of the application domain where vehicle can be made intelligent by using loT.

With the development and applications of many embedded techniques, car security system design and analyses are constantly improving. [5]Many new techniques, such as biometric recognition technique, image processing technique, communication technique and so on, have been integrated into car security systems. At the same time, the amount of accident of cars still remains high, specially, lost.

So, one practicable car security system should be efficient, robust and reliable.

III. SYSTEM BLOCK DIAGRAM:



IV. SYSTEM DESCRIPTION

1. RASPBERRY PI:

On first sight the new Raspberry Pi model B+ looks quite different to previous models and indeed nearly all of the new features and enhancements introduced on the model B+ relate to connectivity and physical (as opposed to electronic) design.

Fig 7.1 - Raspberry pi module B

The Model B+ is the higher-spec variant of the Raspberry Pi. It was released to replace the original Model B in mid-2014. Comparing with Model B it has below features:

- **More GPIO**: The GPIO header has expanded to 40 pins, while retaining the same pin out for the first 26 pins as the Model B.
- **More USB**: It now has 4 USB 2.0 ports, compared to 2 on the Model B, and better hot plug and over current behavior.
- **Improved Micro SD**: The old friction-fit SD card socket has been replaced with a much nicer push-push micro SD version.
- **Lower Power Consumption**: By replacing linear regulators with switching ones we've reduced power consumption by between 0.5W and 1W.
- **Better Audio**: The audio circuit incorporates a dedicated low-noise power supply.
- **Neater Form Factor:** We've aligned the USB connectors with the board edge, moved composite video onto the 3.5mm jack, and added four squarely-placed mounting holes.

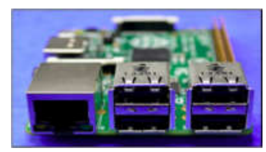


Fig7.2 - Raspberry pi USB port

There are now a total of 40 GPIO pins, 26 of which can be used as digital inputs or outputs. Perhaps more importantly, 9 of the 14 new GPIO pins are dedicated inputs/outputs (pins which do not have an alternative function), so now if you want to use the on-board UART, I2C or SPI bus you can do so and still have plenty of free GPIO inputs and outputs to play with. The new expanded GPIO pin out is as shown below.

Fig 7.3 – Raspberry pi GPIO ports

Pins 3 and 5 (GPIO 2 and GPIO 3) both have on board 1.8KOhm pull-up resistors fitted to them (and they also double up as the I2C interface pins). Pins 27 and 28 (ID_SD and ID_SC) are reserved exclusively for ID EEPROM use and cannot be used as input/output pins. The layout of the GPIO pins is backwards compatible with previous Raspberry Pi models – pins 1 to 26 are directly compatible with previous Raspberry Pi GPIO headers, although it should be noted that the whole GPIO header has been moved away from the corner of the board to allow room for an additional mounting hole - therefore any plug in board designed for previous Raspberry Pi models
may be compatible, but will not sit drifting- Raspberry pi GPIO port subtly above the Raspberry Pi B+ board because the GPIO header has been repositioned.

Fig 7.4 - Raspberry pi audio jack

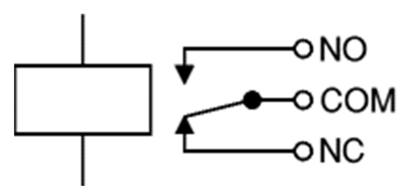
As far as other on-board connectors are concerned, the 3.5mm audio jack output socket and RCA composite video output socket (as found on previous Raspberry Pi models) have been replaced with a single 3.5mm 4-Pole A/V socket located next to the HDMI socket (which itself has been moved slightly on the PCB) and the power connector on the new Raspberry Pi model B+ has been relocated next to the HDMI socket. This means that all audio video and power connectors are now located along one side of the PCB which will help keep all connected cables tidy.

Fig 7.5 - Raspberry pi memory card slot

Amongst other changes introduced on the new Raspberry Pi model B+, the SD memory card slot used on previous Raspberry Pi models has been replaced with a Micro SD memory card slot, the status LEDs have been moved to the opposite end of the PCB and now consist only of a red "PWR" LED and a green "ACT" LED, and the PCB now has 4 mounting holes laid out in a rectangular pattern, which will make mounting the PCB securely so much easier.

2. Relay:

A relay is an **electrically operated switch**. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have **double throw** (**changeover**) switch contacts as shown in the diagram.



Relay Circuit

symbol

Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA, enough to supply a relay coil directly.

Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available.

The relay's switch connections are usually labeled COM, NC and NO:

•**COM**= Common, always connect to this, it is the moving part of the switch.

•**NC**= Normally Closed, COM is connected to this when the relay coil is **off**.

•**NO**= Normally Open, COM is connected to this when the relay coil is **on**.

Connect to **COM and NO** if you want the switched circuit to be **on when the relay coil is on**.

Connect to **COM and NC** if you want the switched circuit to be **on when the relay coil is off**.

3. Motors:

The input of a DC motor is current/voltage and its output is torque (speed). 12V DC geared motors for robotics applications. It is very easy to use and available in standard size. Nuts and threads on shaft are available to easily connect and also there is an internal threaded shaft for easy connection to the wheel.

4. Camera Module:

Camera Module Rev 1.3 consists of:

- 5MP
- Lens ¼ 5M
- Aperture: 2.9

- FOV: 72.4 Degrees
- Still Picture Resolution: 2592x1944

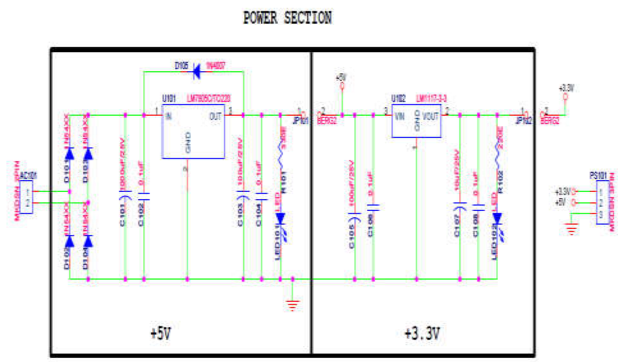
Setting up the camera hardware:

Please note that camera modules are static-sensitive. Earth yourself prior to handling the PCB: a sink tap/faucet or similar should suffice if you don't have an earthing strap.
The camera board attaches to the Raspberry Pi via a 15-way ribbon cable. There are only two connections to make: the ribbon cable need to be attached to the camera PCB and the Raspberry Pi itself. You need to get it the right way round, or the camera will not work. On the camera PCB, the blue backing on the cable should be facing away from the PCB, and on the Raspberry Pi it should be facing towards the Ethernet connection (or where the Ethernet connector would be if you are using a model A). Although the connectors on the PCB and the Pi are different, they work in a similar way. On the Raspberry Pi, pull up the tabs on each end of the connector. It should slide up easily, and be able to pivot around slightly. Fully insert the ribbon cable into the slot, ensuring it is straight, then gently press down the tabs to clip it into place. The camera PCB itself also requires you to pull the tabs away from the board, gently insert the cable, then push the tabs back. The PCB connector is a little more awkward than the one on the Pi itself. You can watch a video showing you how to attach the connectors at http://youtu.be/GImeVqHQzsE

Setting up the Camera software:

Execute the following instructions on the command line to download and install the latest kernel, GPU firmware and applications. You will need an internet connection for this to work correctly.
sudo apt-get update
sudo apt-get upgrade
Now you need to enable camera support, using the raspiconfig
Program, you will have used when you first set up your Raspberry Pi.
sudo raspi-config
Use the cursor keys to move to the camera option and select *enable*. On exiting raspi-config it will ask to reboot. The *enable* option will ensure that on reboot the correct GPU firmware will be running (with the camera driver and tuning), and the GPU memory split is sufficient to allow the camera to acquire enough memory to run correctly.
To test that the system is installed and working, try the following command:
raspistill -v -o test.jpg
The display should show a 5-second preview from the camera and then take a picture, saved to the file test.jpg, while displaying various informational messages.

5. Power supply:



A. Rectifier unit:
In a power supply unit, rectification is normally achieved by a solid state diode. Diode contains two electrodes called the anode and the cathode. A diode has the property that will let electron flow easily in one direction. As a result when AC is applied to a diode, electrons only flow when the anode is positive and cathode is negative. Reversing the polarity of voltage applied to a diode will not permit electron flow. It is to be noted that the current flow through the load is always in one direction for each alteration of the applied AC input. This is of course, means that AC is rectified into DC. The output DC is not a pure DC. It is pulsating DC voltage.

B. Filter unit:
After pulsating DC has been produced by our rectifier, it must be filtered in or for it to be usable in a power supply. Filtering involves the ripple frequency. Depending on the design, it may be used to regulate one or more AC or DC voltages.

V. PROGRAMMING

1) Programming language- python:

The Raspberry Pi has two versions of Python installed on it: Python 2.7 and Python 3. IDE is a set of tools for creating and testing programs. The Python IDE is called IDLE, and there are two versions of it: IDLE (which is for Python 2.7) and IDLE 3 (which is for Python 3). Python is the Pi's recommended programming language.

2) Operating System:

NOOBS-New Out Of Box Software
NOOBS is a way to make setting up a Raspberry Pi for the first time. You won't need network access, and you won't need to download any special imaging software. Just head to

the raspberry pi.org page, grab a copy of the NOOBS zip file, and unpack it to freshly formatted SD card.

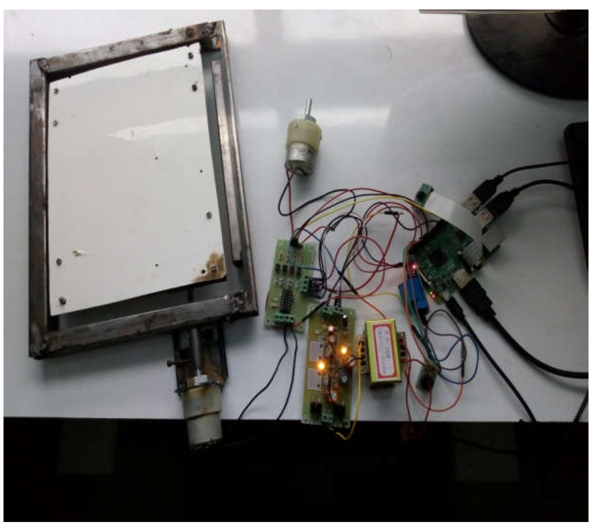
3) System schematic:
Proteus PCB design and stimulation software:

It is a software suite containing schematic**,** simulation as well as PCB designing**.**

VI. Simulation And Testing

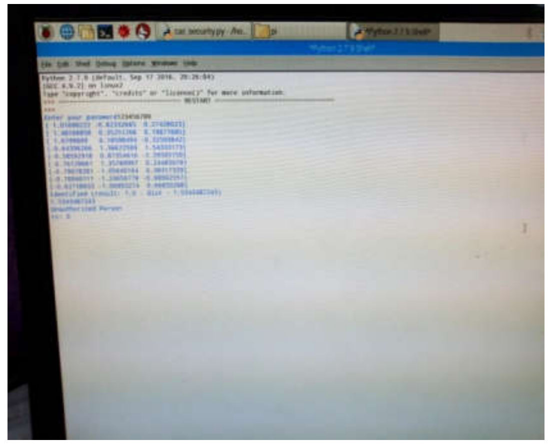
A. Hardware Testing

Initially as the first criteria to security in our project is door assembly we first tested the set up for door assembly. And we obtained the result as: door is unlocked on entering the right password and after a few milliseconds delay the door is locked again. Our second step for security is buzzer i.e. on entering the wrong password thrice the buzzer would ring loudly. Set up for this is implemented and tested accordingly. Our third criteria for security: camera module which is implemented and tested. The result obtained was: immediate activation of camera as door is unlocked and capturing the image of person seated. The ignition system would turn on if the captured image matches with the predefined image in database. So the implementation of ignition system is shown by a dc motor through relay which is done and tested.

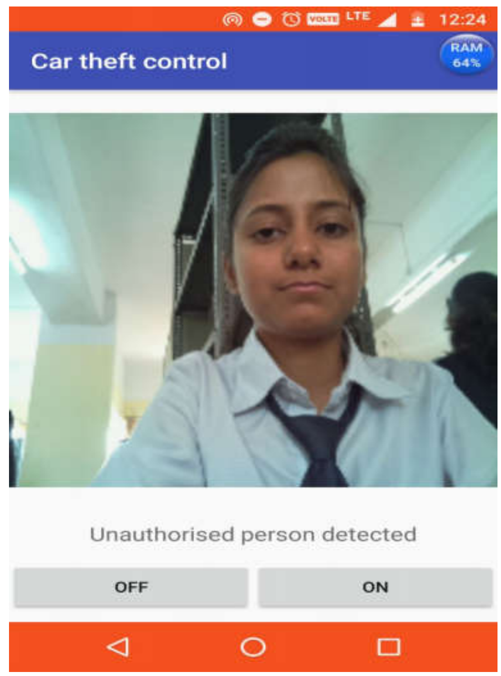


B. Software Testing:

Initially we require a database which has images of owner and his family members, friends. Code for creating the database is implemented and tested using Python 2.7 IDE. Then the code for capturing the image through camera module and its comparison with predefined images is done.



On recognition of unauthorised person there is transmission of captured image via WiFi to the android app present on owner's cell phone. The code for this transmission is created and tested using Android Studio.



VII. Conclusion

In this paper we have proposed a Smart Car based application which can secure the car from theft. Password based door will prevent the theft initially. Again after entering the car there is an immediate activation of camera which will capture the image of the person seated in car, followed by image comparison. On finding the authorized image, will help in starting the car. And if unauthorized person is detected there is quick transmission of the image to the owner of the car.

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