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Research paper

Anti-theft Security System for Vehicles

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Abstract

In today's world vehicles form an important asset to us, without which our life would be incomplete. But, when it comes to the security of our vehicles, we are very helpless. It is of a great concern, especially in metropolitan cities, where these incidents occur each and every day. So, in this paper, I have focussed on the security of vehicles. The setup consists of a mix of software and hardware. In software, I will be using an android application, and in hardware, a Raspberry pi board B+ model, a jaw or a gripper and other hardware devices. This whole system will allow you to connect with your vehicle from anytime, anywhere and confirm it's security. A vehicle is usually the most expensive and important asset next to a home, so this system enables you to keep this asset at your fingertips using wireless technology. Think of it as a wireless leash to your car.

Keywords: *Android Application; Hardware; Internet; Raspberry pi board B+ model; Software; Vehicular Security System*

1. Introduction

Vehicle's security is of utmost importance in today's world. As unemployment is increasing day by day, even the literate people are involved in theft and robbery. So, the security of our vehicles is the foremost requirement. The system which is designed, ensures the security of our vehicle. It mainly uses two resources, firstly, an android app and secondly, a device, which will be installed in our vehicles. We would be able to control our vehicle using the app. The functions made in the app will communicate with the device in the vehicle, to control it . But, in order for this system to work, our android phone and the device, should have an internet connection. Thus, as we are using an internet connection for communication, this system has an unlimited range, means we can control our vehicle from any part of the world, as compared to present days, where we use a key to connect to our vehicle from a distance, but that has a limited range. With the help of this system , we can connect to our vehicle from anywhere, anytime, with a simple click on a button in the android app. Moreover, we can discover our vehicle's location, start it, stop it, lock/unlock the doors, disable the use of our vehicle, monitor the alarm security system and much more.

If a thief will try to steal our vehicle, we will be immediately informed of it, through a text message, that someone is messing with our vehicle. Then we can lock our vehicle with a simple click on our smartphone, that means no one can move your vehicle after that. Infact, the accelerator, gear and brake pedals will be locked, so that the vehicle does not move from it's position.

Thus with this system, theft of the vehicles can be prevented to a greater extent, which is a very important asset to us and thus leading to a safe society.

2. Background of the Study

A system is an assemble of related components making a whole system. Security system is a system that gives an alarm when someone tries to break into the vehicle. Earlier people were dependant on simple ways of alert to breach in security. Approximate seventy percent of the vehicles today have a remote keyless entry (RKE) system [12,15]. Most remote keyless systems alert the vehicle against theft, lock and unlock the doors. Remote keyless systems are made of a key fob transmitter and a receiver which is installed inside the vehicle. These systems use a frequency of 315 MegaHz in the the U.S. and Japan, and 433.92 MegaHz in Europe[6]. The challenges for the remote keyless entry designs are achieving low power consumption in both RKE transmitter and receiver, while achieving good range and reliability for the RKE system[6,7,8,9].

Traditionally, the Security Systems were prone to thefts as they were not very secure as in the work of Ji Shin[14] in 2009. Later the enhancements in security of vehicles was introduced by Montaser N. Ramadan, Mohammad A. Al-Khedher, Sharaf A. Al-Khedher[2] in 2012. After that, significant improvements has been made towards Security of Vehicles, notably by N. M. Z. Hashim, M. H. A. Halim, H. Bakri, S. H. Husin, M. M. Said[16] in 2013 and Harish Chandra Mohanta, Rajat Kumar Mahapatra, Jyotirmayee Muduli[7] in 2014. Further improvements were noticed in the work of Shubhankar Shome, Rabindranath Bera[5] in 2015 and Michal Czubenko, Zdzislaw, Kowalczuk, Andrew Ordys[9] in 2015.

3. Technologies used

3.1 ADT(Android Developer Tools)

ADT is a plugin for eclipse[1] that has a set of tools integrated with the eclipse IDE. ADT helps us to develop the android apps. ADT has SDK tools and UI design tools for rapid prototyping, designing and building your applications user's interface. **A**pplication is developed in JAVA programming language using Android SDK[19,20].

Fig.1: Emulator for android app

3.2 Java

Java is a programming language developed by Jamer Gosling at Sun Microsystems. The Syntax of Java is developed from C and C++. Java apps are compiled to bytecode that can run on any java virtual machine. It is the most popular language used today. We have used Java programming language, so that our application is secure, no one can easily hack it.

3.3 Python

Python is an open-source and a new programming language. It is an interactive, interpreted and object-oriented programming language. Python [16] has a very clear syntax. It has interfaces to many system calls and libraries. It is extensible in C and C++. Python is a portable language across all major hardware and software platforms. We have used python to do coding on the GPIO pins of the Raspberry pi board B+ model, as it is the best and easy language to use with Raspberry pi board B+ model.

4. Hardware used

4.1 Raspberry pi Board B+ model

The Raspberry pi Board B+ model[3] is a debit card-sized single board computer developed in the UK by Raspberry pi foundation. It is a low cost computer that can be plugged into a computer monitor or a TV and uses a keyboard and a mouse. It is a little device that many people can use to explore computing and to learn how to do programming in scratch and python. A very strong feature of Raspberry pi board is it's GPIO(general-purpose input-output) pins , along the top-edge of the board. GPIO pins are the input/output pins, and any of the GPIO pins can be designated(in software) as an input or output pin, which can be used for a wide range of purposes. In our system, raspberry pi board B+ model forms a part of the device, which would be installed in the car.

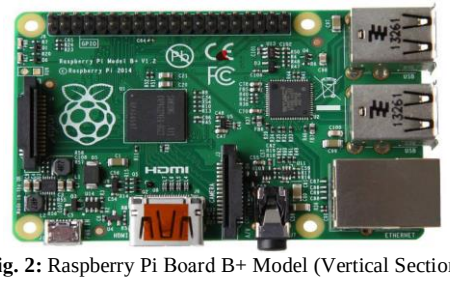

Fig. 2: Raspberry Pi Board B+ Model (Vertical Section)

Fig.3: Raspberry Pi B+ Model (Horizontal Section)

4.2. A jaw or a gripper

A jaw or a gripper is a hardware which is used to grasp any object. In our system, it will be fixed inside the car near the gear, accelerator and the brake pedals at a particular angle, so that if a thief tries to steal the car, then with the mere press of a button on our phone, the gripper can be moved in forward direction, with the help of motor(to which power is provided by the voltage generated through the internet), to hold the gear, accelerator and brake pedals in their position, so that the thief will not be able to move our car.

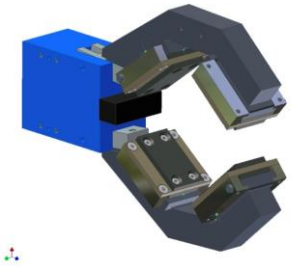

Fig. 4: A jaw or a gripper

4.3 Wi-fi Dongle

A Wi-fi Dongle is plugged into the Raspberry pi board. It will allow us to connect to a wireless network anywhere.

Fig. 5: Wi-fi Dongle

4.4 Keyboard, Mouse and Adapter

We will be needing a keyboard, a mouse and an adapter that are all connected to the Raspberry pi Board B+ model[6,10].

4.5 A Memory Card

A memory card will be inserted in the raspberry pi B+ model to store the python coding done on Raspberry pi B+ board,.

4.6 Integrated Circuit(IC)

We have used L239D IC[15], to which all the motors are connected through jumpers(wires). And inputs from the raspberry pi board are given to the IC and IC generates the corresponding output function, which rotates the motors in clockwise and anti-clockwise direction.

Fig. 6: Integrated Circuit(IC)

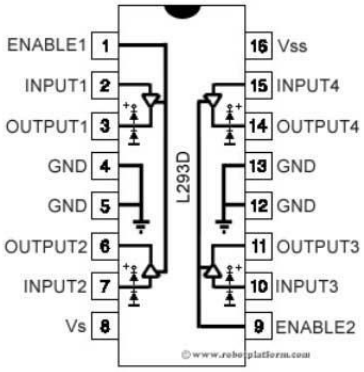

Fig. 7: IC diagram

4.7 A step down transformer

A step down transformer [2] is used to step down the high voltage to the normal bearable range i.e bearable to the device from AC 220V to AC 20V.

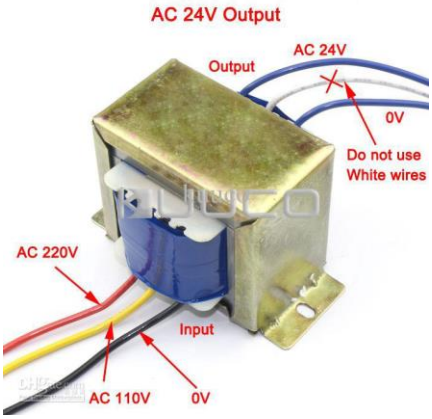

Fig. 8:A Step down transformer

4.8 Diodes

Four diodes are used on the board for the conversion of AC into DC voltage. Diodes[10] are connected in such a way that part of sine wave in the negative portion is made to occur on the positive portion.

Fig. 9: Zener Diode

4.9 Capacitor

A Capacitor[1] forms a part in conversion of AC into DC voltage. The sine wave formed by the diodes is passed through a capacitor, rendering waves which do not touch the x-axis and they lie far above the x-axis.

Fig. 10: Capacitor

4.10 Voltage Regulator

A Voltage regulator[1] regulates the voltage and step downs it further to the nominal voltage bearable by the IC's 1 V or 1.5 V.

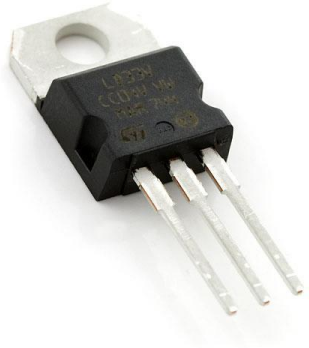

Fig.11: Voltage regulator

4.11 A resistor

A resistor [2,3] is used to offer resistance to the current so that the current remains in the bearable conditions and offers nominal voltage to the IC.

Fig.12: Resistor

4.12 Motors and Jumpers

I have used motors in my setup for locking system and door movement

Fig. 13: Motor

Jumpers are the wires which are used to connect motors and Raspberry pi board to the IC board.

Fig. 14: Jumper wires

5. The Working of the System

5.1 Overall description

First of all, we made an app using android developer tools. To use the app, the user has to register on the app, and then he can login into it's account. After login, the user will find various options on the application interface to control the various functions of the vehicle and to lock the accelerator, gear and break pedals of the vehicle, to ensure it's security. Our main aim is to provide security of the vehicle. It can be any vehicle, but in our case we are taking, specifically a car.

Suppose, a thief tries to steal our car, and tamper with it, then immediately a text message will be dropped on our phone, as well in the app. As soon as we receive the text message, we can go to the android application and click on the accelerator, gear and brake buttons, given in the app.

As soon as we click on the buttons, the corresponding values will be passed to the device installed in the car, through internet, and a voltage of 3.3 V will be generated, which is received by the Raspberry pi board. We have another board inside the device, on which two IC's are embedded. We have used L293D IC's[3]. A resistor, capacitor, voltage regulator and diodes are also embedded on the board, whose functions are described in the section above. A step down transformer is also connected to the board. The jaws or grippers are connected to the IC's, on the board.

The 3.3 voltage which is received by the GPIO pins of the Raspberry pi board and the external voltage of the device, are then fed to the board containig IC's, through jumpers (wires). The motive of making this board is to regulate the voltage and bring it down to the nominal range bearable by the device, and to rotate the motors in jaws or grippers, through IC's, so that the jaws move in the forward direction to hold the accelerator, gear, and brake pedals in their position. The regulated voltage from the board through the IC's is now fed to the jaws or grippers, which have motors inside them. The voltage will drive the motors and thus the jaws would move forward and hold the acclereator, gear and brake pedals in their position. We can also use additional motors to control the functions of the car such as lock/unlock the doors etc. The same motor can be rotated clockwise as well as anticlockwise for example, for the opening of a door and closing of the door respectively.

Thus even, if the thief is able to break into the car, then also he will not be able to move the car. Then we can reach out to the spot, as soon as possible, and catch the thief.

5.2 Description of the Device that will be installed in the car.

The device that will be installed in the car contains a Raspberry pi board B+ model and an another board containing the IC's.

In order to simulate this system , we have used a Raspberry Pi Board B+ model. In addition I have used a mouse, a keyboard, a monitor and a wi-fi dongle. These can be connected to the ports of raspberry pi board. A memory card is also inserted into it.

We have done python coding on the GPIO pins to provide various functions of the car and for locking. When we click a button on the app, a value is passed to the raspberry pi board, and a power of 3.3V is generated which is recieved by the GPIO input pins and then this voltage is fed through the GPIO output pins to the board containing the IC's, which will regulate the voltage. This volatge and the regulated external voltage of the device will move the jaws or grippers in forward direction to hold the accelerator, gear and brake pedals, in their position.

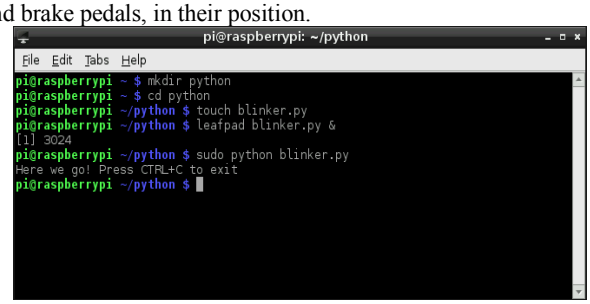

Fig. 15: Raspberry pi board Interface

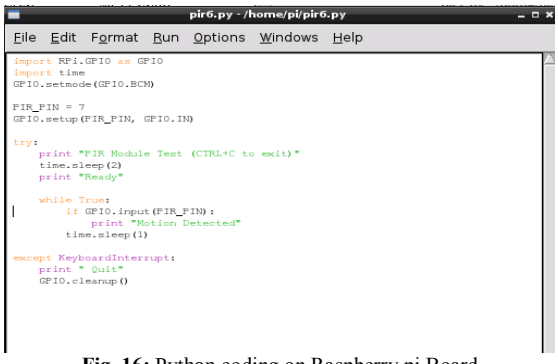

Fig. 16: Python coding on Raspberry pi Board

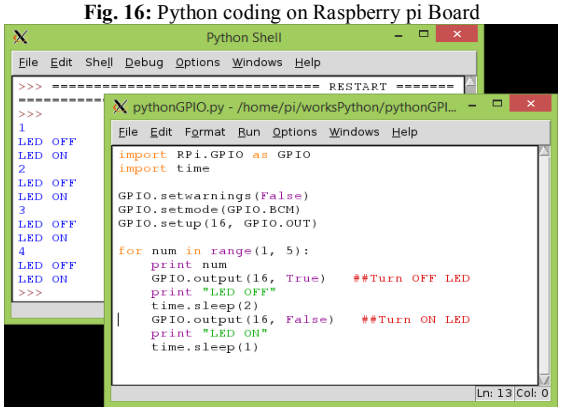

Fig. 17: GPIO LED Output

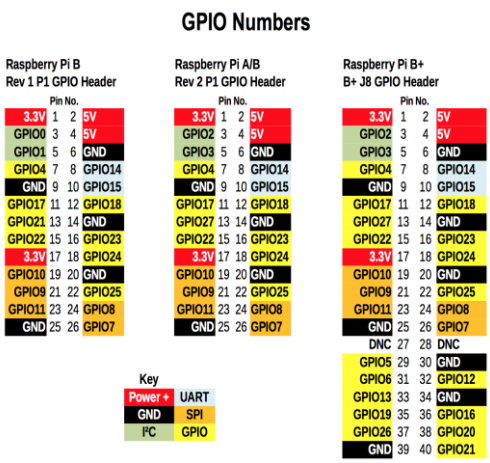

Fig. 18: GPIO Numbers

6. Conclusion

In this paper, we have made an android app, which is used to communicate with the device installed in our vehicles, which in turn will control the functions of the vehicle, as well as ensure the the locking of the accelerator, gear and brake pedals, so that the vehicle does not move. Thus, the most expensive and important asset of all of us, will be on our fingertips and fully secure. This will prove to be a great technique to prevent the theft of the vehicles, especially in metropolitan cities, where theft cases are being reported, everyday.

7. Future Work

In future, we are planning to install a GPS system[8,19] into the device, with which the location of the vehicle can be instantly located at any time remotely from anywhere. Furthermore, more functionalities to automate the vehicle remotely from anytime anywhere with the app are under process too. I am also planning to increase the security of the vehicle by cutting off the battery supply to the vehicle, thus adding to it's security.

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