Fingerprint Ignition System & Keyless Entry Via Fingerprint

Rushikesh Vallakati[1], Ruturaj Kavitke[2], Rushikesh Deokar[3], Paresh Sawale[4], Prof. R. G. Janunkar[5]

[1,2,3,4]Engineering Students, [5]Project Guide
Dhole Patil Collage of Engineering, Wagholi, Pune

***Abstract*: Biometric systems have overtime served as robust security mechanisms in various domains. Fingerprints are the oldest and most widely used form of biometric identification. A critical step in exploring its advantages is to adopt it for use as a form of security in already existing systems, such as vehicles. This research work focuses on the use of fingerprints for vehicle ignition, as opposed to the conventional method of using keys. The prototype system could be divided into the following modules: fingerprint analysis software module that accepts fingerprints images; hardware interface module and the ignition system module. The fingerprint recognition software enables fingerprints of valid users of the vehicle to be enrolled in a database. Before any user can ignite the vehicle, his/her fingerprint image is matched against the fingerprints in the database, while users with no match in the database are prevented from igniting the vehicle. Control for the ignition system of the vehicle is achieved by sending appropriate signals to the parallel port of the computer and subsequently to the interface control circuit. The developed prototype serves as an impetus to drive future research, geared towards developing a more robust and embedded real-time fingerprint-based ignition systems in vehicles. After testing of the overall designed project, the results obtained were satisfactory. Hence, the approach adopted in this study can be applied to various systems and fields such as banks, attendance system management in school, hotels, homes and so on.**

***Keywords*: Fingerprint Ignition System, Biomatric, Keyless Entry in Vehicles, Vehicle Security, Anti-theft System**

1. Introduction

The issue of car hijacking or snatching on highway, car theft due to easy access to car's functional system can be reduced by using a biometric system for starting the car's engine as the necessity of protection and access restriction in many luxurious assets is now very important (Omidiora et al., 2011, Sasi and Nair, 2013). Fingerprint recognition system is inexpensive compared to other biometric systems, is user-friendly, has high reliability and can be used in a variety of environments. Owing to Radio Frequency Identity jamming of the push-button system experienced in cars which can easily be stolen within the car key frequency range as a major challenge facing this system, there is a need to find a solution to this problem.

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2. Problem Statement

- In our country many vehicles are hijacking or robbed by theft. Vehicle is easily robbed by theft because of manual operating doors system.
- For our vehicle safety we use fingerprint sensor for unlocking and locking doors and also fingerprint sensor used to start the vehicle.

3. Objectives

- Only authorized person can operate vehicle.
- Prevent vehicle from the theft.
- It gives attractive look of vehicle dashboard.
- Its more protecting vehicle than manual operating system.

4. Concept

Fingerprint Basics

All humans have minute raised ridges of skin on the inside surfaces of their hands and fingers and on the bottom surfaces of their feet and toes, known as 'friction ridge skin'. The friction ridges provide a gripping surface in much the same way that the tread pattern of a car tyre does only skin on the body without hairs. Fingerprints are patterns of ridges and valleys on the surface of the finger. The exact position of the fetus in the womb at a particular moment and the exact composition and density of surrounding amniotic fluid decides how every individual ridge will form. This development process occurs in such a way that, in the entire course of human history, there is virtually no possibility of the same exact pattern forming twice.

Consequently, fingerprints are a unique marker for every person, even identical twins. No matter how similar two prints may look at a glance, a trained investigator or suitable software can pick out clear, defined differences. This is the basic idea of fingerprint

analysis, in both crime investigation and security. The two fundamental principles underlying the use of fingerprints as a means of identifying individuals are: immutability and individuality or uniqueness.

Immutability: This refers to the permanent and unchanging character of the pattern on each Finger. Several years accumulated fingerprint study and experience has demonstrated that friction ridge patterns do not change naturally during the life of a person. This pattern starts developing in the third month of pregnancy and is fully formed by the fourth month. During a person's lifetime, the pattern remains the same, apart from changing in size or by accident, mutilation or skin disease, until death. In fact, the friction ridge patterns will remain after death until the body decomposes

Uniqueness: Individuality refers to the uniqueness of ridge details across individuals; the probability that two fingerprints are alike is about 1 in 1.9 x 1015. Friction ridge detail forms in a purely random manner during fetal development in the womb. There is sufficient variability in the arrangement of minutiae to ensure that no two friction ridge patterns are identical, whether they are on different fingers of the same person or on the fingers of different people. Although this is difficult to prove empirically, no two fingerprints have ever been found to be identical in over a century of the use of fingerprinting. Studies have further shown that while identical twins share the same DNA profile markers, they can nevertheless be differentiated by their fingerprints.

5. Ignition Systems of Vehicles

The ignition system of an internal-combustion engine is an important part of the overall engine system that provides for the timely burning of the fuel mixture within the engine. All conventional petrol (gasoline) engines require an ignition system. The ignition system is usually switched on/off through a lock switch, operated with a key or code patch. The ignition system works in perfect concert with the rest of the engine of a vehicle. The goal is to ignite the fuel at exactly the right time so that the expanding gases can do the maximum amount of work that in line with the processes to make the vehicle move. If the ignition system fires at the wrong time, power will fall and gas consumption and emissions can increase.

The part of the ignition system that first initiates the process of moving a vehicle is the key system in conjunction with the kick starter. A wire from the battery in the vehicle connects to the kick-starter and other wires connect the kick starter to the key system. When the car key in the ignition system is turned once, two wires coming from the kick starter to the key system are bridged. This causes the engine and some other parts of the vehicle to be put in a READY or ON state. Turning the key again makes a third wire to temporarily join the already bridged wires, causing voltage to flow from the battery to the necessary parts vehicle so as to enable the vehicle move.

6. Design and Manufacturing

Process flow to complete this project successfully is included with input, process and output of the system. Fingerprint is scanned to activate the ignition when the authorized user fingerprint is detected. Adding or deleting a fingerprint option is included in this project. In the case of adding or deleting a fingerprint, a master fingerprint will be set as an ID first. When the master fingerprint ID is authorized, then only user can be added to be an authorized user or deleted from the list. Followed by the Arduino which will interpret the received message from the fingerprint scanner. The results will display the status of the user in LCD. If the fingerprints are matched, the ignition system of the vehicle will turn on. If an unauthorized fingerprint is detected, the buzzer will turn on and an alert message is sent to the authorized user.

This section deals with design and analysis of this work whose block diagram of various parts is shown in figure 1, as it contributes to the overall design of the work. The design incorporates both hardware and software.

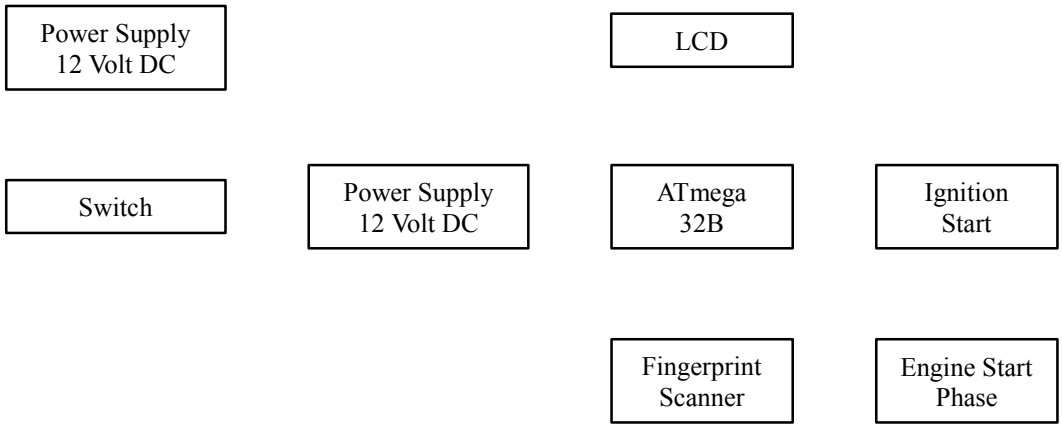

Fig. - Block Diagram of Fingerprint-based Car Starting System

In the design of this fingerprint-based car starting system, signals are generated by the microcontroller to appropriate module circuit. The whole system is aimed to be constructed in a plastic casing to enhance heat evacuation and working efficiency of the system. The microcontroller reads the state of the input buttons which could be either a 1 or a 0. The signal microcontroller gets from the

input button tells what to work on at that time. This project is aimed to replace the push-button in vehicle ignition and create a more reliable and secured way of starting the ignition with fingerprint pattern only.

7. Vehicle Ignition System

The vehicle engine ignition system is shown in Figure 1. It consists of battery, fuse, ignition switch, relay, neutral safety switch, solenoid, starter motor. The purpose of the ignition system is to start the starter coil in crank shaft and generate a very high voltage from the battery of vehicle and sends it to each spark-plug which in turn ignites the fuel-air mixture in the engine's fuel combustion chambers.

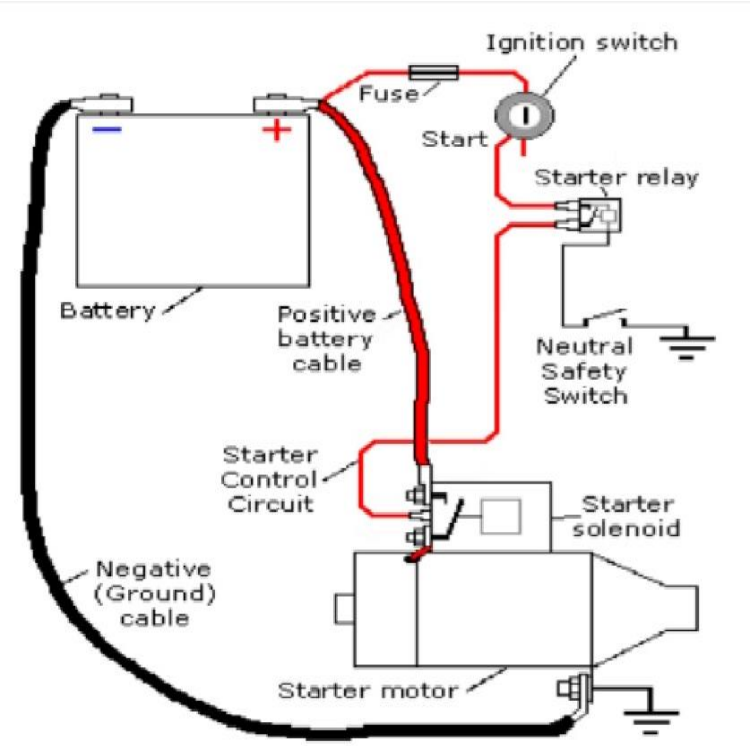

Fig. - Starting System of Electronic Ignition

The mechanical system uses breaker points to interrupt their low voltage, high current function through the primary winding of the coil on the mechanical system will be exposed to mechanical wear form where they ride the internal combustion engine's camshaft to open and close (Shui, 2006), as well as oxidation and burning occurs at the contact surfaces from the constant sparking occurs at the internal combustion engine. They need regular functioning to compensate for wear, which is responsible for spark timing, is subject to mechanical variations in internal combustion engines. Also, the spark voltage depends on contact effectiveness, and poor sparking which can lead to lower engine efficiency and therefore reduces the engine's performance. By comparison with the electrical system, a mechanical contact breaker system has no control over an average ignition current of greater than 3A while still giving a reasonable service to engine's life, and this may limit the power of the spark in ignition and ultimate engine's speed and therefore Electronic Ignition (EI) solves these problems.

Digital electronic ignition system (Froilan Destreza1, 2014) is available for small engines from 100 mm to 10000 mm. This ignition system is made possible by using low cost, high speed, high efficiency performance, and small footprint function of vehicle ignition. The Figure 2 shows the block diagram of vehicle anti-theft system using fingerprint recognition technique.

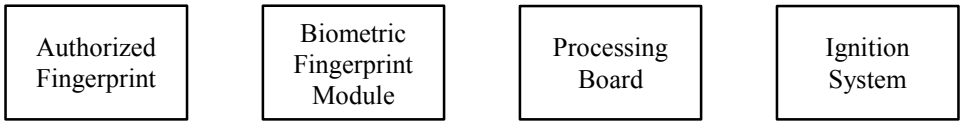

Fig. : Block Diagram of Vehicle Anti-theft System

In this above anti-theft system, the R305 fingerprint module is used. The fingerprint module connection is shown in Figure.3. Fingerprint processing includes two parts. They are fingerprint enrolment and fingerprint matching (the matching can be 1:1 or 1:N) type. For 1:1 matching type, system will compare the finger which is enrolled with templates stored in the Module; for 1:N matching type, system will search the total library file for the matching finger. In both types, system will return the matching result, success or failure. In this project work 1:N type is used.

There are eight pin connections in the fingerprint sensor. These pin connections are explained in the Table.1. Fingerprint sensor built inside the R305 fingerprint module scans the finger and verifies with the pre-loaded data and shows the result whether it is

matched or not. The R305 fingerprint module is connected and gives the data to the Arduino board. If the result matches then it made the relay to supply voltage. If it is not matched then the relay is low, the supply has been stopped to the unit. The parameter shown in the above Table.1, is used to control the UART communication (Preetham, 2013), speed of the module. Corresponding baud rate is 9600 * N bps. N value is an integer, where N = [1,12]. The default baud rate is 57600 bps. Baud rate can be varied between 9600～115200 bps.

Pin Number	Name	Function description
1	Vin	Power Output
2	GND	Signal Ground
3	TD	Data Output. TTL Logic level
4	RD	Data Input. TTL Logic level
5	VCC	+5V DC
6	D-	Data -
7	D+	Data +
8	GND	Ground

Power input to the fingerprint module is DC 3.6 V to 6.0 V. Working current of fingerprint sensor for typical current it is: 100 mA and for peak current it is: 150 mA. For each different fingerprint separate Id is given. Enroll can be done with the help of switch or it can be previously stored when loading the program to the Arduino UNO board using the Arduino IDE software. To verify the authorized person fingerprint there is a button for verify if the fingerprint scanned is an authorized one then relay becomes high and then engine starts otherwise the engine will not start.

8. Working

This project/designed system is a portable system/device with non-robust methodology. A 12 volt battery is used to supply the needed voltage via/through switch, which is connected between the 12 volts battery and the power regulator which output is made to enable transition of power to all modules of the system. For protection, a Zener diode rated 5 volts is connected to protect the modules from voltage higher than 5 volts. The Peripheral Interface Controller used in this project/design is ATmega and this chip is interfaced with LCD module, Fingerprint Module, ignition system of the car. This chip has 40 pins where 36 of the pins are input/output pins. The pins connected to the ignition system, the control bus of the LCD and the data bus of the LCD are configured as output. The RXD and TXD of the chip that are connected to the fingerprint module are configured as input and output respectively. They are used to access the fingerprints scanner module and control some operations of the chip. A 20 MHz crystal oscillator is used to clock the system opera.

9. Conclusion

This work is a well operating prototype of a fingerprint based vehicle staring system. The system intelligent agents were able to communicate well and appropriate output is given under user input. The system requests for user's finger, process it and give appropriate output based on if the finger is stored in the fingerprint module or not. The system is also able to enroll new user's finger at request but prompt for passcode before it could be done. Passcode editing can also be done on request in the system. Hence, fingerprint technology improves the security of an automobile making it possible for the car to be used by only authorized users. Therefore implementing this system on vehicles makes the achievement of our car security system comes in a cheap and easily available form. The output is viewed with the use of an LED. Biometric recognition systems present security and convenience than conventional methods of personal recognition.

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