Vehicle Ignition using Fingerprint Sensor

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Abstract

This paper focuses on the ignition of vehicle using fingerprint sensor and liquid crystal display, we are generating the same results along with same proficiency and accuracy in it by reducing its cost factor, so that it is easily affordable by customers and we can widely spread and implement the security in different domains. This approach would be fruitful to users who want to possess valid and authenticated entry.

Keywords: Fingerprint Sensor, LCD, microcontroller, Relay motor, scanner

I. INTRODUCTION

Vehicles have been used in one form or other since the invention of wheel. With the invention of wheel, came in the 2nd most advanced technology, The Steam Engine. With the development of steam engine vehicle took the form of what we see today. In earlier times crank shaft mechanism were used to ignite the vehicles. Leaving that conventional method behind came in the concept of igniting the vehicles using key. And now, Keys are being replaced by Push start buttons. This project was started with the sole purpose of eliminating keys as conventional method of starting the vehicle. With the introduction of Biometrics in the 18th century, security advancement in technology has gone up to various levels [1]. In the 18th century it was used to verify the employees working for the British Empire. Since then Biometrics has taken its toll. Biometrics is formed from the Greek words ‘Bio’ and ‘Metrics’ where ‘Bio’ means ‘life’ and ‘Metrics’ means ‘to measure’. The four major methods used in Biometrics are: Palm, Fingerprint, Iris, Voice, Face etc. There are many more methods, but these four are the most important. Biometrics are used in Schools, Banks, Colleges, and Universities etc. One of the growing industries is the automotive industry. One of the first companies to introduce finger print recognition in cars was Mercedes, which was then followed by Volkswagen. But now a days almost all the car makers are implementing Biometric based security. Fingerprint sensors are quite cheap in comparison to other Biometric sensors. And they are relatively easier to maintain also. The reason for going into biometrics is that its chances of being duplicated are very less. There two main purpose for this project. First being the eliminating the use of key completely for igniting the vehicle. Furthermore even the entry into the car can be done without the use of keys by using a technology called RFID (Radio Frequency Identification). The second purpose is to cut the cost for this technology that only the premium car makers are imposing in the market. This can work can work with any four wheeler vehicle. This project has been simplified to such an extent that it can also be implemented in two wheelers as well. The paper is divided into sections as follows. Section 2 describes the System in detail. Section 3 explains the Hardware and the Software used. Results in Section 4 and at the end we conclude with the conclusion and references.

II. RELATED WORK

In this project the hardware and the software both play an equal and an important role [5]. Rather than using the conventional methods to start the vehicle, a new method is used to start the vehicle. Fingerprint of the owner of the vehicle can start the vehicle. Rather than using the key of the car to start the vehicle fingerprint is used to ignite, since fingers can't be duplicated. The 16 bit AVR microcontroller is used which is the center of the User Authentication and the Vehicle Ignition. The Fingerprint sensors take in the fingerprint of the user which in turns sends the signals to the microcontroller. The microcontroller then matches the scanned fingerprint with the ones that are stored in its database. Once the fingerprint is matched, the microcontroller then sends the desired signal to the vehicle after which the user can start the vehicle. Fingerprints can be added or deleted as per the users’ convenience. Since the microcontroller has a little bit of flash memory available, the fingerprints can be stored in it. Three buttons are present which A GSM module is also used which also plays an important role [4]. Whenever a non-authenticated person tries to scan his fingerprint, a message is sent to all the registered users. Since the vehicle will not start without the fingerprint. The vehicle needs to have Fingerprint saved off all the users who are going to drive the vehicle. An LCD display is also used which would display the status whether the fingerprints are being added, deleted or a successful authentication. The Figure 1 shown below represents the circuit diagram of the system which comprises of the connectivity with the sensors, LCD and power supply. Ignition system, GSM Module. Providing Power Supply is also one of the major factor. Since, All the hardware used operate on +5V supply and the supply that we get in the car is a +12V DC. Hence, An additional IC has been used to control the flow of power supply, so that the hardwares don’t burn up.
III. HARDWARE AND SOFTWARE

A. The hardware used in the project are briefly categorized and explained in the following sub-sections.

1) AVR Microcontroller
The Microcontroller is a 16bit AVR Microcontroller. A microprocessor cannot be used for this purpose. As a microprocessor is used for products with multipurpose, and also it is expensive than a microcontroller. On the other hand, a microcontroller is designed for performing specific purpose. A microprocessor contains the full implementation of a microprocessor RAM, ROM, Timers, I/O, Clocks, and Serial Ports etc. It is also known as a "System on a Chip" or a "Computer on a Chip". The AT89C52 is the model of the microcontroller that is used in this project. It is a low power - high performance 16 bit microcontroller. The Flash memory on the microcontroller allows it to be reprogrammed, if in case any error comes whilst programming.
It is a 40 pin microcontroller. It has four ports namely Port 0, Port 1, Port 2, Port 3 [2]. All the four ports are 8 bit Bi-directional ports with internal pull-up registers. The LCD is connected to Port 1, the GSM Module is connected to Port 2, and the Fingerprint Sensor is connected to Port 3. A separate power supply has to be provided externally for it to work. The microcontroller solely works on signals. Whenever it has to perform any desired function, it just sends the signal to its respective port and hence the function is carried out. One of the most important feature of this microcontroller is that it operates at a very low operating voltage i.e 2.7V to 5.5V. Hence a lot of power supply is not required. The microcontroller uses an RISC (Reduced Instruction Set Computer) architecture. It has 4 Bi-directional 8 bit I/O ports [6]. The AVR uses a Harvard architecture, with separate memories and buses for programs and data. Instructions in the program memory are executed with a single level pipelining. While one instruction is being executed, the next instruction is pre-fetched from the program memory. All AVR ports have true Read-Modify-Write functionality when used as general digital I/O ports. This means that the direction of one port pin can be changed without unintentionally changing the direction of any other pin. The microcontroller has to be supplied with a continuous power supply of +5V. The microcontroller has only one TxD and RxD port.
2) **Fingerprint Sensor**

It is a 4 pin device which is an optical biometric fingerprint reader which can be used for various applications such as access control, safety deposit locks, banks, and car locks etc. [8]. The model used in this project is the R305 fingerprint scanner module. The reason being it is one of the cheapest fingerprint reader available in the market. One of the main features is that it consumes very less power, and it gives the similar performance as to the expensive ones. The fingerprint sensor is used to read the fingerprint of the already registered user/users. It can also be used to add/delete new/existing fingerprints.

Its four pins are Tx-In, Rx-Out, GND and +5V [7]. Tx-In and Rx-Out pins are used for Input and Output purpose. The GND and the +5V are used for power supply and grounding purpose. It is very easy to implement, being a simple connector.

When the user places his finger on the sensor for the first time, a 3-Dimensional image of the fingerprint is captured. It is then stored on the memory of the controller using various algorithms. Internally, it just converts it pieces of code which the microcontroller stores it in its memory and verifies it. Along with the fingerprint sensor three buttons are also used among which one of them is used for sensing the fingerprints. The other two are used whenever a fingerprint is too added or deleted. It scans the edges of the fingers and stores it in the memory of the controller. In case of deleting the fingerprint, we have to first place the fingerprint that needs to be deleted, and on pressing the delete button we have to scan that same fingerprint again. This deletes the fingerprint from the memory of controller. There are basically two modes in a fingerprint scanner, first is scanning and the second is writing.

3) **GSM/GPRS Module**

The GSM/GPRS Module that is used in this project is the SIM900A. It is the low cost and a simple GSM module. It can be used to make calls, send text messages and even emails in case it is a Internet based SIM card. The GSM/GPRS module uses a dual band 900 / 1800 MHz GSM/GPRS modem [9]. It works on 4V DC regulated power supply that is controlled by the microcontroller. Apart from that it is a plug and play device which means no drivers are required for this module to be installed.

The purpose for this Hardware’s usage is to send a message to the registered mobile no, when someone tries to access the vehicle illegally. It either sends an SMS or it can give a call as well, which can be chosen as per the users requirements. It all has an inbuilt TCP/IP protocol stack. It will also send an Email to the registered owner of the vehicle. Since a mobile no can be changed anytime and randomly, but a email is seldom changed. hence both an email and an sms will be sent whenever a user is added, a user is deleted or an invalid access occurs.

![Fig. 5: Block Diagram of GSM/GPRS Module](image-url)

It has 5 pins.
1) 1st pin is for Power Supply i.e +5V supply.
2) 2nd Pin and 6th pin are for Ground purposes. It uses a UART() Protocol for communication.
3) 3rd pin is the Tx-In ie the UART data output pin
4) 4th pin is the Rx-In ie the UART input pin.
5) 5th pin is the RESET pin. It is used to Reset the GSM/GPRS Module.
4) **Liquid Crystal Display**

![Liquid Crystal Display Diagram](image)

Fig. 6: Block diagram of a Liquid Crystal Display

An LCD is used for displaying the status of the entire project. Since the main idea is to make the project cost-effective [8]. A 16 by 2 LCD is sufficient enough. Although many bit LCD are available. The model used is the HD44780. The display is a dot matrix display used to display characters, alphanumeric characters, symbols etc. The LCD unit receives character codes from the microcontroller, latches the codes to its display data RAM (80-byte DD RAM for storing 80 characters), transforms each character code into a 5 × 7 dot-matrix character pattern, and displays the characters on its LCD screen. It is a 16 pin module.

1) Pin1 - VDD - Ground Pin
2) Pin2 - VCC - Power supply +5V
3) Pin3 - VEE - Used for adjusting the contrast of the LCD
4) Pin4 - RS - Register Select - It is used for selecting Register. It selects Command when input is low and selects Data when input is high
5) Pin5 - RW - Read/Write - Used to select the Read or Write signal. It is used to either Read from the LCD or Write to the LCD. When the input is low data is written on the LCD and when the input is high, it is used to Read the data from the LCD.
6) Pin6 - E - Enable Access - It is the operation enable signal. It sends data to the data pins when an input goes from high to low.
7) Pin7-14 - Data Pins - They are 8 bi-directional data pins from DB0 to DB7. DB0- DB3 are low bit data pins. DB4-DB7 are high bit pins.
8) Pin15 - LED+ - It is used to increase the backlight of the LCD. It is connected to the +5V or the power supply.
9) Pin16 - LED- - It is used to decrease the backlight of the LCD. It is connected to the Ground.

When the fingerprint is to be added, deleted or scanned, it will show the status Fingerprint Verified for Scanning. Fingerprint Added on addition of a fingerprint and Fingerprint Deleted on the deletion of a fingerprint. When a non verified fingerprint is scanned it will display the status as Invalid Access.

5) **Power Supply**

An IC 7805 is used for regulating the power supply. It is also known as regulator. It controls the flow of supply. It gives +5V Power supply. It is a part of 78xx IC’s family. The number 5 indicates +5V. The Power supply takes in +12V DC supply and then gives a +5V supply. An additional 110ohms Resistor is also used which will stop the excess of flow of current.

![Power Supply Diagram](image)

Fig. 7: Block diagram of the Power Supply
B. The hardware used in the project are briefly categorized and explained in the following sub-sections.

1) Proteus
It is a software that is used in the simulation and designing of Electronics Circuits. It is a complete packaged computer aided designing software. It has 4 components Proteus PCB Design, ISIS, VSM and ARES. Proteus PCB Design is used to design PCB(Printed Circuit Boards) and simulate them before they are actually implemented in real time based situation. ISIS(Intelligent Input Schematic System) provides an environment for designing and simulating electronic circuits. Hardwares like the Oscillators, Analog and Digital Signal Generators, Timers, AC and DC Voltmeters and Ammeters and various protocols like RS232 etc. VSM(Virtual System Modeling) is graphical environment for designing and simulation of circuits. Mostly microprocessor based applications are tested here, Since it facilitates the real time changing of variables like no of inputs etc. and get the desired output. Torun the simulations in VSM, code files in the form of HEX are required. ARES(Advance Routing and Editing Software) is also a software similar to ISIS and VSM used for PCB designing. One of the best features it has that components can be dragged and dropped onto it. Also that hardwares can be accelerated in ARES. The circuits can be viewed in 3D as well.

2) Keil Micro Vision
Keil was the first software to implement C compilers for the 80xx family of microcontrollers. It is used to perform project management, source code editing and debugging. In this the program may be developed, tested and finally be implemented. It is mainly developed and supported by ARM these days. It also supports RTOS(Real Time Operating System) as well ARM based devices. It includes both the C and the C++ compilers. It has UNILINK Debug and Trace Adapters that helps us to connect our PC to the desired system that we are developing and also performs debugging, tracing and analyzes the program that is running on the hardware connected to the PC. Keil was specifically designed to support the 80xx family. The program that is written in the keil is then converted into a file with an extension called as HEX, which can then be loaded onto Proteus for simulation or the microcontroller programmer for real time purpose.

3) Embedded C
Embedded C is just another form of C/C++ with the same execution styles and format. Rather than using Assembly Language which requires a lot of Theoretical Knowledge whereas Embedded C only requires the names of the Ports and the SFR's(Special Function Register). Embedded C has the same syntax and the semantics as that of C Programming like main(), variable declaration, data type declaration, arrays, conditional declarations etc. A separate set of programme has to be written for the LCD, Fingerprint Sensor, GSM/GPRS Module and the microcontroller. The main reason of choosing Embedded C was that it is very simple to implement and learn. Also that it is very reliable and that it is portable among different platforms.

C. Microcontroller Programmer
A microcontroller programmer or microcontroller program burner is also another hardware device but it is not included in the project module. Its only purpose is to burn the program that we write in the proteus onto microcontroller. It rerads the HEX file created by proteus and then stores it in the controller's memory. There are three types of Microcontroller programmers namely Parallel Programmer, Serial Programmer and the USB Programmer. It is done by placing the controller on the board and loading the HEX file onto the microcontroller's memory using the Application Programming Interface. Many microcontrollers can be burned only once and many microcontrollers can be burned several times.

IV. Conclusion
This paper mainly focuses on the ignition of vehicle using sensors, which would provide ease to users in different circumstances, such as in case they forget the keys inside the vehicle or at the other current place [10]. The use of fingerprint sensors provides the authentication to valid and registered users.
There are many improvements or functionalities that could be added on to the current version of this system to make it more efficient in terms of security and portability [11]. The vehicle ignition is highly affected in case the registered user finger is defaced or defected or colored, the system won’t allow the user to ignite the vehicle. To overcome this limitation we need to add on other features such as it scans the iris or heartbeat of the concerned user and after that it allows permissibility to the user, which would enhance the level of security up to a new apex. Our proposed works deals with the project in 2 modules that consists of an LCD crystal display which shows and display the value and the other one it comprises of fingerprint sensor which takes input from the user side. The results and observation described in the previous section assures the optimal and working results generated by the system. It improves the existing system by reducing the cost of the existing and overcoming the conventional system. As an application of it we can implement the same basic concept in other domains also, which requires more security from thefts such as authorized user entry only, verified users access in unauthorized regions only. Addition of more functionality would make it useful to be applied in other domains also.

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REFERENCES