

Adaptive Ignition System for Vehicle Safety and Security

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Abstract:

Security and safety of vehicles are of greatest concern nowadays. The automobile industry have imparted many methods to enhance the security of the vehicles but most have been implemented only in high end models. Traditionally available security mechanisms such as using keys, locks for tyres, steering ,hood etc can be compromised easily. The Adaptive Vehicle Ignition system has been proposed considering the limitations of the existing models. In this model the authorization is being provided by verifying the finger prints. The system uses Arduino UNO as the controlling unit. The R307 fingerprint sensor is interfaced with the Arduino to check the identity of the user and switches the ignition only when the fingerprint matches. The system also consist of a GSM module. The primary owner of the vehicle will get a message each time the vehicle ignites, through the GSM module and the system has been designed in such a way that if any unauthorized user tries to ignite the vehicle, a message will get directed to the primary user. This enhances the security furthermore.

Keywords: Ignition, Vehicle, GSM, Antitheft, Adaptive, Fingerprint sensor, Arduino UNO, Matlab.

I. INTRODUCTION

The owner invests a huge amount of money in the purchase of the vehicle. This makes the owner more cautious in terms of ensuring the safety and security of the vehicle. Thus the proposed project makes use of fingerprint of individuals to start/stop the engine of an automobile. This solves and reduces the problem of key theft. Each and every human being can be uniquely identified by their biometrics such as face recognition, voice recognition, palm prints, retina scan/ iris recognition, finger prints etc. The most accurate among these are fingerprints. Many techniques have been used to secure the vehicles but they have been incorporated only in few high end model. The aim and scope of the proposed project is to provide security to all vehicles in an economical way. The already existing security systems for vehicles are namely steering wheel lock, hood locks, tyre locks, electronic keys etc. Hood Locks, locks the hood and can be opened only with a key. Tyre locks are used to immobilize the tyres and are usually used by the policemen. Based on radio frequencies (RFID) electronic keys are used to ignite the engines of the cars. Today, the number of vehicle theft is increasing at an alarming rate. The surveys quote that the rate of automobile theft is more than

the burglary or other forms of theft. It is also recorded that around 125 vehicles have been stolen a day in the nation's capital. So there is a need to secure the system as the traditional methods can be easily accessed. But in the proposed model, the fingerprints can not be easily forged and in addition to it the GSM model is also being used to intimate the primary user whenever the car ignites. Thereafter, this provides more security than the existing models.

II. BACKGROUND

The vehicle thefts in society has been a major concern nowadays. There are various theft protection programs that has been brought into action to minimize the consistency. Theft of unattended vehicle without a key, opportunistic theft, crack jacking etc, are the major categories of theft [1]. This has considerably become the major factor to safeguard the vehicle. Different ways and innovations have been implemented for the security but they are easily being cracked. Thus there is a need to develop a system which is reliable, useful and secure.

A. Literature Survey

Jayasree, proposed [2] a method which uses fingerprint-based lock system for door locks. Jamilah[3], gave a concept for the subscriber to ignite car engine by using their mobile phone. With SMS (text) message, the car can be starts and a few minutes later the car is ready to go. Winda [4], introduces an intelligent automatic starting engine based on voice access control system. B.S. Ashwin[5], designed a system that consist of smart card reader, controller module, seat belt sensing module, ignition system module and the smart card which is inserted into the system by the user. But the risk of smart card getting misplaced is high.

P. Deep Das, implemented a next generation system to provide protection to vehicles from thefts and accident as the road accident is killing more people than serious health disease[7]. Human iris is scanned using camera and the template is generated and stored. This helps only the authorised user to access the vehicle enhancing the security[10].

III. DESCRIPTION OF THE PROPOSED SYSTEM

A. Overview

The proposed system has mainly made use of three components namely a Fingerprint sensor, Arduino UNO and a GSM module to provide at most safety for the owner's vehicle. Initially, the fingerprint has to be placed twice for a successful enrollment. During enrollment, the image is converted to grayscale and then the binarization of image is carried out such that the ridges get converted to black and the furrows to white. For further enhancement edge detection is performed. The minutiae extraction is performed by thinning process and then the template is stored in memory. The fingerprint sensor checks and matches the inputted fingerprint with the enrolled fingerprints stored in the memory. If the input matches with the enrolled fingerprint, then the Arduino turns ON the ignition of the car. The system also proposes the use of GSM module which sends SMS to the primary owner each time a fingerprint is placed and each time the car ignites.

B. Description of Each Component

1) Fingerprint module

The R307 fingerprint scanner module has been used in the proposed system Figure.1. It is one of the economically available sensors which has its own unique identity for recognition. The performance of this scanner is relatively high compared to other scanners and is used to efficiently recognize the already registered fingerprints as it has its own memory. It consist of 4 pins that is transmitter-in, receiver-out, GND and +5V.



FIGURE 1: R307 Fingerprint Module

i) Fingerprint Recognition System

Fingerprints are unique and most accurate among all biometrics. As mentioned above there are various other biometric patterns namely iris, DNA, face, retina, palm print, voice, signature, hand shape, typing rhythm and gait which has not proved to be reliable and cost effective[13]. To illustrate it further palm prints are usually frayed; Voice, signature, hand shapes and iris images are easily forged[13]. In addition, iris and face recognition can be influenced by attackers to spoof and they also change in relative to the person's age. Now comparing to other biometrics, fingerprints are accepted worldwide and it is difficult to steal or forge. The main types of fingerprint readers are optical, capacitive, ultrasonic and thermal. Minutiae matching and pattern matching are the two fingerprint matching techniques. Minutiae points are majorly used in minutiae matching that is the location and direction of each points. The pattern matching simply compares two images to see how similar they are[9]. They are often used in fingerprint recognition system to detect duplicates[9].

ii) Fingerprint template generation and reading:

Image capturing module, feature extraction module and pattern matching module are the three main modules used in fingerprint recognition system[13]

Figure.2, In image capturing and feature extraction, the fingerprint is first scanned ,enhanced and then analysed. Then binarization takes place where 8-bit grayscale fingerprint image is converted into 1-bit ridge image.It is continued with a thinning process where the minutiae is constructed.Finally the minutiae and ridge are extracted and some post processing is performed on this final image to eliminate any spurious minutiae ,then stored as a template in the memory. Based on the fingerprint model ,it can store 127 such templates.

Figure.3, Now to ignite the engine, the similarity is determined by minutiae analysis where the current user’s fingerprint is compared with the template in the memory. If the finger print matches,the arduino sends signal to ignite the vechile’s engine.

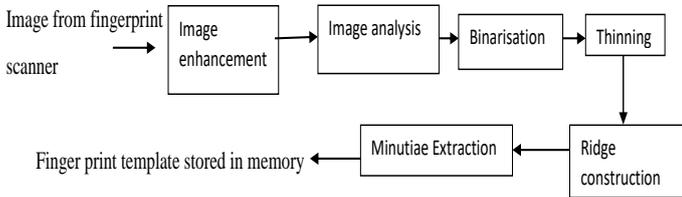


FIGURE 2: Finger print template generation

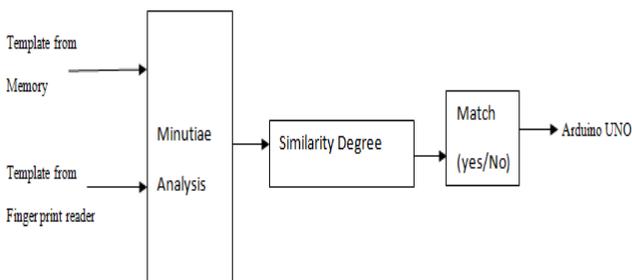


FIGURE 3: Finger Print Reader

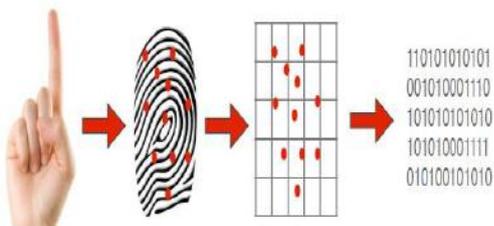


FIGURE 4 :Binarization of Finger Print

2) GSM Module

Global System for Mobile Communication (GSM) module Figure.5, is a circuit which is widely used

mobile communication system in the world.. It is used to establish communication between user and system.It uses Time Division Multiple Access(TDMA) as a digital system for communication purpose. GSM is the worldwide accepted standard for digital cellular communication.GSM module is helpful in telecommunication and nowadays it is used in application as a safety setup.



FIGURE.5: GSM Module

3) Arduino UNO

Arduino UNO is a microcontroller board.This is based on Atmega328P.This has 14 input/output pins,3V and 5V vcc,6 analog inputs and USB Figure.6.Fingerprint sensor and GSM are connected to the arduino UNO which process based on the given input.

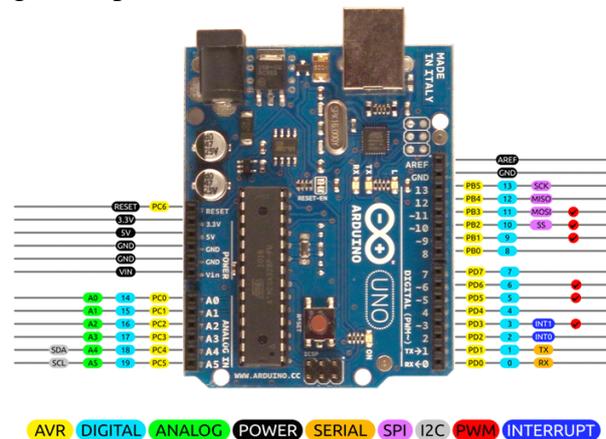


FIGURE 6: Arduino Pin Diagram

IV. WORKING PRINCIPLE

A. Integration of Fingerprint Scanner with Arduino UNO

Initially for the scanning of finger prints,we use R307 finger print scanner and Arduino UNO

controller to enroll the finger print. The transmitter Tx, of the Arduino is connected to the receiver Rx and the receiver of the scanner, to the transmitter of the Arduino UNO Figure.7. Once connected, the Arduino recognises the sensor that is connected Figure.8. To enroll, the finger is kept twice and then it is converted into a digital form . Therefore each and every user is given a separate ID where it is stored in the memory of the sensor. The vehicle will ignite only when the placed fingerprint matches with the enrolled ID. Figure.9 shows the output of the serial monitor. Initially it displays the number of templates stored in the sensor memory. When a valid fingerprint is placed , it shows the ID in which the template is stored and the level of confidence.

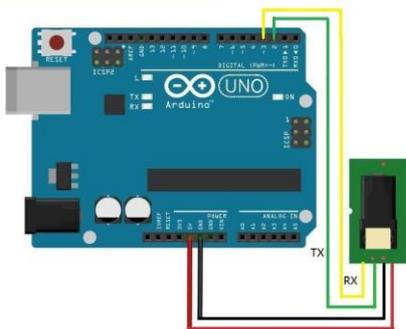


FIGURE 7: Integration of Scanner and Arduino UNO

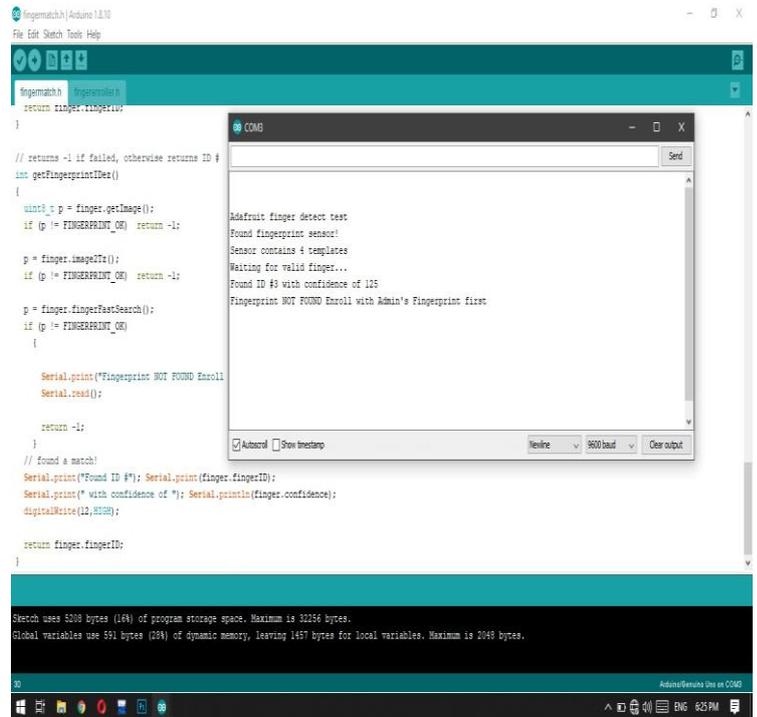


FIGURE 9: Fingerprint verification

B. Intergration of GSM module with Arduino UNO

Additionally, we use a GSM module to enhance the security of the system. Whenever the fingerprint matches and the vechile ignites the message is sent to the authorised owner along with the name of the current user via GSM.

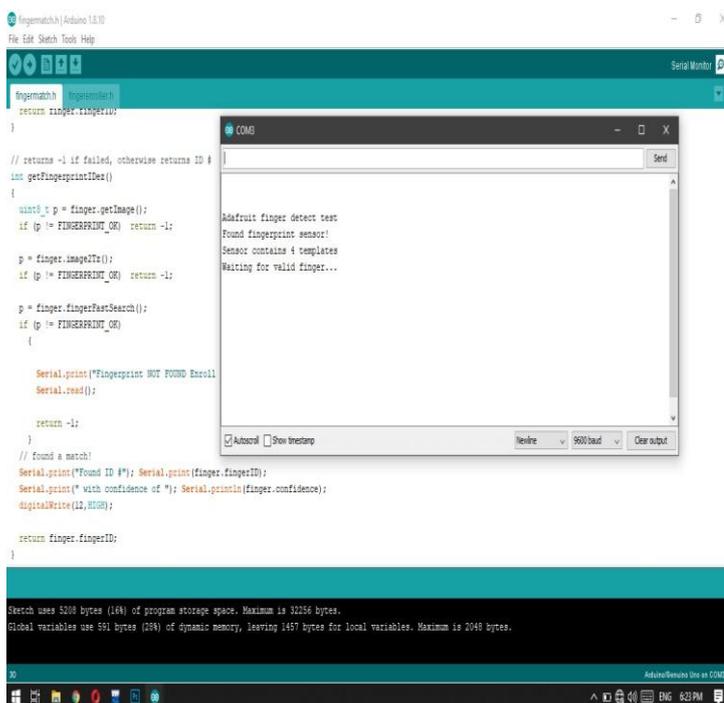


FIGURE 8: Identification of found fingerprint sensor

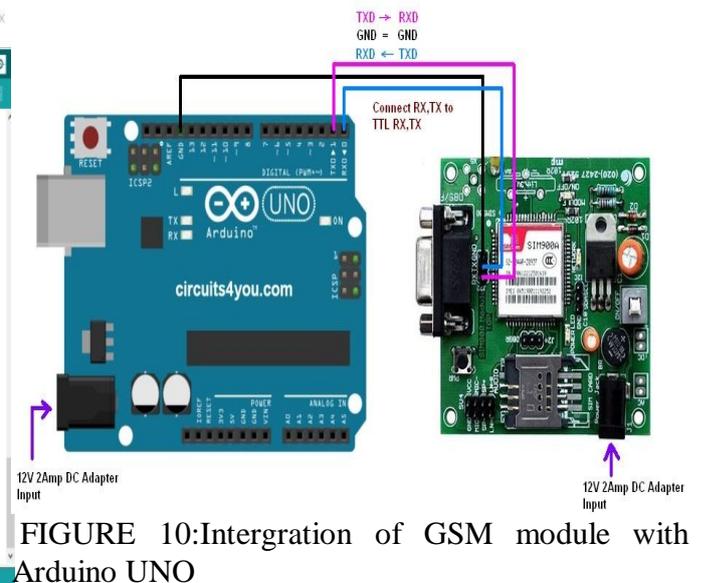
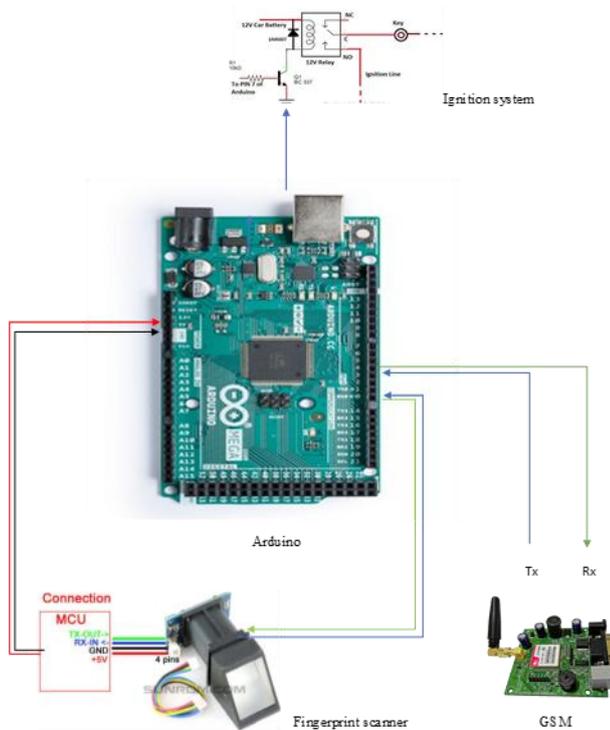


FIGURE 10: Intergration of GSM module with Arduino UNO

V. ARCHITECTURE DESIGN



VI. CONCLUSION AND FUTURE ENHANCEMENT

Safety and Security is fundamental criteria in all kind of applications. The most efficient among all biometric if made use in security and safety is fingerprint. The GSM module in the proposed system, not only can be used to send message to the owner regarding security but also can be used for safety purposes in case of emergency. The future enhancement in this system can be a traffic signal detecting, alcohol sensing, image processing ,GPS for tracking etc. In case of emergency, the GSM can be used to send message to the owner and incase the module did not receive any reply, the alarm can be switched on. Thus the proposed system not only can be used to provide security for the vehicle but also for the safety of the driver and passengers.

VII. REFERENCE

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