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Design and development of fingerprint based vehicle starting system

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Abstract
The aim of this paper is to design and develop a finger print based car ignition system with a view of reducing car theft and to ward off unauthorized users. Recently, car hijack has been on the increase as armed robbers focus on stealing cars especially the brand new ones. Hence the need to protect the cars from hijackers is considered to be essential. In this paper, nobody can ignite the vehicle except authorized by the designed system already captures its fingerprints pattern features through enrolment into the system. This is achieved with the use of fingerprint module, PIC18F4620 microcontroller and Liquid Crystal Display (LCD) module. More so, 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, microcontroller, interface, vehicles [5]

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). Biometric systems have in a long time served as a strong security system in many different applications and it can also be implemented in automobile industry. Biometric system is a technological system that uses information about a person to identify. [10, 13]

Literature Review
The history of fingerprint started in China. That was when the first record of the teck neck was being used with thumb prints being imprinted in clay. In the 14th century, various Persian government papers had impression of fingers. Observation had it that no two fingerprints were exactly alike. In 1880, Henry Faulds proposed an article where friction ridges can be extensively used in crime scenes to identify criminals. He gave two examples which are; a sooty finger marks on a white wall exonerated an accused individual and a greasy print on a drinking glass that revealed who had been drinking some distilled spirits (Faulds, 1923) Fingerprint matching techniques are of two types: graph based and minutiae based. The template size of the biometric information based on minutiae is much smaller and the processing speed is higher than that of graph-based fingerprint matching. These characteristics are very important for saving memory and energy on the embedded devices (K and J., 1990). So much work as been done using the fingerprint for one kind of security system or the other, among whom are the works of Kumar, Mudholkar, Pandit, Kawale, to mention but a few (Kumar and Ryu, 2009, Kumar and Kumar, 2014, Mudholkar *et al.,* 2012, Pandit *et al.,* 2013, Kawale, 2013). Modern vehicles uses computer controlled battery ignition system; no matter the type of mechanism used, all ignition systems use battery, switch, coil, switching device and spark plug Delmar (2008). However, in this modern technology dispensation, biometrics has been employed for the ignition and security process (Omidiora *et al.,* 2011, Sasi and Nair, 2013, Karthikeyan.a and Sowndharya. j, 2012, Pingat *et al.,* 2013). [2, 7, 8, 9]

Design
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.

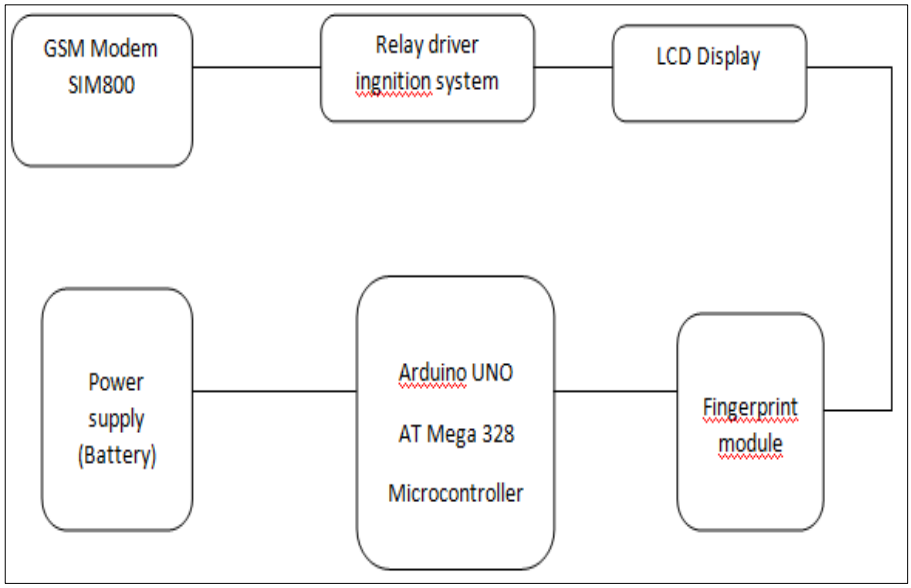

Fig 1: Block diagram of fingerprint based vehicle starter.

Block diagram of fingerprint based vehicle starter

(a) Liquid Crystal Display

The LCD circuit was built using its datasheet. Data transfer is done in nibble (D4 – D7). V_{dd} and V_{ss} were connected as instructed by the datasheet. A variable 5KΩ resistor is used to control the contrast of the LCD. The min. and max. Voltage of LCD is 0V and 6.50 V respectively from datasheet. Since V_{dd} = 4.87 V, a resistor that will draw an equivalent or almost 4.87 V from V_{ee} terminal is calculated.

(b) Light Emitting Diode

From datasheet downloaded, V_f = 1.8 V and I_f = 30mA for both red and yellow L.E.D. so from measurement, voltage from the PIC chip is 4.90VCalculating the value for R gives. (3)Where; I = 30mA = forward current V_f = 1.8V = forward voltage (4) V_s = 4.9V = voltage source. (5) (6) From resistor catalogue, 100Ω is preferable. [3]

Mode of Operation

This project/designed system is a portable system /device with non-robustmethodology. A -12 volt battery is used to supply the needed voltage via/through the 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 PIC18F4620 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. Three buttons with functions ENTER, UP and DOWN are connected to the chip and their operation is directly seen on the LCD. They are used to access the FPM10A fingerprint module and control some operations of the chip. A 20MHz crystal oscillator is used to clock the system operation. The fingerprint module operates in two ways; enrolment and verification. When verifying user's finger, it searches through stored finger in it FLASH memory and check for match. If there is a match, the module's TXD pin gives output 1 and the chip gets the response and activates the ignition system phase. If no match is found, low signal is sent to the chip and low output is given to the ignition system phase. When enrolling a new user's finger, admin passcode is requested by the PIC chip. If passcode matches user's passcode in the EPROM of the chip, access is granted to enroll finger. If no match is seen in the EPROM of the chip, no access is granted. After access has been granted to the admin, two things can be done, register new user's finger and edit user's passcode. [6, 12]

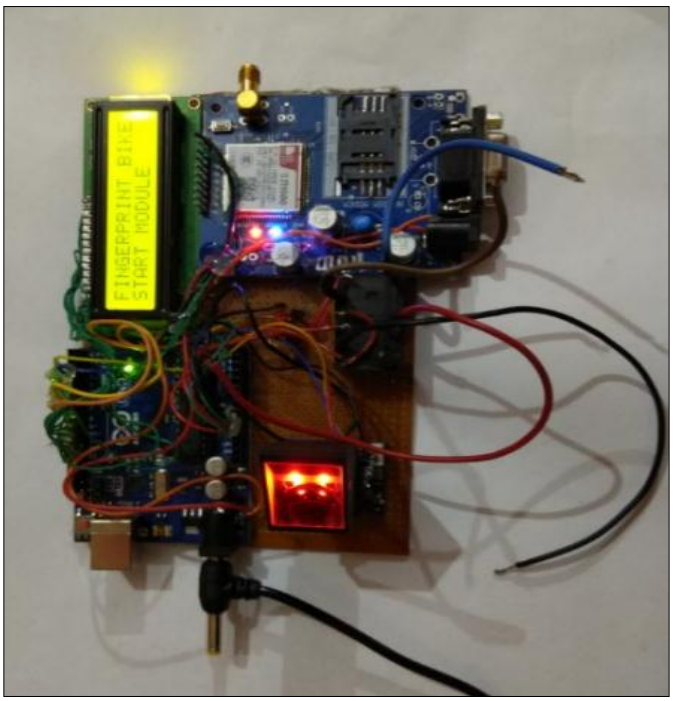

Fig 2: fingerprint based vehicle starter project

Algorithm of Fingerprint Based Vehicle Starting System

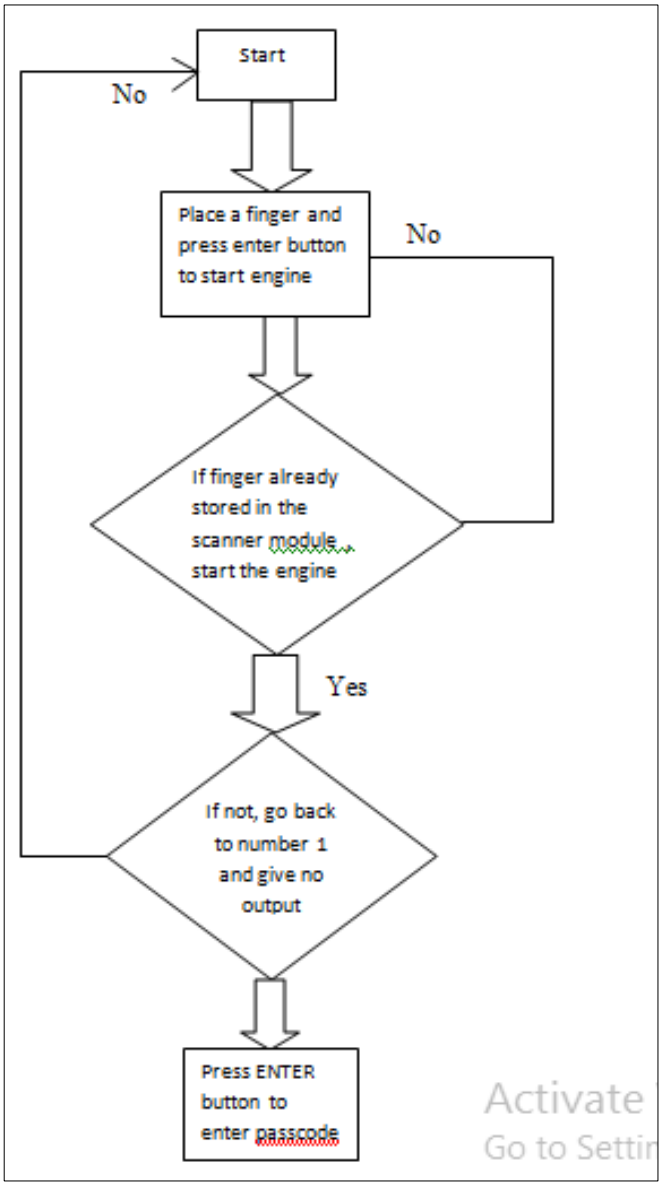

Fig 3: Algorithm of fingerprint based vehicle starter

Results and Discussion of Results

The results and interpretation of the results will be discussed below.

Results

Realizing a project physically has lots to do with research, choice of component and testing of the 0, 2, 4, 6.

Designed Value

Measured value components

After carrying out lots of simulations on Proteus, the project was implemented and tested to ensure proper operation under stated instruction.

The various modules were tested and satisfactory results were obtained. [4, 13]

Table 1: Designed and measured value of components used in power circuit Components.

Components	Designed Value	Measured value
Capacitor C1(µF)	100	99.70
Capacitor C2 (pF)	22	21.90
Battery (V) 12	11.80	
Output (V) 5	4.90	

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