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Biometric Security based Vehicular Safety System

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Abstract*: In vehicular system, security of the vehicle and safety of driver plays a major role. Current scenario is that the security systems installed in vehicles are not enough to prevent thefts because locks can be broken or passwords can be hacked. Biometric authentication uses physiological or behavioral characteristics to determine a user's identity. So, it is the safest and most reliable security method for vehicular systems. Also, it is low cost and highly secure system. The objective of our project is to ensure safe driving and propose a theft free vehicular safety system. One method of ensuring safety is authentication of driver through biometric system (here we have used fingerprint recognition). Without biometric authentication, access to ignition system won't be granted. This makes sure that an unauthorized person cannot drive the vehicle. Biometric security is most reliable because it can identify people with minimum ambiguity.*

Keywords *- Biometric authentication, LPC2148, R305 Fingerprint module, Limit switch, SIM300 GSM module, Ignition system*

1. Introduction

If we pick up any car purchase criteria survey world-wide, 'safety' invariably appears amongst the top three criteria, much more important than in-vehicle connectivity. The consumer realizes that the objective of the car is to take him/her and their loved ones from Point A to Point B in the safest manner.
Modern automobile security systems include remote keyless entry systems which can be easily decoded by thieves. Existing vehicular safety systems do not include biometric authentication. Biometric features are most unique and almost theft free (Finger print, retina/eyeball detection, face recognition etc).
Burglar Alarm, if present can be easily manipulated and digital passwords can be hacked. Sometimes security systems fail due to hacked password and encryption of decrypted data. Smart card is a good solution to these problems but if lost or damaged, may put the driver into a huge problem.
So we have proposed a system which can overcome the drawbacks of currently existing systems to ensure safe driving and vehicle security.

2. Block Diagram

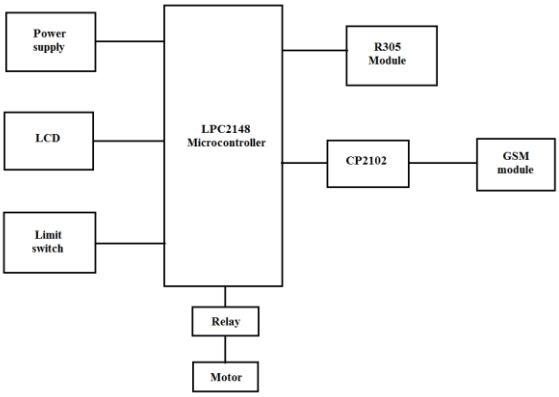

Fig 1: Overall system block diagram

3. Description of Block diagram

In order to enable timely security to the vehicle and driver, we have divided the entire the system into four stages.

Stage 1: Biometric Authentication of driver using Fingerprint detection. This is done with the help of R305 module.

Stage 2: If fingerprints do not match with the database, SMS will be sent to registered number with the help of GSM module alerting the owner regarding unauthorized action.

Stage 3: If the driver is found to be authorized, system will check for seat belt safety which is incorporated using limit switch.

Stage 4: If both the conditions are satisfied, only then an access will be granted to turn on the ignition system.

3.1 R305 Module

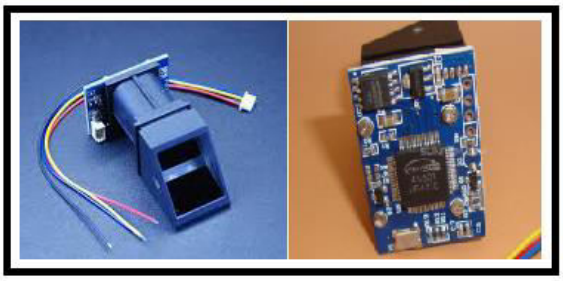

Fig 2: Fingerprint module

This is an optical biometric fingerprint reader/sensor (R305) module with TTL UART interface for direct connections to a microcontroller UART. The user can store the finger print data in the module and can configure it in 1:1 or 1: N mode for identifying the person. This module can directly interface with any 3.3V or 5V microcontrollers, but a suitable level converter/serial adapter is required for interfacing with the serial port of a PC.

3.2 LPC2148

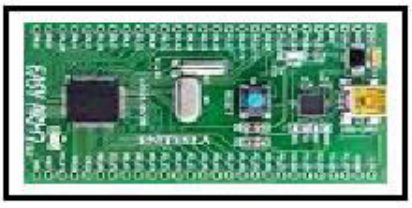

Fig 3: LPC2148 board

The LPC2148 microcontrollers is based on a 16-bit/32-bit ARM7TDMI-SCPU with real-time emulation and embedded trace support, that combine the microcontroller with embedded high-speed flash memory ranging from 32 kB to 512 kB. A128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2148 are ideal for applications where miniaturization is a key requirement.

3.3 GSM module

Fig 4: SIM300

GSM module provides the industry standard serial RS232 interface for easy connection to computers and other devices along with serial TTL interface for easy and direct interface to microcontrollers. It has got an onboard 3V Lithium Battery holder with appropriate circuitry for providing backup for the modules' internal RTC. This module can be used for GSM based Voice communications, Data/Fax, SMS, GPRS and TCP/IP stack. It be controlled through standard AT commands. GSM module comes with an onboard wire antenna for better reception. This board provides an option for adding an external antenna through an SMA connector. The SIM300 allows an adjustable serial baud rate from 1200 to 115200 bps (9600 default).

4. Working

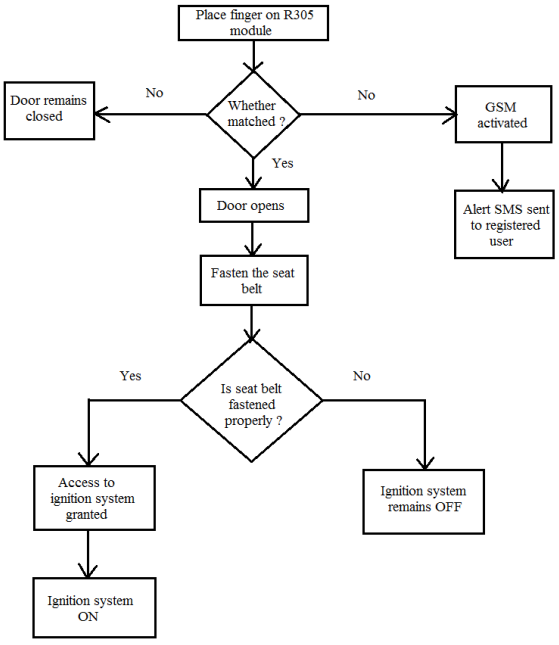

Fig 3: LPC2148 board

4.1 Biometric Authentication of driver using Fingerprint detection

This is done with the help of **R305 module**. R305 is an optical biometric fingerprint sensor module. Fingerprint processing includes two parts, fingerprint enrollment and fingerprint matching. An authorized person has to enroll his/her fingerprint into R305 in the enrollment mode. In matching mode, R305 will check the real time fingerprint with the templates stored in database of R305.

Fig 5: Default message on LCD

4.2 SMS alert if an unauthorized fingerprint is detected

If fingerprint do not match even after checking for 3 times with the database, SMS will be sent to registered number with the help of **GSM module** alerting the owner regarding unauthorized action being taking place. We have used SIM300 GSM module. It is used to send SMS, make and receive calls, and do other GSM operations by controlling it through simple AT commands from micro controllers and computers. RS232 to TTL converter is used here to interface GSM module with ARM controller.

Fig 6: Default message on LCD

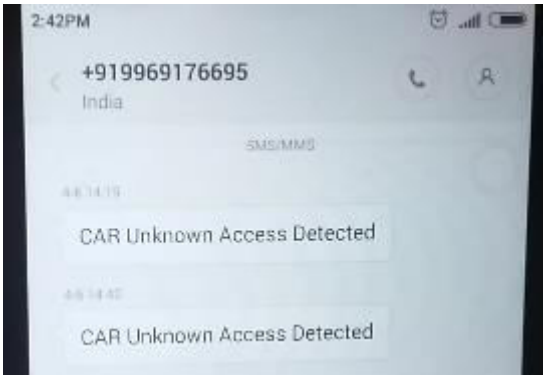

Fig 7: SMS sent when wrong fingerprint is detected

4.3 Seat belt safety

If the driver is found to be authorized, system will check for **seat belt safety** which is incorporated using limit switch. A limit switch is an electromechanical device that consists of an actuator mechanically linked to a set of contacts. When an object comes into contact with the actuator, the device operates the contacts to make or break an electrical connection. This will ensure at least the minimum safety of driver.

4.4 Ignition System

If both the conditions are satisfied, only then an access will be granted to turn on the ignition system. Here we have used relay to give access to the motor. Motor is used to depict ignition system.

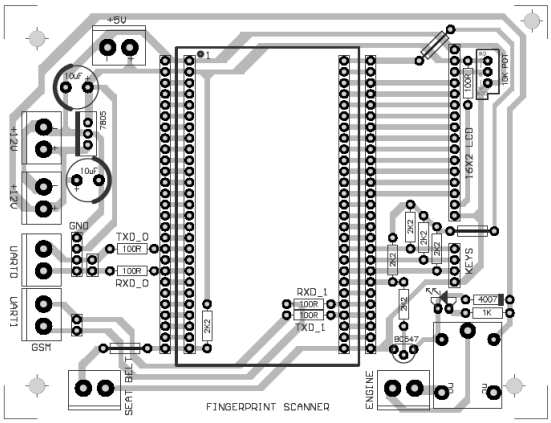

Fig 8: PCB layout

5. Result

Input	Output
Scan real time Fingerprint of driver using R305 module	Display result on LCD
Fingerprint match is found	Open the door
Check for seat belt safety	If fastened properly, grant access to ignition system else it will remain in off state
No fingerprint match found	Send SMS alert to registered number via GSM module

6. Applications

Application of this project is pretty straight-forward. It is a strictly user-ended system optimized to provide the user with safety of their vehicle from theft. Most distinguishing feature is biometric authentication of driver and denial of access to ignition system.
Moreover, the owner is sent an alert message regarding an unauthorized person trying to access the vehicle.

7. Future Scope

There is a huge scope for development with regard to this application. The system can be extended to cover a variety of functionalities. These can be implemented in the near future:
Presently the prototype has been implemented for two level security, first is the biometric authentication and the next one is restriction on ignition system. Once an unauthorized action is found, photograph of such a person can be taken using a camera installed on the door of vehicle.
Only seat belt safety is incorporated which can be extended to Alcohol detector without which access to ignition system won't be granted.
To prevent accidents, lane departure warning and pedestrian detection can also be added to the system.

8. Conclusion

There are numerous contemporary systems that exist to provide security to the vehicle from its theft. Our principal aim was to create a similar system but for the user end. This system is different from the other systems due to biometric authentication of driver.
We have added a feature of sending an alert message to the registered user regarding an unauthorized user being trying to access the vehicle. We could achieve this due to use of GSM module (SIM300).
We have incorporated seatbelt safety in our system which will ensure the minimum safety of the driver.
The most interesting part of the project was to control the ignition system. We have implemented the system such that it won't be given access till the driver is authorized and seat belt is fastened.

9. References

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