

"Applications of Biometric In Automobiles"

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Abstract - In this current world where technology is growing up day by day and scientific researchers are presenting new era of discoveries, the vehicle usage is basic necessity for everyone. Biometrics is a rapidly evolving technology which is being widely used in forensics such as criminal identification and prison security, and has the potential to be used in a large range of civilian application areas. Biometrics can be used to prevent unauthorized access to ATMs, cellular phones, smart cards, desktop PCs, workstations, and computer networks. It can be used during transactions conducted via telephone and internet (electronic commerce and electronic banking). In automobiles, biometrics can replace keys with key-less entry devices. Although many technologies fit in the biometric space, each works a bit differently. Relatively new on the biometric scene, face recognition devices use PC-attached cameras to record facial geometry. Automobile theft is the biggest problem in the remote location of the city and neither key lock nor Remote keyless system provides reliable solution because key can be copied very easily and remote keyless system encrypted data use radio waves which can be recorded and used to unlock the car. To design a unique key which doesn't rely on key or radio wave, biometric solution is the only better option.

Key Words: Finger Prints, Hand Geometry, Biometrics, Pattern Matching, Global System for Mobile (GSM), Automobile ignition control and Anti-theft Mechanisms.

1. INTRODUCTION

Every person has its own unique fingerprint which can be used as unique unlock/lock key of your automobile. Biometrics refers to the automatic identification of a person based on his/her physiological or behavioral characteristics. This method of identification is preferred over traditional methods involving passwords and PIN numbers for various reasons: the person to be identified is required to be physically present at the point-of identification; identification based on biometric techniques obviates the need to remember a password or carry a token. With the increased use of computers as vehicles of information technology, it is necessary to restrict access to sensitive/personal data. By replacing PINs, biometric techniques can potentially prevent unauthorized access to or fraudulent use of ATMs, cellular phones, smart cards, desktop PCs, workstations, and computer networks. PINs and passwords may be forgotten, and token based methods of identification like passports and driver's licenses may be forged, stolen, or lost. Thus biometric systems of

identification are enjoying a renewed interest. Various types of biometric systems are being used for real-time identification, the most popular are based on face recognition and fingerprint matching. However, there are other biometric systems that utilize iris and retinal scan, speech, facial thermo grams, and hand geometry.

A biometric system is essentially a pattern recognition system which makes a personal identification by determining the authenticity of a specific physiological or behavioral characteristics possessed by the user. An important issue in designing a practical system is to determine how an individual is identified. Depending on the context, a biometric system can be either a verification (authentication) system or an identification system.

Some of the reasons due to which vehicle protection is limited are given below:

- Due to longer distance (range), siren cannot be heard.
- Most of the cars have similar sounds.
- Physically, alarms can be disabled on theft attempts.
- Alarm sound can be mitigated in crowded areas.

2. SURVEY ON AUTOMOBILE THEFT

There is a good article written by Indian express about automobile theft in metro city like Delhi. In Delhi 2 case is registered in every 30 minutes. Software-Savvy, Tech-Friendly Thieves Armed with latest technology and tools, come in group of four or five, expert in every field on automobile engineering, they can find a way in [4]. They don't require to copy the ignition key as they use some Chinese software "the Engine Control Module (ECM) code breaker", available online and costs Rs 1 lakh. They can break steering lock and gear box lock with specialized tools and start the car. Here is the case study on automobile theft by Indian express.

3. Biometrics

The term "Biometrics" pertains to the analysis of measureable physiological and behavioral traits of human beings. This analysis aids in the identification of individuals by precisely dissecting and recognizing their unique characteristics.

The primary application of biometrics in automotive is in the avenue of Vehicle Security. BMW and Volvo have developed

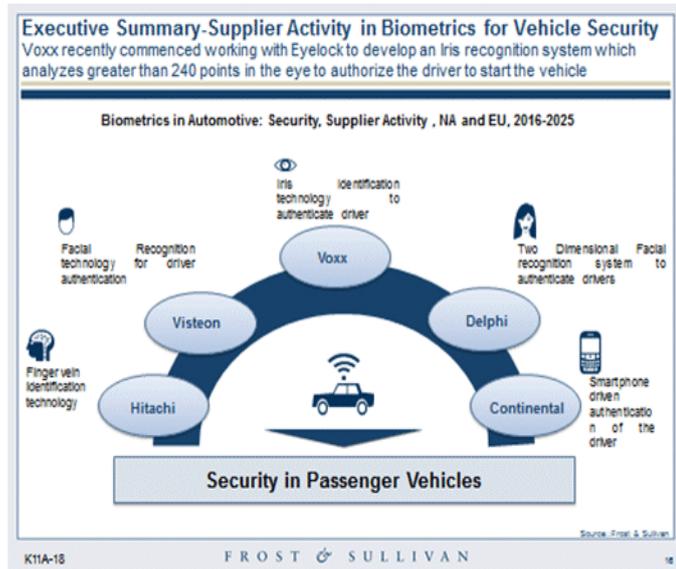
palm vein and fingerprint recognition systems, respectively, for vehicle entry, while Volkswagen has created a facial recognition technology for driver authentication. Driver identification and authentication is further poised to be bolstered by the advent of cutting edge biometric technologies such as ECG, developed by biometric specialist companies such as Nymi. The company has developed a wrist band which can be used to capture the unique heart beat signature of a user. This can later be used to authenticate the person for a wide range of applications including secure entry into a vehicle. The Nymi system promises to be a foolproof authentication system, as once a heartbeat signature is paired with a band, it cannot be used by anyone else.

TABLE I- PERFORMANCE COMPARISON OF VARIOUS BIOMETRICS.

BIOMETRICS	EER	FAR	FRR	COMMENTS
Face	NA	1%	10%	Varied light, indoor/outdoor
Fingerprint	2%	2%	2%	Cut on fingers
Hand Geometry	3%	5%	2%	Rings & improper placement
Iris	0.01%	0.94%	0.99%	Indoor environment
Keystrokes	1.8%	7%	0.1%	6 months period
Voice	6%	2%	10%	multilingual

3.1 Fingerprint

Among all the biometric techniques, fingerprint-based identification is the oldest method which has been successfully used in numerous applications. Everyone is known to have unique, immutable fingerprints. A fingerprint is made of a series of ridges and furrows on the surface of the finger. The uniqueness of a fingerprint can be determined by the pattern of ridges and furrows as well as the minutiae points. Minutiae points are local ridge characteristics that occur at either a ridge bifurcation or a ridge ending. Fingerprint matching techniques can be placed into two categories: minutiae based and correlation based. Minutiae-based techniques first find minutiae points and then map their relative placement on the finger. However, there are some difficulties when using this approach. It is difficult to extract the minutiae points accurately when the fingerprint is of low quality. Also this method does not take into account the global pattern of ridges and furrows. The correlation-based method is able to overcome some of the difficulties of the minutiae-based approach. However, it has some of its own shortcomings. Correlation-based techniques require the precise location of a registration point and are affected by image translation and rotation.



The physical characteristics of a person like finger prints, hand geometry, face, voice and iris are known as biometrics. Each biometric trait has its strengths and weaknesses. The suitable biometric can be selected depending upon the application in various computer based security systems.

The performance comparison of Biometric technologies based on FAR (False Acceptance Rate), FRR (False Rejection Rate), EER (Equal Error Rate) is given below:

Equal Error Rate –Rate at which both acceptance and rejection errors are equal. Lower the EER, system is more accurate.

False Acceptance Rate – Rate at which system incorrectly matches the input patterns to non-matching template in the database.

False Rejection Rate – Rate at which system fails to detect match between input pattern and matching template in the database.

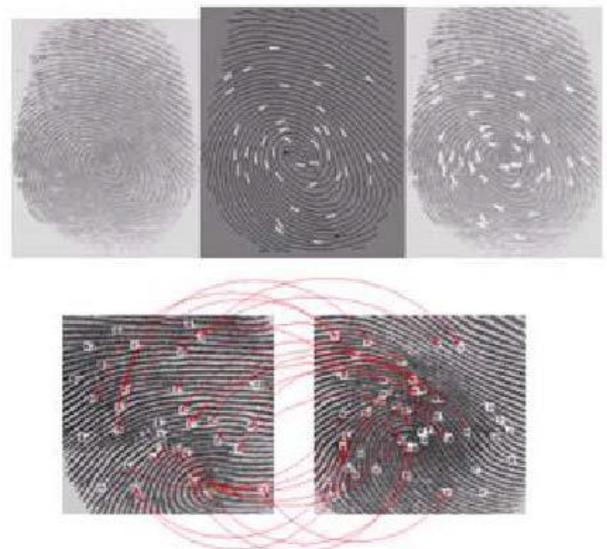


Fig-1 Minutiae points of Fingerprints.

Finger print recognition module is capable of storing physical images in binary form. Later the binary versions can be used to authenticate the user.

a. Fingerprint sensing, in which the fingerprint of an individual is acquired by a fingerprint scanner to produce a digital representation.

b. Pre-processing, in which the input fingerprint is enhanced and adapted to simplify the task of feature extraction.

c. Feature extraction, in which the fingerprint is further processed to generate discriminative properties called feature vectors.

d. Fingerprint matching, in which feature vector of the input fingerprint is compared against one or more templates. These templates are stored in the database.



Fig-2 Fingerprint Module

3.2 Hand Geometry

Hand Geometry Biometric Recognition System uses the geometric shape of the hand to identify the person. This system also uses finger length, thickness, and curvature for the purpose of verification. The hand geometry is not distinctive but it is the ideal choice. The hand geometry data collection is easier and hand geometry can be combined with other biometrics like finger print. The recent applications of the hand geometry biometric systems include San Francisco International Airport uses hand geometry to restrict access to critical areas, child day care centers use to verify the identity parents, payroll accuracy and access control, the fast gate pilot program to track border crossings for frequent travelers, United States military using for access control and majority of nuclear power plants in US use hand geometry for access control. The hand geometry is used in biometric systems as it behaves the following features:

- Very small template size, easy to maintain and store large database

- High reliability and accuracy
- Robust, user friendly and easy to integrate into existing and third party systems
- Ideal for rough outdoor environments like construction industry and can handle high throughput of people
- Relatively inexpensive offers excellent return on investment.



Fig-3 Hand Geometry Scanner.

3.3 Smart Card Reader

There are different types of biometric identification methods employed in access control like fingerprint recognition, facial recognition. Biometric identification technology has been promoted for its ability to significantly increase the security level of systems. All biometric identification devices work similarly, by comparing the template stored in its flash memory to the real time scan obtained during the process of identification. If there is a high or enough degree of probability that the template in the memory is compatible match with the live scan (the scan belongs to the authorized person), the identification details of that person are sent to a control panel, here an LCD module. Smart cards are of two types: contact dependent and contactless. Both have embedded microprocessor/controller and memory. The smart card differs from the proximity card. Proximity card has only one function: to provide the reader with the card's identification number.

The difference between the two types of smart cards is the manner with which the microprocessor on the card communicates with the external world. Licenses are replaced with these smart cards. A contact dependent smart card must physically touch the contacts on the reader to transfer information between them. Since contact cards must be inserted into readers proper care must be taken to insert in the proper orientation and nominal speed. Such a transaction is not acceptable for most access control applications. The use of contact smart cards as physical access control is limited

mostly to vehicle parking zone applications when payment data is stored in card memory and when the speed of transactions is not a key performance factor. A contactless smart card uses the radio-based technology and the frequency band used it uses is a higher frequency (13.56 MHz instead of 125 kHz), which allows the transfer of large amount data, and multi point communication with several cards at the same time.

A contactless card does not have to touch or get in contact with the reader or even be taken out of a wallet. Most access control systems only read serial numbers of contactless smart cards and available memory is not utilized. This memory is used for storing biometric data (i.e. fingerprint template, iris pattern) of a user. In such case a biometric reader first reads the template on the smartcard and then compares it to the finger print (hand, eye, etc.) presented by the user. In this way biometric data of users does not have to be distributed or networked and stored in the memory of controllers or readers, which simplifies the system and reduces memory requirements.



Fig-4 Car Access Card.

4. CONCLUSIONS:

The Biometric security Systems are the systems which uses the physical characteristics of a person like finger print, hand geometry, face, voice and iris. We can design our own security system with our own unique hardware, which cannot be crack by thief easily. Car unlocking method is only valid fingerprint which is unique for each user. Designing hardware is very easy because it is based on open source hardware, which provide easy to design hardware solution which remove the hassle of study of internals of controller. The developed system ensures that only authorized drivers can drive the vehicle and misuse of vehicles by others can be prevented. The system also provides facility for monitoring seat belt status. It also gives time to get the system repaired if any malfunction exists. The system makes sure that vehicle's access is given to only authorize personal and thus accidents can also be averted.

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