Review of Multimodal Biometric

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Abstract— Automatic person authentication is an important task in our day to day life. Earlier method of establishing a person's Authenticate includes knowledge based like password or token base like id cards. These identities may be lost stolen or shared by any person .For these reasons they are not suitable for authentication. Biometrics refers a technology to authenticate individuals by automated means that rely on anatomical or behavioral human characteristics. A multimodal biometric system combines two or more features of a person to be recognized together to determine a person's authentication. This paper discusses types of Biometrics, Characteristics, level of fusion and Challenges and Research area etc.

Keywords— *Biometric, Unimodal, Multimodal, Security, Spoofing Attacks*

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I. INTRODUCTION

Automatic person authentication is an important task in our day to day life. Earlier method of establishing a person's Authenticate includes knowledge based like password or token base like id cards. These identities may be lost stolen or shared by any person .For these reasons they are not suitable for authentication then introduce Biometric System. Biometrics" means "life measurement", A technology to authenticate individuals by automated means that rely on anatomical or behavioural human characteristics Biometric systems have the potential to do the people authentication with a high degree of assurance.

Characteristics of Biometric:-
Any physical and/or behaviour characteristics of a human can be considered as a biometric if it exhibits following characteristics[9].

- **Universality:** Each person accessing the biometric application should posses a valid biometric trait.
- **Uniqueness:** The given biometric trait should exhibits distinct features across individuals comprising the population.
- **Permanence:** The biometric characteristics should remain sufficient invariant over a period of time.
- **Measurability:** The biometric characteristics can be quantitatively measured i.e. acquiring and processing of biometric trait should not cause inconvenience to the individual.
- **Performance:** The biometric trait should the required accuracy imposed by the application.
- **Acceptability:** The chosen biometric trait must be accepted by a target population that will utilize the application.
- **Circumvention:** This indicates how easily the chosen biometric trait can fooled using artifacts.
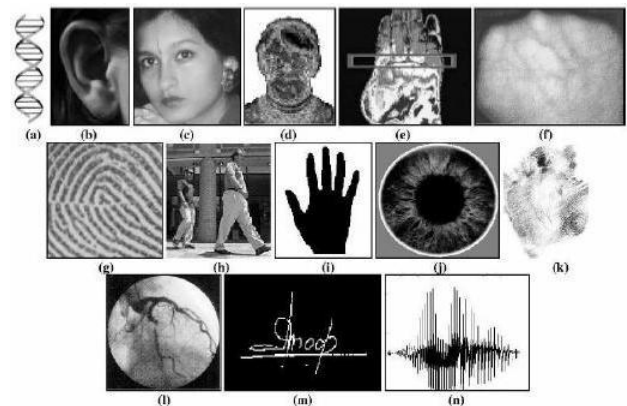

Fig. 1 Examples of biometric characteristics: (a) DNA, (b) ear, (c) face, (d) facial thermo gram, (e) hand thermo gram, (f) hand vein, (g) fingerprint, (h) gait,(i) hand geometry, (j) iris, (k) palm print, (l) retina, (m) signature, and (n) voice

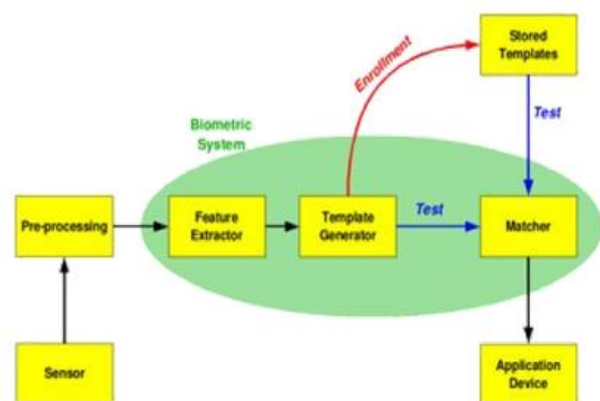### Basic modal of biometric System:-

Fig. 2 Basic modal of Biometrics

Need of Multimodal Biometrics :-

Most of the biometric systems deployed in real world applications are unimodal which rely on the evidence of single source of information for authentication (e.g. fingerprint, face,

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voice etc.). These systems are vulnerable to variety of problems such as noisy data, intra-class variations, inter-class similarities, non-universality and spoofing. It leads to considerably high false acceptance rate (FAR) and false rejection rate (FRR), limited discrimination capability, upper bound in performance and lack of permanence. Some of the limitations imposed by Unimodal biometric systems can be overcome by including multiple sources of information for establishing identity. These systems allow the integration of two or more types of biometric systems known as multimodal biometric systems. These systems are more reliable due to the presence of multiple, independent biometric.
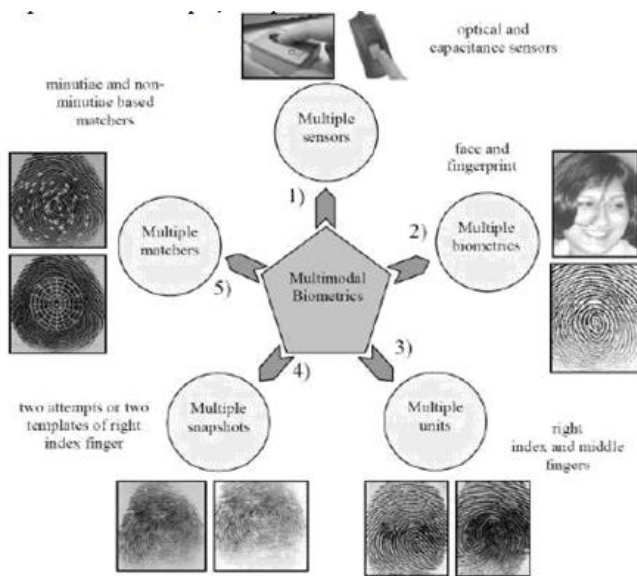

Fig. 3 Diagram of Multimodal Biometrics

Fusion in Multimodal Biometric System:-

A Mechanism that can combine the classification results from each biometric channel is called as biometric fusion[8].

INFORMATION FUSION:-

Pre-classification fusion: Prior to classification /matching, integration of information can take place either at the sensor level or at the feature level.

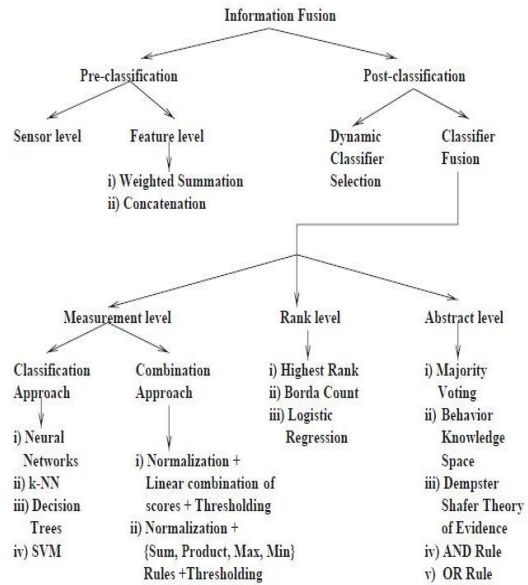*Post-classification fusion:* Schemes for integration of information after the classification..

Fig. 4 Approaches to information fusion

Level of fusion:-

A generic biometric system has 4 important modules:

1) **Sensor module:** It captures the *trait* in the form of raw biometric *data*
2) **Feature extraction module:** It processes the data to extract a *feature set* that is a compact representation of the trait
3) **Matching module:** It employs a classifier to compare the extracted feature set with the templates residing in the database to generate matching scores
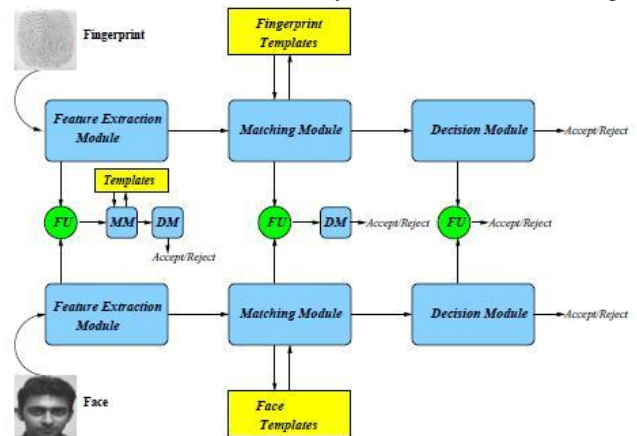   **Decision module** which uses the matching scores to either determine an identity or validate a claimed Fig.

Fig. 5 Levels of fusion in bimodal biometric system; FU: Fusion Module, MM: Matching Module, DM: Decision Module

II. APPLICATIONS

Most of the people associate with biometric due to Security There are following application of biometric.
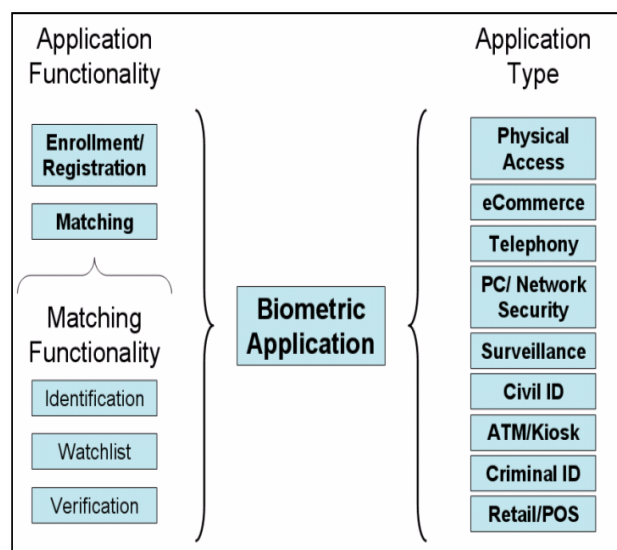
Fig. 6 Application of Multimodal biometric

III. CHALLENGES AND RESEARCH AREAS:-

Based on applications and facts presented in the previous sections, followings are the challenges in designing the multimodal systems. Successful pursuit of these biometric challenges will generate significant advances to improve safety and security in future missions. The sensors used for acquiring the data should show consistency in performance under variety of operational environment. Fundamental understanding of biometric technologies, operational requirements and privacy principles to enable beneficial public debate on where and how biometrics systems should be used, embed privacy functionality into every layer of architecture, protective solutions that meet operational needs, enhance public confidence in biometric technology and safeguard personal information. Designing biometric sensors, which automatically recognize the operating environment (outdoor / indoor / lighting etc) and communicate with other system components to automatically adjust settings to deliver optimal data, is also the challenging area. The sensor should be fast in collecting quality images from a distance and should have low cost with no failures to enroll. The multimodal biometric systems can be improved by enhancing matching algorithms, integration of multiple sensors, analysis of the scalability of biometric systems, followed by research on scalability improvements and quality measures to assist decision making in matching process. Open standards for biometric data interchange formats, file formats, applications interfaces, implementation agreements, testing methodology, adoption of standards based solutions, guidelines for auditing biometric systems and records and framework for integration of privacy principles are the possible research areas in the field[11].

IV. CONCLUSION

Biometrics systems are widely used to overcome the traditional methods of authentication. But the unimodal biometric system fails in case of lack of biometric data for particular trait. Thus the individual traits (face, fingerprint, iris and signature) are combined to develop a multimodal biometric system. The performance of multimodal system better as compared to unimodal biometrics with accuracy .

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