

Multimodal Biometrics - Accurate Identification System

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Abstract: Authentication is the process of validating the identity of an individual based on certain input that he/she provides. Authentication has become a major consideration of research due to the increasing number of attacks on computer networks around the globe. This review paper focuses on multimodal biometric authentication systems in today's application. The aim is to draw out the best combination of authentication factors for multimodal use. We study the strengths and weaknesses of selected biometric mechanisms in multimodal biometric systems to overcome the current biometric drawbacks.

Keywords: authentication, biometrics, unimodal, multimodal.

1. Introduction

Authentication is the process or action of proving or showing something to be true, genuine, or valid. Authentication is common in computer science where access to any resources on a system normally requires verification of identity. The processes of authentication come in a wide variety utilizing a number of factors. These processes are mostly divided into three categories which are: “something you remember”, “something you possess”, and “something you are”. Our focus is on “something you are” type of authentication. “Something you are” is an upcoming process for authentication. This type of authentication is on the whole known as biometrics and is considered one of the most secure and tried-n-true forms of authentication.

Biometrics systems have been parted into two categories which are: Unimodal biometric system and Multimodal biometric system. The vital difference between the two is that a Unimodal system works with only one trait or behavior while a Multimodal system merges the power of multiple traits or behaviors such as combining any number of bio-measurable traits such as fingerprint with finger knuckle print and voice, and etc.

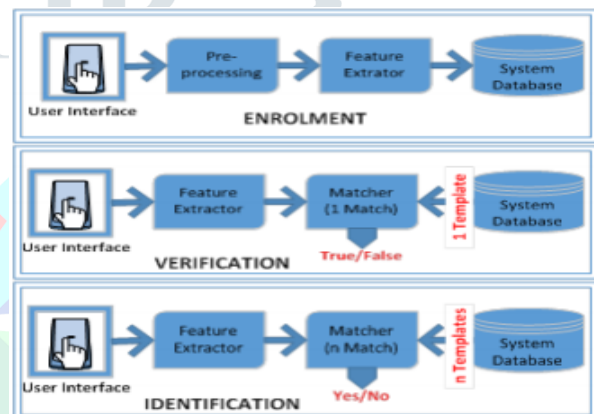


Figure 1: Unimodal Biometric

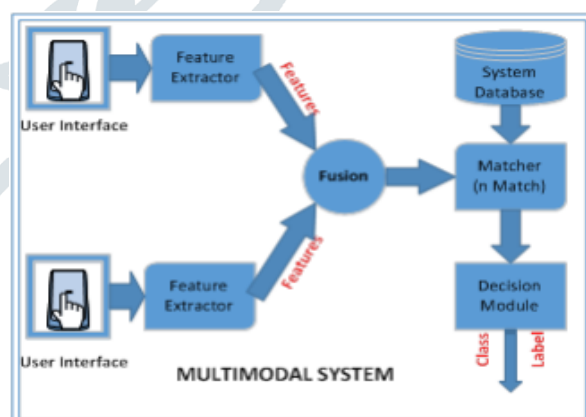


Figure 2: Multimodal Biometric

Our focus is particularly on multimodal biometrics system of authentication because it shows significant promise in terms of security and performance increased with providing convenience for users. The paper discusses the current trends in research of multimodal systems and identifies the strengths and weaknesses of this form of authentication.

2. Multimodal Biometric

Multimodal biometric is a system that merges the obtained result from more than one biometric traits for the purpose of individual identification. Multimodal biometric systems are more reliable than unimodal biometric system because many independent biometric modalities are used in it. The use of multimodal biometric system may result in highly accurate and secure biometric identification system, as unimodal (simple) biometric system may not provide high accurate identification due to non-universality. Such as, a few proportions of individuals can have cut, worn or unrecognizable prints, fingerprint biometric may produce improper results. The failure in multimodal biometric systems of any one trait may not affect seriously the individual identification as different technologies as well as different traits can be successfully employed. Hence the spoofing can extremely be minimized; thus improving the efficiency of the overall system.

3. Strengths of Multimodal Biometrics

Multimodal biometrics systems have proven to overcome some problems associated with unimodal systems. Unimodal systems suffer from problems of intra-class distinctions, non-universality, inflexibility, noise, high error rates and spoof attacks. Multimodal systems are able to protect itself from these problems. Intra-class distinctions generally means that data is spread over a large plane making it difficult to be classified. A multimodal system employs more than one biometric factors and thus the fusion allows more bio-measurable data to be initialized providing a better classification of bio-measurable data. The fusion of bio factors also provides flexibility to the system and prevents noisy data to have valuable effects on the decision. Multimodal systems are generally more reliable as there are multiple levels of authentication and its one factor is compromised the remaining factors will be able to secure the system. The system analyses patterns from various biometric factors which solves the challenge on non-universality. Even if someone does not possess some required factor, the system will still be able to authenticate that person with other stored factors. While there are many advantages of implementing a multimodal biometrics system, it also faces some major challenges.

4. Weaknesses of Multimodal Biometrics

Multimodal systems are also facing challenges in various points of its implementation. The research has listed the following identified challenges:

- (1) multimodal systems are difficult to design,
- (2) user acceptance is quite low,
- (3) requires a higher level of investment and
- (4) the performance tradeoff.

Multimodal biometric system design needs to consider various questions such as which and what number of factors to be used. Designs also need to consider a suitable architecture of the system that considers fusion of multiple biometric factors. Again, the fusion level becomes a question of concern. Furthermore, proper threshold has to be initialized for all the factors to ensure suitable levels of False Rejection Rate(FRR) and False Acceptance Rate(FAR). Designing a multimodal biometric system will require significant research and experimentation before it can be implemented which could become a costly endeavor. User acceptance is a concern to the emerging technology as success would depend on the acceptance of people. Generally, people don't prefer to pass through too many scans due to reasons such as inconvenience and discomfort. A multimodal system requires accession of multiple hardware scanners and Software Development Kits(SDK). While some hardware scanners such as fingerprint are relatively economical, some scanners requiring expertise in connection are expensive. Finally, as there is a significant pre investment in the multimodal system, the system has to perform to an excellence level of acceptance. Multiple layers of data collection and fusion does take its toll on the system. In addition, the data generated from the factors can be huge, some ranging to hundreds of columns of data which needs to be pre-processed and normalized.

5. Solutions To The Challenges

The challenges facing multimodal biometric systems need to be addressed to ensure the growth of the technology. Design is one of the major issues of biometrics programming. While there are a variety of programming languages and Integrated Development Environments (IDEs) that support image processing and biometrics programming, there is no suitable programming environment that provides unchallenging design and implementation of biometrics applications. Applications currently need to be developed by importing various SDK's for different biometric factors. This task becomes cumbersome and time consuming. A specific IDE designed for developing biometric application can ease the load of programmers allowing them to focus on better data-structures and algorithms for implementation. This would allow for the development of robust systems that are not only efficient but also effective one for users. In addition, IDE should be able to handle most of the underlying

architectural and technical details such as preprocessing and data management. It is important to work on developing IDEs supporting robust development of biometrics applications. If the systematic details can be managed by a system, then development and research will start at a much faster rate allowing for greater advancements in significantly less time. The reduced time for development will allow the developers to focus on applications that are user-friendly. Thus, tells the final issue of multimodal biometrics systems.

6. Conclusion And Future Works

It can be concluded that technically authentication come in various forms. The most popular among the authentication mechanisms is used in biometrics. While biometric started off with simple unimodal systems which normally considered only one bio-measurable factor for authentication, the higher need for security had given rise to a quality system known as multimodal biometric system. Multimodal biometric system utilizes multiple bio-measurable factors in a system allowing the system to be more secure, reliable and less stringent with variations in factors. Together with the advantages, multimodal biometric systems also suffer from some major challenges such as difficulty in designing and implementation, higher cost in implementation and lack of user acceptance. However, an IDE that can assist in the development and implementation phase will enable programmers to tackle the challenges faced by multimodal biometrics systems. In future, the development of biometric IDEs will provide directions for research in multimodal biometrics systems for secure and reliable authentication.

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