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# Using Biometrics with User Identity Verification and Continuous In Secure Internet Services

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## ABSTRACT

Security of web-based applications is a serious concern, due to the recent increase in the frequency and complexity of cyber-attacks, biometric techniques offer emerging solution for secure and trusted user identity verification, where username and password are replaced by biometric traits. Biometrics is the science and technology of determining identity based on physiological and behavioural traits. Biometrics includes retinal scans, finger and handprint recognition, and face recognition, handwriting analysis, voice recognition and Keyboard biometrics. In addition, parallel to the spreading usage of biometric systems, the incentive in their misuse is also growing, especially in the financial and banking sectors. Biometric user authentication is typically formulated as a "one-shot" process, providing verification of the user when a resource is requested (e.g., logging in to a computer system or accessing an ATM machine). Suppose, here we consider this simple scenario: a user has already logged into a security-critical service, and then the user leaves the PC unattended in the work area for a while, the user session is active, allowing impostors to impersonate the user and access strictly personal data. In these scenarios, the services where the users are authenticated can be misused easily. The basic solution for this is to use very short session timeouts and request the user to input his login data repeatedly. We explore the continuous user verification for the secure internet services using biometrics in the session management No checks are performed during working sessions, which are terminated by an explicit logout or expire after an idle activity period of the user However a single verification step is still deemed sufficient, and the identity of a user is considered immutable during the entire session. This paper explores promising alternatives offered by applying biometrics in the management of sessions. A secure protocol is defined for perpetual authentication through continuous user verification. Finally, the use of biometric authentication allows credentials to be acquired transparently i.e. without explicitly notifying the user or requiring his interaction, which is essential to guarantee better service usability.

**Keywords:** Continuous User Verification, Biometric Authentication, Web Security

## I. INTRODUCTION

There are many world events that have been directed our attention toward safety and security. Therefore security of such web-based applications is becoming important and necessary part of today's technology world. Hence, now day's biometric techniques offer emerging secure and trusted user identity verification. Every biometrics refers that the identification of a person based on his or her physiological or behavioural characteristics. Now days there are many devices based on biometric characteristics that are unique for every person. In the biometric technique, username and password is replaced by biometric data. Biometrics are the science and technology of determining and identifying the legitimate user identity based on physiological and behavioral traits which includes face recognition, retinal scans, fingerprint, voice recognition and keystroke dynamics. By using continuous verification the identity of the human operating the computer is continually verified. Username and password of traditional authentication system is get replace by biometric trait in case of biometric technique. Biometrics are the science and technology of determining and identifying the correct user identity based on physiological and behavioral traits which includes face recognition, retinal scans, fingerprint voice recognition and keystroke dynamics. Biometric user authentication is formulated as a single shot verification .Single shot verification provides user verification only at the login time. If the identity of user is verified once,

then resources of the system are available to user for fixed period of time and the identity of user is permanent for whole session. A basic solution is to use very short session timeouts and periodically request the user to input his/her credentials again and again. To timely detect misuses of computer resources and prevent that an unauthorized user maliciously replaces an authorized one, solutions based on multi-modal bio-metric continuous authentication are proposed, turning user verification into a continuous process instead of onetime occurrence. To avoid that a single biometric trait is forged, biometrics authentication can rely on multiple biometrics traits new approach for users verification and session management are discussed in this paper that is defined and implemented in the context of the multi-modal biometric authentication system CASHMA-(Context Aware Security by Hierarchical Multilevel Architecture). The CASHMA system realizes a secure biometric authentication service on the Internet, in this users need to remember only one username and use their biometric data rather than passwords to authenticate in multiple web services.

## II. METHODS AND MATERIAL

### A. Security Methods

**Biometrics :** Biometrics is generally used by means the measurement of some physical characteristic of the human body for the purpose of identifying the person. Biometrics traits include fingerprint, face image, and iris, retina pattern .A more inclusive idea of biometrics also includes the behavioral characteristics, such as gait, speech pattern, and keyboard typing dynamics .A strong link is provided between a physical person and his or her digital identities by biometric traits. Human characteristics such as face, iris and voice can't be forged, lost, shared, or stolen .They are unique because the individual is unique.

### 1. Fingerprint Biometrics

Fingerprint identification is one of the most well-known and publicized biometrics. Because of their uniqueness and consistency over time, fingerprints have been used for identification for over a century.Fingerprint identification is popular because of the inherent ease in acquisition, the numerous sources (ten fingers) available for collection, and their established use and collections by law enforcement and immigration.

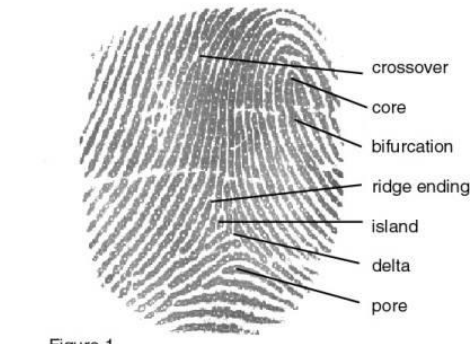


Figure 1

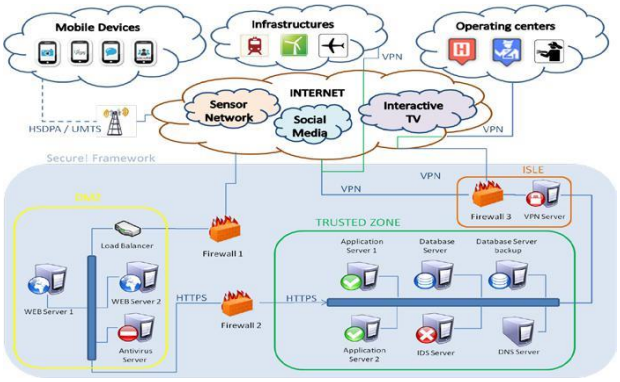

### 2. Face Biometrics

A general face recognition system includes many steps 1. Face detection, 2. Feature extraction, and 3.face recognition.Face detection and recognition includes many complementary parts, each part is a complement to the other.

### 3. Voice Biometrics

Speech recognition is the process by which a computer identifies spoken words. Basically, it means talking to your computer, and having it correctly recognized what you are saying. Voice or speech recognition is the ability of a machine or program to receive and interpret dictation, or to understand and carry out spoken commands.. For the voice recognition part the following steps have to be followed[5]. I) At first, we have to provide the user details as input in the form of voice asked by system. II) The system will then generate a ".wav" file and the generated file will be saved in the

database for future references. III) At the time of log in by the user, user needs to provide the same information given at the time of registration and the system compares the recorded voice with the one saved in database. If both match, user logs in successfully, otherwise not.




## B. Literature Survey

### 1) Quantitative Security Evaluation of a Multi-Biometric Authentication System

**Authors:** L. Montecchi, P. Lollini, A. Bondavalli, and E. La Mattina,

Biometric authentication systems verify the identity of users by relying on their distinctive traits, like fingerprint, face, iris, signature, voice, etc. Biometrics is commonly perceived as a strong authentication method; in practice several well-known vulnerabilities exist, and security aspects should be carefully considered, especially when it is adopted to secure the access to applications controlling critical systems and infrastructures. In this paper we perform a quantitative security evaluation of the CASHMA multi-biometric authentication system, assessing the security provided by different system configurations against attackers with different capabilities. The analysis is performed using the ADVISE modeling formalism, a formalism for security evaluation that extends attack graphs; it allows to combine information on the system, the attacker, and the metrics of interest to produce quantitative results. The obtained results provide useful insight on the security offered by the different system configurations, and demonstrate the feasibility of the approach to model security threats and countermeasures in real scenarios.

### 2) Model-based evaluation of scalability and security tradeoffs : A case study on a multi-service platform

**Authors:** L. Montecchi, N. Nostro, A. Ceccarelli, G. Vella, A. Caruso and A. Bondavalli

Current ICT infrastructures are characterized by increasing requirements of reliability, security, performance, availability, adaptability. A relevant issue is represented by the scalability of the system with respect to the increasing number of users and applications, thus requiring a careful dimensioning of resources. Furthermore, new security issues to be faced arise from exposing applications and data to the Internet, thus requiring an attentive analysis of potential threats and the identification of stronger security mechanisms to be implemented, which may produce a negative impact on system performance and scalability properties. The paper presents a model-based evaluation of scalability and security tradeoffs of a multi-service web-based platform, by evaluating how the introduction of security mechanisms may lead to a degradation of performance properties. The evaluation focuses on the OPENNESS platform, a web-based platform providing different kind of services, to different categories of users. The evaluation aims at identifying the bottlenecks of the system, under different configurations, and assess the impact of security countermeasures which were identified by a thorough threat analysis activity previously carried out on the target system. The modeling activity has been carried out using the Stochastic Activity Networks (SANs) formalism, making full use of its characteristics of modularity and reusability. The analysis model is realized through the composition of a set of predefined template models, which facilitates the construction of the overall system model, and the evaluation of different configuration by composing them in different ways.

### 3) Attacks on Biometric Systems: A Case Study in Fingerprints

**Authors:** U. Uludag and A.K. Jain

In spite of numerous advantages of biometrics-based personal authentication systems over traditional security systems based on token or knowledge, they are vulnerable to attacks that can decrease their security considerably. In this paper, we analyze these attacks in the realm of a fingerprint biometric system. We propose an attack system that uses a hill climbing procedure to synthesize the target minutia templates and evaluate its feasibility with extensive experimental results conducted on a large fingerprint database. Several

measures that can be utilized to decrease the probability of such attacks and their ramifications are also presented.

**4) Automated Generation and Analysis of Attack Graphs**

**Authors :** O. Sheyner, J. Haines, S. Jha, R. Lippmann, and J.M. Wing

An integral part of modeling the global view of network security is constructing attack graphs. Manual attack graph construction is tedious, error-prone, and impractical for attack graphs larger than a hundred nodes. In this paper we present an automated technique for generating and analyzing attack graphs. We base our technique on symbolic model checking algorithms, letting us construct attack graphs automatically and efficiently. We also describe two analyses to help decide which attacks would be most cost-effective to guard against. We implemented our technique in a tool suite and tested it on a small network example, which includes models of a firewall and an intrusion detection system.

**5) Risk-Based Security Engineering through the Eyes of the Adversary**

**Authors :** S. Evans and J. Wallner

Today, security engineering for complex systems is typically done as an ad hoc process. Taking a risk-based security engineering approach replaces today's ad hoc methods with a more rigorous and disciplined approach that uses a multi-criterion decision model. This approach builds on existing techniques for integrating risk analysis with classical systems engineering. A resulting security metric can be compared with cost and performance metrics in making engineering trade-off decisions.

### C. Problem Statement

- Once the user's identity has been verified, the system resources are available for a fixed period of time or until explicit logout from the user. This approach assumes that a single verification (at the beginning of the session) is sufficient, and that the identity of the user is constant during the whole session.
- In existing, a multi-modal biometric verification system is designed and developed to detect the physical presence of the user logged in a computer.
- The work in another existing paper, proposes a multi-modal biometric continuous authentication solution for local access to high-security systems as ATMs, where the raw data acquired are weighted in the user verification process, based on i) type of the biometric traits and ii) time, since different sensors are able to provide raw data with different timings. Point ii) introduces the need of a temporal integration method which depends on the availability of past observations: based on the assumption that as time passes, the confidence in the acquired (aging) values decreases. The paper applies a degeneracy function that measures the uncertainty of the score computed by the verification function.

**Disadvantages of Existing System**

- None of existing approaches supports continuous authentication.
- Emerging biometric solutions allow substituting username and password with biometric data during session establishment, but in such an approach still a single verification is deemed sufficient, and the identity of a user is considered immutable during the entire session.

## III. RESULTS AND DISCUSSION

### 1. Proposed System

- This paper presents a new approach for user verification and session management that is applied in the context aware security by hierarchical multilevel architectures (CASHMA) system for secure biometric authentication on the Internet.
- CASHMA is able to operate securely with any kind of web service, including services with high security demands as online banking services, and it is intended to be used from different client devices, e.g., smartphones, Desktop PCs or even biometric kiosks placed at the entrance of secure areas. Depending on the preferences and requirements of the owner of the web service, the CASHMA authentication service can complement a traditional authentication service, or can replace it.

- Our continuous authentication approach is grounded on transparent acquisition of biometric data and on adaptive timeout management on the basis of the trust posed in the user and in the different subsystems used for authentication. The user session is open and secure despite possible idle activity of the user, while potential misuses are detected by continuously confirming the presence of the proper user.

## 2. Advantages of Proposed System

- Our approach does not require that the reaction to a user verification mismatch is executed by the user device (e.g., the logout procedure), but it is transparently handled by the CASHMA authentication service and the web services, which apply their own reaction procedures.
- Provides a tradeoff between usability and security.

## 3. Related Work

**Trust Levels and Timeout Computation:** The algorithm to express the expiration time of the session that executes iteratively on the CASHMA authentication server it takes a new timeout and equally the expiration time each time the CASHMA authentication server receives fresh biometric data from a user. Let us consider that the initial phase happens at time $t0$ when biometric data is acquiredand transmitted by the CASHMA application of the user and that during the maintenance phase at time ti> t0forany i=1,…, m. new biometric data is acquired by the CASHMA application of the user u (we assume these data are transmitted to the CASHMA authentication server and lead to successful verification. The steps of the algorithm described hereafter are executed .To ease the readability of the notation, in the following the user u is often omitted; for example, g(ti)=g(u,ti).

### A. CASHMA-(Context Aware Security by Hierarchical Multilevel Architecture):

In the following we have given the information contained in the body of the CASHMA certificate transmitted to the client by the CASHMA authentication server, which is necessary to understand details of the protocol. Time stamp and sequence number identify each certificate, and protect from replay attacks. the outcome of the verification is decision ,carried out on the server side. It consists of the expiration time of the session that is assigned by the CASHMA authentication server. The global trust level and the session timeout are usually computed considering the time instant in which the CASHMA application acquires the biometric data.

### B. Continuous Authentication (CA) System:

Most existing computer systems authenticate a user only at the initial log-in session. As a result, it is possible for another user, authorized or unauthorized, to access the system resources, with or without the permission of the signed-on user, until the initial user logs out. This can be a critical security flaw not only for high-security systems (e.g., the intellectual property office of a corporation) but also for lowsecurity access control systems (e.g., personal computers in a general office environment). To deal with this problem, systems need methods for continuous user authentication where the signed-on user is continuously monitored and authenticated. Biometric authentication is useful for continuous authentication. For a continuous user authentication to be user friendly, passive authentication is desirable because the system should not require user active cooperation to authenticate users continuously [11]. In addition, a single biometric trait (unimodal technique) is not sufficient to authenticate a user continuously because the system sometimes cannot observe the biometric information. For example, the system will not be able to capture a user face image if he turns his head away from the monitor. In general, to address the limitations of single biometrics, using multimodal biometrics (combining two or more single biometrics, (e.g., face and finger print) is a good solution.

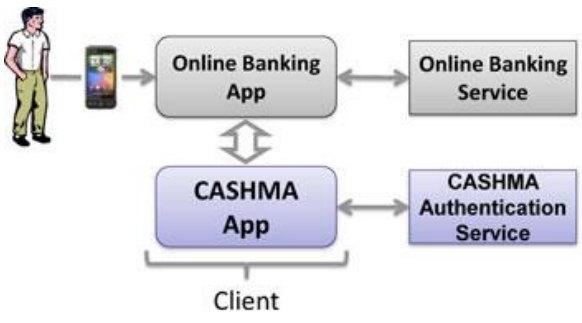
### C. Trust Levels And Timeout Computation

In this section the basic definitions are introduce that are adopted in this paper. Given an unimodal biometric subsystems Sk with k = 1, 2,..,n that are able to deciding dependently on the authenticity of a user, the False Non-Match Rate, FNMRk , is the proportion of genuine comparisons which result in false which does not matches. False non-match is the decision of non-match when comparing biometric samples which are in the form of same biometric source. It is the probability that the unimodal system Sk wrongly rejects a valid user. Oppositely, the False Match Rate, FMRk , is the probability that the unimodal subsystem Sk makes a

false match error, it wrongly decides that an invalid user is rather than valid one. A false match error in a unimodal system would lead to authenticate an invalid user. To make easy the discussion but by not losing the general applicability of the approach, we suppose that each sensor allows only one biometric trait.

**Computation of Trust in the Subsystems :** The algorithm starts computing the trust in the subsystems .Intuitively, the subsystem trust level could be simply set to the static value m(Sk,t)=1 - FMR(Sk).for each unimodal subsystem Sk and any time t (we assume that information on the subsystems used, including their FMRs, is contain edam a repository accessible by the CASHMA authentication server). Instead we apply a penalty function to calibrate the trust in the subsystems on the basis of its usage. Basically, in our approach the more the subsystem is used, the less it is trusted: to avoid that a malicious user is required to manipulate only one biometric trait (e.g., through sensor spoofing) to keep authenticated to the online service, we decrease the trust in those subsystems which are repeatedly used to acquire the biometric data.

**Computation of Trust in the User**: As time passes from the most recent user identity verification the probability that an attacker substituted to the legitimate user increases i.e., the level of trust in the user decreases. This leads us to model the user trust level through time using a function which is asymptotically decreasing towards zero. Among the possible models we selected the function in (1), which: i) asymptotically decreases towards zero; ii) yields trust(,$ti - 1$)for Δti=0and iii) can be tuned with two parameters which control the delay (s)and the slope (k) with which the trust level decreases over time. Different functions maybe preferred under specific conditions or users requirements in this paper we focus on introducing the protocol, which can be realized also with other functions.




## IV. CONCLUSION

In this paper, Continuous authentication verification with multimodal biometrics improves security and usability of user session. The protocol computes adaptive timeouts which is based on the trust put on the activity of user and in the quality as well as the kind of biometric data user is providing. The transparent acquisition of biometric data, realized through monitoring in background the user's actions, allows maintaining the session open without explicit interactions with the user, thus improving usability. A running prototype is available for PCs.

In future research user satisfaction, security level, cost and maintenance, I think this is the important and main challenges. The next step would be to put more attention to the check level of security, also to do more testing in order to get more accurate results.

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