

A Design of Security Framework for e-Health Authentication System using QR Code

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Abstract. E-Health is nowadays a commonly used system, widely known as electronic health, where there exist many types of services; providing electronic health records, prescriptions, consumer health information, healthcare information systems, etc. In this modern period of time, a considerable number of patients have taken e-health into consideration, due to the convenience of services provided. The popularity has recently been increasing due to a wide range of services. From the e-health system administrator's point of view, protecting privacy of patients is considered a challenging task, and also building trust of patients in e-health. In this paper, an effective security framework; which is authentication technique that suits the modern e-health is proposed.

Keywords: Privacy, E-health, Web authentication, Mobile authentication, Two-factor authentication, QR Code, Mobile device information

1 Introduction

E-health has increased its success and popularity in a short period of time. In practical, the system has to be secure and e-health service provider is entrusted with the responsibility to handle the sensitive information [1]. The e-health system is facing many threats such as sensitive data are in wrong hands, unreliable authentication process, and confidentiality of patients. The above factors may cause a drastic impact directly or indirectly to the patients, as well as the reputation of the service providers. Data integrity and availability are also of great importance; as a patient's life could depend upon the e-health system. Patient's information should be conserved and ensured that it is always up to date, and is not altered by those who have no right [1] [2].

In this paper, a design of security framework for e-health authentication system is proposed. The process includes the use of QR Code and smartphone, together with the web application that can handle many transactions at a time and be able to detect the device details. This authentication technique can be applied in various scenarios. At this point, the design system is proposed for the authentication process in e-health. With the proposed approach, e-health service is secure and cost-effective.

2 Background and Related work

1. Web Authentication

It is widely known that a number of people relying on internet, to accomplish their tasks are increasing. The authentication system should be developed in order to satisfy users from time to time. In the modern web applications, mutual authentication is provided. A pair of username and password is considered insufficient for a strong authentication process. Phone number, device detection, location detection, and keystroke behavior are now used together with username and password for the authentication process.

2. QR Code

QR (Quick Response) Code is the trademark for a type of two-dimensional matrix barcode introduced by the Japanese company Denso-Wave in 1994. A barcode is an optically machine-readable label that is attached to the product with the information related to that item. QR Code has now been widely used in a variety of fields, such as URLs, business cards, sales wrapping, code payments, etc. A study by MRI shows that 90% of Japanese mobile phone users have a QR Code scanner reader.

3. Mobile Device Information

Mobile devices such as smartphones and tablets have been used all over the world. Each mobile device is unique in terms of the device serial embedded. These data make each mobile device different from others, and managed by the product company. With mobile device information as a factor for the authentication, the risks can be more or less reduced. Motivated by this idea, a new approach is proposed by including the device information detection for the authentication process.

4. Authentication and Authorization Framework

A technique for authentication and authorization for e-Health is proposed. The work suggests that authorization and authentication are to be performed simultaneously and sequentially for the access control. The limitation is that design and implementation are not provided.

An implementation of a simple two-factor authentication is proposed. It utilizes the usage of QR Code nowadays and a smartphone device for a secure login transaction. The system does not require users to type their password. The idea of this system is to leverage the mobile device as a personal identifier, and bring advantages in order to improve the security in authentication process in terms of the mobility, efficiency and flexibility of the system.

An idea of using one-time password scheme with QR Code based on mobile phone was proposed. The major concern of this scheme is to make use of the deployed widespread QR Code techniques. It is separated into two phases: Registration and Verification phases. The paper shows the security analysis which is proved to be safe from illegal users' attempt and man-in-the-middle attack.

3 Design and Implementation

The proposed scheme essentially makes use of the existing QR Code technology, web application, and mobile device. Mobile device is used as a personal identifier, where embedded serial of each device is unique. The web application includes the normal authentication process, where a pair of username and password is used. Detecting device information and generating QR Code are two main features added to this scheme. A database is needed on the server to store user's identification information, registered device information, one-time QR Code, etc.

In the hospital system; doctors, nurses, and other related staffs have to register their device and get a pair of username and password. They are only allowed to access the system with their registered device using username and password. In case the system is accessed from unregistered devices, an extended authentication process will be activated, where QR Code will be generated and shown on the screen. Users are required to use their registered device with the QR Code scanner application to snap and transmit the one-time password back to the web server.

With this authentication method, the system relies on the web server, a mobile device, and web services which serve as the medium between mobile application and web server. Mobile devices with internet connection; says WiFi or 3G technology allows users to access the web server from anywhere. User has two ways to access the system. The first one, user can use his/her own registered mobile device together with their username and password pair. The second one, user uses any other devices to access the system; but in this case he/she has to use his/her registered mobile device to snap the given QR Code and transmit back to the web server for the authentication.

1. System Overview

Users have two alternate ways to access the system, either by using their registered mobile device or personal computer. The information needed to access the system via the registered mobile device is username, password, and device serial number. When a user uses the mobile device to access the system, username and password will be checked accordingly; followed by the device information. In case a user requests to access from unregistered devices such as personal computer or laptop, he/she is required to use his/her registered mobile device to decode the one-time QR code for verifying identification. This QR Code will be generated and displayed on the screen whenever the system is accessed from unregistered devices.

2. Registration Process

When a user registers for an account, information has to be provided. The information includes a pair of username and password, device serial number, and phone number. All the user information is encrypted and stored in the database of e-Health system. These parameters shall be verified when an access is requested. All the registered information will be stored in the web server.

3. Verification Process

The verification process is required when a user request an access to the system. This figure shows the process when a user accesses the system using unregistered device; says personal computer. User inputs username and password normally via the web interface. The authentication server would detect that the device information is not in the list, and one-time password will be encoded into the form of QR Code and display on user's personal computer. The user is then required to use registered mobile device to decode the given QR Code and send to the web server, using the specific mobile application. Lastly, the authentication server will verify the information including mobile device serial number, and mobile number. Once the verification process is completed, access request will be granted.

4 Conclusion

In this paper, multi-factor authentication system for e-Health is proposed. The system utilizes the popularity usage of QR Code and smartphone device for a secure login. Multi-factor authentication includes mobile device detection, username and password pair, and maybe as well mobile number. With the proposed system, the vulnerability of a traditional authentication process can be overcome. In addition, the registration and verification processes are explained. The idea of this system is to leverage the mobile device as a personal and unique identifier for each user. The system brings many advantages in improving the security of the secure authentication process in terms of mobility, efficiency, and flexibility.

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