Reliable Health Care System Model for WBAN and Cloud Integration

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Abstract

Wireless Body Area Network (WBAN), is emerging steadily in healthcare system. Handling the patient information with their relevance medical data in secure manner is essential in any healthcare services and managing the data's from various WBAN network is vital for real time applications. To accomplish this task, Cloud-assisted WBAN is promoted in recent years due to its flexible data storage and incorporate various security measures to WBAN. Still, numerical issues are raised in this open access cloud system to ensure the security and validate the healthcare information from remote terminals with guaranteed QoS support. This paper overcome these challenges and proposes a novel method that combines cloud-based WBANs with key driven QR pattern generation techniques in order to provide security and allows authentication driven data access to medical personals. To accommodate wide range of potential requirements color QR patterns are generated using user defined key values. Such color QR pattern provides flexibility to handle wide range of medical data from heterogeneous users with promising error metrics confidence. Furthermore, the integration of this QR patterns with the cloud-assisted WBAN system improves reliability over data execution criterions with maximized error tolerance level due to its inherent error correction capabilities

Key words:
Access control, WBAN system, cloud server, data sharing, security, QR pattern, privacy.

1. Introduction

In last few decades, due to the advancements in wireless body area networks (WBAN) to provide e health care system demands highly robust security measures [1]. On the other side malicious attacks are also increased steadily. Existing well known cryptographic measures [2-3] are not applicable for wireless sensor networks for security concern since computational complexity and power handling capacity are given maximum priority to any sensor networks due to the difficulty in changing batteries regularly. Therefore, to provide security solutions with all these bounds requires some application-specific models for WBAN system. In [4] WBAN system is developed to monitor athletes' activities and assist the training process. Here WBAN ensures the transmission of data reliably within a given time bound during monitoring process. The technical issues of WBAN system like security and accessibility measures are also addressed for

real time application. In [5] explores possibilities of WBAN security vulnerabilities and problems over data Assessment carried in real time. Analytical results also include the basic operations required to provide solutions for all these issues.

In addition to the problems over e healthcare system the inclusion of the cloud-assisted WBAN gives raises numerous security issues and new challenges need to be solved in order to give health care services to wide range of patients. Moreover healthy privacy is getting a lot of attention since health care information are stored in third-party-cloud server. In general cloud-assisted WBAN, enables patient medical information collection from people anywhere and allows medical personals to access the medical report at any time with improved access control mechanism. In [6] proposed prioritized health services using pseudo-cluster based data aggregation in cloud-assisted WBAN. This method includes channelization model to prefer the choice of packets needs to be transmitted to the cloud. By considering the parametric constraints of cloud assisted WBAN system query processing model is developed in [7] which reduce processing time as well as power consumption. In [8] developed efficient network model for uninterrupted media healthcare data transmission to cloud storage in cloud assisted WBAN system. This network model includes all four layers namely perception layer, network layer, cloud computing layer, and application layer. Hybrid autonomic resource provision model is developed in [9] by combining data computing and queuing model using CloudSim toolkit to accommodate fluctuating demands of WBANs services. In [10] used Advanced Encryption Standard (AES) for secured transmission of healthcare information's of patients to provide authenticity. And also optimize the average end-to-end delay of secured WBAN cloud system for e healthcare system. Fine-grained access control is developed in [11] based on Attribute-based encryption (ABE) to ensure the confdentiality of cloud stored medical records. In [12] integrated cryptographic mechanism to with fine-grained access control to improve data confidentiality. As a summary outsourcing the medical records to multiple independently worked medical authorities required unified access control mechanism without making any compromises in confidentiality.

In this paper, some of the major technical requirements of cloud assisted WBAN system is analyzed to mitigate the security related problems and provides unified pattern types to minimize the efforts needed for medical personals for accessing the stored data. This work considers WBAN system with two biomedical signals which includes data extraction with node validation management in cloud-assisted Wireless Body Area Network (WBAN) environment. Specifically, color QR pattern model is proposed for multi-tiered medical data access control with a cloud

2. Cloud Assisted WBAN System

The integration of cloud storage with WBAN system enables e-health care system to make the real-time health services to wide range of patients. It has several issues that needs to be solves such as simplified data computing, sensor node validation to avoid false data and controlled data access to medical personals over data generated by WBAN sensors.

2.1 Wireless body area networks

A WBAN includes both wireless data transmission to access points which considers the data transfer from sensor nodes to localized data storage and data transfer to cloud. The proposed WBAN systems include ECG signal and EEG signal. These two biomedical signals can be used in monitoring patients with heart related issues during a rehabilitation period and their state of mind over that period. This model includes RR peak detection over ECG signal to measure beat count and wavelet based decomposition framework for EEG signal classification as shown in Figure 1.
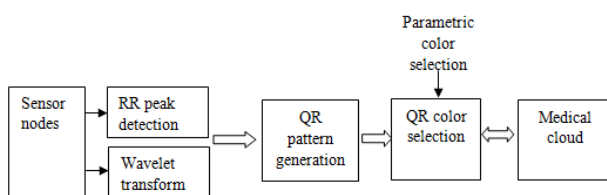

Figure 1. QR pattern based WBAN system for access control and data protection

2.2 Communication between the cloud server and node points

Communication between patient access points and cloud is used to interconnect WBANs with the cloud for data storage. Here only beat count with status of ECG

signals and wavelet features of EEG signals are collected from WBAN network. The main purpose of this work is to validate the access point of each patient by establishing security measure within the cloud, and allows authenticated controlled access over each of these health status data through the gateway. All these validated medical records are stored into medical database servers along with patient details in order to be accessible by medical personals located in remote places.

In this proposed cloud system consists of following phases namely sensor node validation, securing patient details, avoid any sorts of malicious attacks and authentication driven data assessments etc.

3. Secured QR Pattern Generation Model

Here patients are registered in cloud storage with the initiated color key generated from patient ID and transform the personal details into QR pattern. In order to validate the sensor details from access points during data transmission to cloud. The level of security and robustness to malicious attacks color variants keys are generated for each user's code which will lead numerous obstacles to hacker as shown in Table 1. The randomization in color keys improves significant confusion metrics and inherent error correction capabilities of QR patterns maximize the Quality of services.

Table 1: Colour variant QR patterns for data validation and attack prevention in WBAN

Signal measures	QR pattern
ECG	
EEG	

3.1 Data validation check

During data transfer from access points to cloud patients personal details are converted into QR pattern which is readily stored in server during registration process. Simple template matching process is used for validation check at the server side. Here both encoding type, pattern size and color components are used during validation check. In addition to this improved security

metrics data loss due to noise interference is not affect the detection with its error tolerance properties.

3.2 Access Control

The medical data access from Cloud data bases can be done with a variety of devices such as laptops and smart phones by medical personals where authentication needs to done before opening the gateway. In WBAN system wide range of health care details and all other relevant information's are distributed in database as a list of records which is linked with the patient personal details. Each individual record of patients contains unique information relating to a particular health problem. Requestor needs only a specific data from the WBAN system for clinical diagnosis or any other useful suggestion towards that particular patient. The proposed QR pattern based security protocol can accommodate growing list of records. Due to this reason, WBAN systems built on the color QR pattern achieve secured distribution of medical records to any number of untrusted medical personals. By structuring the access control network in this way, data sharing can be altered and provides access control over different instances of request made as shown in Table 2.

Table 2: QR pattern analyzes for authentication and medical personal accessibility.

Key bound used:	Coded QR pattern
Valid key (decidable QR pattern)	
Randomized key (In valid pattern)	

4. Performance Evaluation

The core objective of this section is to evaluate the performance metrics of the proposed key driven color QR pattern generation in cloud-based WBAN system and its efficiency over validation and authentication measures. Moreover, in this QR pattern based security model, only color components were used for validating the access points which includes all possible color combinations from R, G, B channels. Decoding the details involves simplified scanner with inherent error correction measures, this

avoids any sort of performance slowdown in terms of end-to-end delay. Here reliability of the QR pattern both in terms of security and robustness to noise interferences are analyzed.

4.1 Security Analysis

Each patient has equipped with unique QR pattern generation in the proposed scheme. The patient centric keys are issued to different medical authorities. During data access authorization is carried out according to the color QR patterns generated from given key values. Moreover, the access control over patient health care details is limited and prioritized according to the medical personals authorization. Color selection includes all possible color components from R,G,B channels and binary templates used for QR pattern generation is done with randomized data grouping and appropriate encoding which gives maximized diffusion over data and confusion metrics over transformations.

5. Conclusion

This work proposed a unique key driven color QR pattern system model for cloud-based WBAN to overcome the limitations of data handling capacity, robustness level over malicious attacks and security. Here color variant QR pattern model is used to validate the data collection from access point based on registered patterns for each patient. And also generates distinct QR patterns for authenticating the medical personals to allow data access from cloud storage with improved accuracy. During data assessments only controlled access is provided to medical persons in accordance with their relevance field of expert. The simulation results show that the proposed QR pattern provides prominent node validity of all individual users and allows controlled data access for real-time medical diagnosis.

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