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EDITORIAL

# Reliable and Secure e-Health Networks

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Electronic health (e-health) is becoming a norm in our society, particularly in the current COVID-19 pandemic. Consequently, the volume, variety, velocity and veracity of healthcare data are also increasing. Due to the nature of healthcare data (e.g., patient's medical history and diagnosis), e-health network reliability and security are crucial. While e-health network reliability and security have been the focus of research in recent years, many open research issues remain, particularly as technologies advance. For example, traditional security strategies may not have kept pace with advances in e-health technologies and societal requirements (e.g., increasing privacy regulations). Thus, this special issue presents various state-of-the-art advances and research opportunities on the topics of e-health network reliability and security, covering both theoretical and practical aspects.

Specifically, in this special issue twelve (12) research papers were accepted after several rounds of reviews, based on their originality, quality, and merit.

The first paper by Pandey et al. [1] presents a solution to detect and thwart the circulation of counterfeit medicines in India through resilient electronic health networks

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using blockchain. To achieve this, the authors proposed recording the medicine logistics requirements from medicine manufacturing to the patient on the blockchain. The system is simulated using a decentralized network of eleven computer nodes and its performance is compared with other existing methods under different network configurations. The authors' simulation results showed that the system offers a reliable solution to the menace of fake medicines.

The second paper by Kumari et al. [2] proposes improvements to the scheme recently presented by Qiu et al. designed for telecare medical information systems (TMIS). The authors show that Qiu et al.'s protocol is vulnerable to offline password guessing, replay, and anonymity violation attacks. To avoid these weaknesses, the authors developed an improved biometric-based three-factor protocol with added security features. The authors claimed that the proposed protocol is more secure and efficient as compared with other authentication protocols for the healthcare environment. To validate this, they use Burrows–Abadi–Needham (BAN) logic.

The third paper by Alzahrani et al. [3] proposes improvements to the new patient healthcare monitoring and authentication protocol presented by Xu et al., designed for WBAN environments. The authors showed that Xu et al.'s protocol is vulnerable to many attacks, including replay attacks and key compromise impersonation attacks, and that it suffers from privacy issues. To avoid these shortcomings, the authors proposed an improved scheme and formally analyzed its security features by implementing BAN logic and an automated simulation tool.

The fourth paper by Xie et al. [4] presents a basic RFID authentication protocol for the healthcare environment, based on indistinguishability obfuscation, to prevent the leakage of sensitive data from the backend server. They claimed that their proposed protocol is the first applications of indistinguishability obfuscation in the field of RFID authentication system, as well as being scalable.

The fifth paper by Chauhan et al. [5] presents an integrated framework of big data analytics with privacy and security concerns in context with healthcare databases for patients suffering from Human Immunodeficiency Virus (HIV) and Tuberculosis (TB). The proposed framework focuses on the detection of patterns from healthcare databases and generation of patterns for future clinical decision making. Finally, the authors proposed a framework using unsupervised learning techniques in STATA and MATLAB 7.1 to develop patterns for the knowledge discovery process. The authors emphasized that their study can potentially benefit end-users to predict future prognosis of the disease and combinatorial effects in determining varied policies that can assist patients with needs.

The sixth paper by Memos et al. [6] proposes a cloud infrastructure for e-health data transmission. In this paper, the authors redesigned the cloud computing model to support better resource allocation, less analysis time of the users' files and quicker response to the users' requests to the cloud servers. They proposed a cloud model architecture comprising four layers: (a) the master cloud server, (b) the slave servers, (c) the virtual sub servers and (d) the users connected to the cloud. The authors' experimental results showed that the proposed layered cloud architecture is more lightweight, efficient, and secure for e-health data transmission.

The seventh paper by Goyal et al. [7] presents a posture aware dynamic data delivery (PA-DDD) protocol in WBAN to deal with shadow effect due to body movement and change in posture. To avoid this problem, the authors used an Improved Initial Centroid K-means (IIC K-means) clustering technique for classification of various human body postures followed by back propagation neural network as a classifier to recognize human body

posture. The authors' simulation results showed that the proposed protocol prolongs the network lifetime and is energy efficient.

The eighth paper by Rachata et al. [8] proposes a mobile application to provide an efficient self-monitoring, which can encourage patients with type 2 diabetes mellitus and hypertension to improve their health status for preventing themselves from cardiovascular complication. To demonstrate the progression of the health status for the patients, the authors used the trend progression module, modelled with a fuzzy logic-based method. To verify an accuracy of the proposed mobile application, the authors tested one hundred twenty-one patients with type 2 diabetes mellitus and hypertension. Finally, the authors showed that the developed mobile application obtains 92% trend progression accuracy compared with decisions from eleven healthcare professionals and can encourage 85% of patients to improve their health status.

The ninth paper by Boubiche et al. [9] reviews the most leading protocols and classify them based the addressed security issue in the wireless sensor networks (WSN). In this paper, the authors outlined the main security constraints and challenges and present the future research directions based on the emerged application fields.

The tenth paper by Chaising et al. [10] proposes the personalized recommendation method using integrated objective distance for preventing Cardiovascular Disease (CVD) complication in the elderly. The authors' experimental results showed that the proposed new measurement can efficiently compute the shortest objective distance between the current health status of elderly individuals and the expected objective level. To verify the proposed model's accuracy, the authors compared the recommendations for 121 elderly persons with the high risk of developing this critical disease with expert recommendations. Finally, the authors showed that the proposed new approach has a high ability in providing personalized recommendation, which is nearly identical to the expert with 95% accuracy.

The eleventh paper by Goyal et al. [11] presents a hybrid Genetic Algorithm (GA) with BAT and Transmission Rate Adaption Policy (TRAP) abbreviated GABAT-TRAP to maximize the energy efficiency of the Wireless Body Area Networks (WBAN) with consideration of both the limitations of Quality of Service (QoS) metrics and dynamic link properties. The authors' simulation results showed that the proposed scheme improves the energy efficiency of WBAN without violating the QoS parameters such as packet delivery ratio, packet loss rate (PLR), and throughput as compared to other schemes such as TRAP, GA-TRAP, BAT-TRAP, UPA, TPC, and LSEPC.

The twelfth paper by Soldatos et al. [12] proposes a platform called SecureIoT to provide security monitoring, security analysis and security automation functionalities on IoT applications that involve smart objects. The authors claimed that the proposed platform enables the collection and analysis of security information from all elements of an IoT systems, including field, edge, and cloud elements. In addition, it allows for the flexible integration of different machine learning and AI models based on the modular and powerful mechanism of IoT security templates. To validate the functionalities, the authors used an Ambient Assisted Living (AAL) system that comprises socially assistive robots.

Now that we have summarized all accepted papers, we would like to thank the Editor-in-Chief (Professor Ramjee Prasad), Mr. Meertinus Faber (Project Coordinator) and Mr. Joseph Ian Reyes (Journal's Editorial Office Assistant) for their support, assistance and for giving us the opportunity to realize this special issue. We also would like to sincerely thank all the authors for their contributions and the subject matter experts for their time and efforts in reviewing the submissions to this special issue. We hope you will enjoy reading this special issue.

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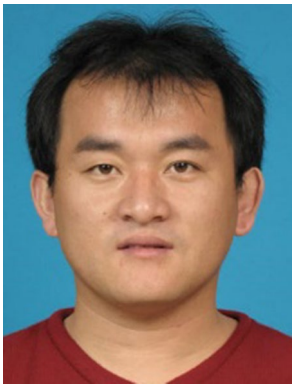

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