Engineering Universe for scientific Research and management
ISSN (Online): 2319-3069 **Vol. XIII Issue II**
February 2021

A REVIEW ON DESIGN OF INFORMATION SECURITY ISSUES IN HEALTHCARE IOT NETWORK

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ABSTRACT
The Internet of Things (IoT) makes smart objects the ultimate building blocks in the development of cyber-physical smart pervasive frameworks. The IoT has a variety of application domains, including health care. The IoT revolution is redesigning modern health care with promising technological, economic, and social prospects. This paper surveys advances in IoT-based health care technologies and reviews the state-of-the-art network architectures/platforms, applications, and industrial trends in IoT-basedhealth care solutions. In addition, this paper analyzes distinct IoT security and privacy features, including security requirements, threat models, and attack taxonomies from the health care perspective. Further, this paper proposes an intelligent collaborative security model to minimize security risk; discusses how different innovations such as big data, ambient intelligence, and wearable's can be leveraged in a health care context; addresses various IoT and eHealth policies and regulations across the world to determine how they can facilitate economies and societies in terms of sustainable development; and provides some avenues for future research on IoT-based health care based on a set of open issues and challenges.

Keywords: Internet of things, health care services, Networks architectures

1. INTRODUCTION

The Internet of Things (IoT) is a concept re ecting a connected set of anyone, anything, anytime, anyplace, any service, and any network. The IoT is a megatrend in next-generation technologies that can impact the wholebusiness spectrum and can be thought of as the interconnection of uniquely identi able smart objects and devices within today's internet infrastructure with extended bene ts.Bene ts typically include the advanced connectivity of these devices, systems, and services that goes beyond machine-to-machine (M2M) scenarios [1]. Therefore, introducing automation is conceivable in nearly every eld. The IoT provides appropriate solutions for a wide range of applications such as smart cities, traf c congestion, waste management, structural health, security, emergency services, logistics, retails, industrial control, and health care. The interested reader is referred to for a deeper understanding of the IoT. Medical care and health care represent one of the most attractive application areas for the IoT [6]. The IoT has the potential to give rise to many medical applications such as remote health monitoring, programs, chronic diseases, and elderly care. Compliance with treatment and medication at home and by healthcare providers is another important potential application. Therefore, various medical devices, sensors, and diagnostic and imaging devices can be viewed as smart devices or objects constituting a core part of the IoT. IoT-based healthcare services are expected to reduce costs, increase the quality of life, and enrich the user's experience. From the perspective of healthcare providers, the IoT has the potential to reduce device downtime through remote provision. In addition, the IoT can correctly identify optimum times for replenishing supplies for various devices for their smooth and continuous operation. Further, the IoT provides for the efficient scheduling of limited resources by ensuring their best use and service of more patients. Fig. 1 illustrates recent healthcare trends [7]. Ease of cost-effective interactions through seamless and secure connectivity across individual patients, clinics, and healthcare organizations is an important trend.

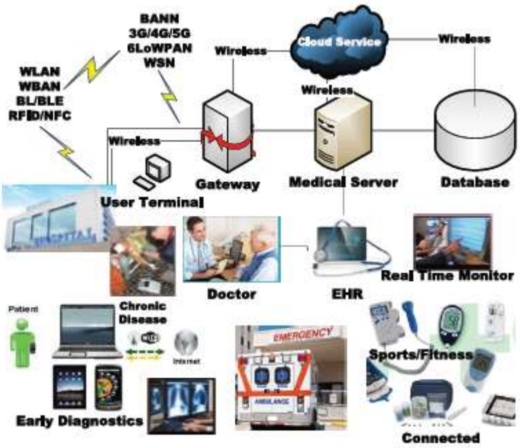

Fig. 1: Healthcare trends.

Networks driven by wireless technologies are expected to support chronic diseases, early diagnosis, real-time monitoring, and medical emergencies. Gateways, medical servers, and health databases play vital roles in creating health records and delivering on-demand health services to authorized stakeholders. In the last few years, this eld has attracted wide attention from researchers to address the potential of the IoT in the healthcare field by considering various practical challenges. As a consequence, there are now numerous applications, services, and prototypes in the field. Research trends in IoT-based health care include network architectures and platforms, new services and applications, interoperability, and security, among others. In addition, policies and guidelines have been developed for deploying the IoT technology in the medical field in many countries and organizations across the world. However, the IoT remains in its infancy in the healthcare field. At this stage, a thorough understanding of current research on the IoT in the healthcare context is expected to be useful for various stakeholders interested in further research. This paper examines the trends in IoT-based healthcare research and uncovers various issues that must be addressed to transform healthcare technologies through the IoT innovation. In this regard, this paper contributes by Classifying existing IoT-based healthcare network studies into three trends and presenting a summary of each.

- Providing an extensive survey of IoT-based healthcare Services and applications.
- Highlighting various industrial efforts to embrace IoT-compatible healthcare products and prototypes.
- Providing extensive insights into security and privacy issues surrounding IoT healthcare solutions and proposing a security model.
- Discussing core technologies that can reshape healthcare technologies based on the IoT.
- Highlighting various policies and strategies that can support researchers and policymakers in integrating the IoT innovation into healthcare technologies in practice.
- Providing challenges and open issues that must be addressed to make IoT-based healthcare technologies robust.

It should be noted that R&D activities in the field of healthcare services based on the wireless sensor network (WSN) [8], can be considered as initial IoT-based healthcare research efforts. However, the ongoing trend is to shift away from registered standards and adopt IP-based sensor networks using the emerging IPv6-based low-power wireless personal area network (6LoWPAN). If WSNs become a core part of the Internet, then a careful analysis is necessary. To better understand the evolution of WSNs toward the IoT and thus their fundamental differences.

2. IoT HEALTHCARE NETWORKS

The IoT healthcare network or the IoT network for health care (hereafter ``the IoThNet'') is one of the vital elements of the IoT in health care. It supports access to the IoT backbone, facilitates the transmission and reception of medical data, and enables the use of healthcare-tailored communications. As shown in Fig. 2, this section discusses the IoThNet topology, architecture, and platform. However, it should be mentioned that the proposed architectures in and can be considered as a good starting point for developing insights into the IoT network.

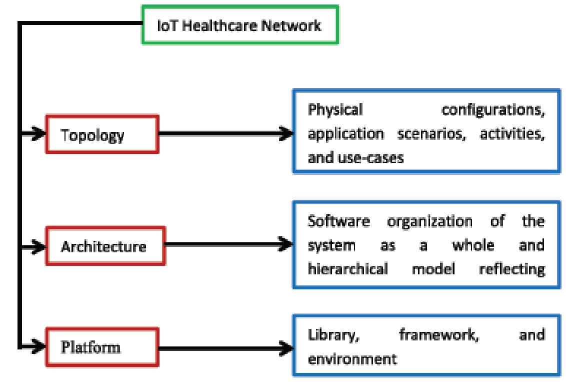

Fig 2: IoT healthcare network (IoThNet) issues.

IoThNet TOPOLOGY

The IoThNet topology refers to the arrangement of different elements of an IoT healthcare network and indicates representative scenarios of seamless healthcare environments. Fig. 3 describes how a heterogeneous computing grid collects enormous amounts of vital signs and sensor data such as blood pressure (BP), body temperature, electrocardiograms (ECG), and oxygen saturation and forms a typical IoThNet topology.

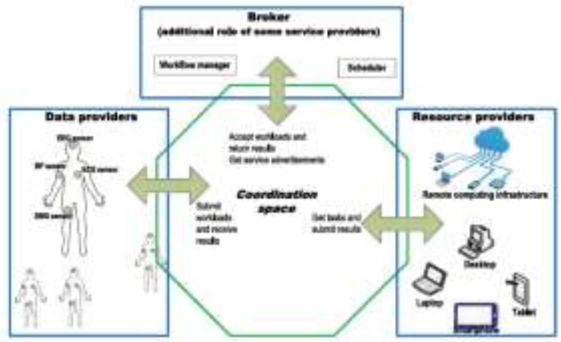

Fig 3: Conceptual diagram of IoT-based ubiquitous healthcare solutions.

It transforms the heterogeneous computing and storage capability of static and mobile electronic devices such as laptops, smartphones, and medical terminals into hybrid computing grids. Fig. 4 visualizes a scenario in which a patient's health pro le and vitals are captured using portable medical devices and sensors attached to his or her body. Captured data are then analyzed and stored, and stored data from various sensors and machines become useful for aggregation. Based on analyses and aggregation, caregivers can monitor patients from any location and respond accordingly. In addition, the topology includes a required network structure for supporting the streaming of medical videos. For example, the topology in Fig. 4 supports the streaming of ultrasound videos through an interconnected network with worldwide interoperability for microwave access (WiMAX), an internet protocol (IP) network, and a global system for a mobile (GSM) network as well as usual gateways and access service networks.

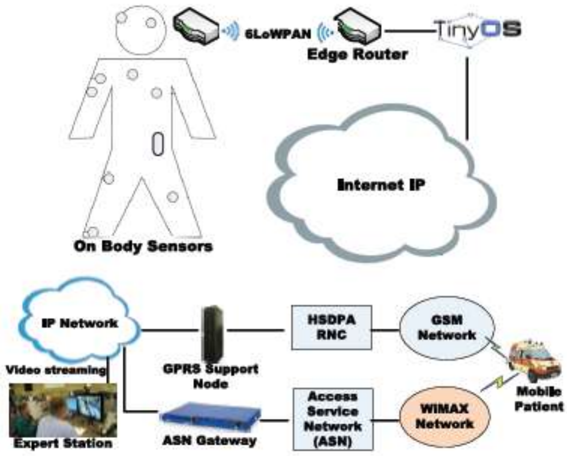

Fig 4: Remote monitoring in wearable's and personalized health care.

3. IoT HEALTHCARE SECURITY

The IoT is growing rapidly. In the next several years, the medical sector is expected to witness the widespread adoption of the IoT and nourish through new eHealth IoT devices and applications. Healthcare devices and applications are expected to deal with vital private information such as personal healthcare data. In addition, such smart devices may be connected to global information networks for their access anytime, anywhere. Therefore, the IoT healthcare domain may be a target of attackers. To facilitate the full adoption of the IoT in the healthcare domain, it is critical to identify and analyze distinct features of IoT security and privacy, including security requirements, vulnerabilities, threat models, and countermeasures, from the healthcare perspective.

P. Keikhosrokiani, N. Zakaria, N. Mustaffa, T.C. Wan, M. I. Sarwar, M. Swan and K. Azimi, (2015), in this paper, the assessment of IoT facilitated skills for physical condition and comfort; including sensors, functioning systems, growth and processing structure, and amalgamation policy is provided in [2]. In the same way, a comprehensive outline for wireless system is specified in [3], maintaining the perception of mobile healthcare applications. They assess a wide variety of communication skills including cellular, wireless LAN and satellite connections. They recommend diverse skills that can be utilized by planning the technical facility with the functional necessities. The instigator wind up with the challenges such as network overcrowding, elevated packet thrashing and suggested to little consistency, and non-deterministic presentation with the provisos of latency, interruption, or throughput, should be attend by the forthcoming superior wireless and cellular communication broadcast equipment, including 5G . [2-3]

S. R. Steinhubl, E. D. Muse, E. J. Topol and A. B. Labrique (2015), in this work, moreover methodological characteristic for information protection and service proposal, the managerial replica and profits replica comprises restrictive issue, which remains a challenge and also unlock investigation issue [3]. The European Commission recommended those insufficient reimbursement replicas are a barrier for innovative resolution in healthcare. Economic replicas for healthcare where reimbursements are acquired from “imprudent, disease stand concern” are supplementary hurdle for innovative services, providing slight motivation to execute practical explanation [34]. Modern approach concerning IoT, designed for HSCWB includes and considered usually for function markets. Direct developments have been constructive to express the probable. [3]

F. Vannieuwenborg et al. (2014), in this article, there is an effort to present the illustration of dealing replica in homecare that might be simulated on analogous services under improvement. Feasible profit replica is known for control services allowing for revenues since apparatus deal, preservation, and per-patient fees. Though, this experimental learning may not demonstrate verified industrial replica. Merely preliminary integrations of explanation among existing concern systems were recognized. Finding established replica in this region is demanding owing to the multifaceted surroundings of performer that are issue of strong teamwork, consequential in uncertain—and unbalanced—allocation of expenses and reimbursement, “frequently is the spend performer not the solitary which will promote the most.” This is a issue deliberated the acceptance of services. [4, 5]

S. Widén et al. (2015), initiated an additional policy reliant on the 5G communications organization which identifies the significance of service improvement “in multi stakeholder surroundings”. It acquires a systems’ amalgamation scheme for industry replica to provide the conversion in the technique for conveying healthcare that is convey by ICT. The suggestion is to develop flexible strategies that allow each actor to focus on its core competences; providing interfaces between different business roles [7]. This proposition is not supported by any empirical data and it is not clear how predefined business roles are compatible with innovation in the sector. However, the framework provides a common setup to develop and discuss roles and relationships; with emphasis on the technology providers. [6]

P. Gope and T. Hwang et al. (2016), proposed a Web of Things (IoT) has been broadly recognized as a potential arrangement to lighten the weights on healthcare frameworks, and has hence been the center of much later inquire about. A impressive sum of this investigate looks at observing patients with particular conditions, such as diabetes or Parkinson’s illness [6, 7]. Encourage inquire about looks to serve particular purposes, such as helping restoration through consistent observing of a patient’s advance. Emergency healthcare has too been recognized as an opportunity by related works but has not however been broadly investigated. [8]

S. H. Chang, C. F. Pasluosta et al. (2016), in this, a basic after reviewing this wide range of existing IoT-based healthcare system, several requirements for the design of such systems become apparent. Each of these papers emphasizes the utilization of sensors for observing quiet wellbeing. All watched wearable sensors, to be specific remote and externally-wearable sensors, as vital to their person frameworks. Various components, moreover suggested the utilization of natural or vision-based sensors around the home. Be that as it may, this confines the convenience of the framework to one physical area.

G. Wolgast, C. Ehrenborg et al. (2016), in this paper, novel existing systems highlight that communications are also essential for an Internet of Things healthcare system. In several existing system models, short-range communications, such as Bluetooth, are suggested for transferring sensor data to a Smartphone to be processed. Long-range infrastructure such as LTE is able to be used to reassign the processed information from the uncomplaining to the healthcare provider, typically a doctor, through SMS or the Internet. The key restriction with the purpose of smart phones typically has limited battery life, requiring frequent recharging; a patient with a flat battery would be a patient disconnected from healthcare providers. A low-powered node calculated specially for supervising healthcare information and it would be preferable.

4. CONCLUSION

Researchers across the world have started to explore various technological solutions to enhance healthcare provision in a manner that complements existing services by mobilizing the potential of the IoT. This paper surveys diverse aspects of IoT-based healthcare technologies and presents various healthcare network architectures and platforms that support access to the IoT backbone and facilitate medical data transmission and reception. Substantial R&D efforts have been made in IoT-driven healthcare services and applications. In addition, the paper provides detailed research activities concerning how the IoT can address pediatric and elderly care, chronic disease supervision, private health, and management. For deeper insights into industry trends and enabling technologies, the paper offers a broad view on how recent and ongoing advances in sensors, devices, internet applications, and other technologies have motivated affordable healthcare gadgets and connected health services to limitlessly expand the potential of IoT-based healthcare services for further developments. To better understand IoT healthcare m security, the paper considers various security

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