Survey Based Analysis of Internet of Things Based Architectural Framework for Healthcare System

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***Abstract*— Healthcare is an important gradation in life and IoT has made this healthcare a get-at-able, easy way to live. Its popularity in the world of technology and internet, IoT is increasing in every field of life with the health sector. Due to the hypnosis feature, IoT is becoming more focused in healthcare industry. However, although, it has not yet been implemented for the wider scope of hospitals around the developing countries. Among many IoT tools, IoT brings tools to strengthen the workplace such as health, safety, and the medical environment. In this paper, introduce and describing a comprehensive survey of IoT with respect to IoT Technologies, Healthcare methods, statistics, System architecture, enabling technologies, security and privacy issues and success case applied in healthcare. This paper will explore the relationship between Physical System in Healthcare (PSH) and IoT based Healthcare, both in which play the important role an intelligent Cyber world but IoT is the vital role. Moreover, we did a survey to investigate between the edge computing and IoT based Healthcare and discuss issues in edge computing. The results of the investigation can be applied in developing countries.**

Keywords— **Physical System in Healthcare (PSH), Hospital Management System (HMS), Survey, Internet of things (IoT)**

1. INTRODUCTION

IoT is an interconnected computing device, mechanical and digital machine that provides unique identifiers (Unique identifiers UIDs are commonly used within the healthcare industry. Reporting medical information with the patient's name, a personal code is created) to objects, animals or humans, and the ability to transfer data through a network, which can perform human-to-human or human-to-computer interactions. While connected to the Internet, the Internet of Things (IoT) seamlessly opens up a world of possibilities for treatment in this biodiversity. The advancement in technology has changed the world of thought as well as the development of smartphones and other handheld gadgets. Health is the root of all happiness.

Over the past few years, the modern technology and gadgets have been developed and developed to monitor critical resources in healthcare and other hospitals. But most of these systems are just maintaining a database of patients. Few of the hospitals have tele-health or health system, but these systems have just implemented telemedicine via the technologies of telecommunication, teleconferencing and video conferencing etc. Literature has shown that these systems lack quality and are expensive and we need a better communication and monitoring system. If we talk about HMIS from all around the world, there are some countries, which have better mobile patient care systems.

Firstly, we have discus the basic of IoT for Healthcare such as IoT Technologies, Healthcare Methods, System Architecture, Enabling Technologies, Security issues and success case applied in healthcare. Secondly, describe relation between physical and IoT in Healthcare. In the Physical system we need to physically attend our hospital and be treatment in our modern life. But IoT in Healthcare we don’t physically attend the hospital. So, we save our time and cost. Finally, we will analyze the Hospital Management system with real data.

1. USED OF IOT TECHNOLOGIES IN HEALTHCARE

The term of IoT (Internet of Things) defines a network connected to the physical objects through the Internet. These physical objects include technology to interact with the internal factors as well as the external environment.

1. *Radio Frequency Identification (RFID) Healthcare system* as is becoming more and more invested in RFID technology. So, that recent market research has revealed there will be exponential growth of RFID technology in that industry by 2021. One of the reasons that RFID is expanding considerably in the industry is the sheer number of applications that can benefit. In hospitals that have been outfitted with the technology, RFID is present in many forms – from tracking of surgical tools to tracking patients and staff.

Radio Frequency Identification (RFID)is a technology and system that transmits and automatically detects radio-based objects and people. RFID has the ability to capture data automatically without human intervention. RFIDs usually consists of readers, tags and middleware. RFID uses radio waves to conduct the tags and attached each physical object. The reader uses radio frequency signals to obtained data from the encrypted tag and data location (1) . Collected data sent to a Local Area Network a database installed server. Users can retrieve the data using an application installed on the server (Togt, Bakker, and Jaspers, 2011) [2]. While RFID has been implemented in Healthcare, limited adoption and use of RFID remains some challenge (Chong, Liu, Luo, and Boon, 2015) [3].

[**https://blog.atlasrfidstore.com/7-things-can-track-hospitals-using-rfid**](https://blog.atlasrfidstore.com/7-things-can-track-hospitals-using-rfid)

**CHALLENGES OF IOT IN HEALTHCARE**

**As much as the Internet of Medical Things seems to be revolutionary and highly-efficient, there are still some major challenges of IoT in healthcare this tech concept must overcome down the road. With large, game-changing integrations such as this one, there comes along a myriad of technical difficulties and adaptation issues. The main include:**

**Underdeveloped initiatives. Many IoMT initiatives directed at battling chronic diseases or other issues still need time to grow and develop. This technological niche as a whole must grow a lot in order to start providing regular enhancement results.**

**Possible lack of available memory. IoT sensors and devices can general colossal amounts of data, all of which is important and needs to be analyzed. This poses a question of huge data repositories that must hold all those volumes of info for indefinite terms.**

**Difficulties with regular updates. With so many hardware solutions comes as much software for powering and managing it all. This software must be timely updated in order to run smoothly and stay at its latest version. And here’s where constant updates will require lots of effort and might spawn many technical issues.**

**Personal sensitive data security. An IoT-powered medicine is a hardware-backed system that functions through the Internet. And online systems get hacked and breached. This spawns a chance of important private data being potentially undermined.**

**Global healthcare regulations. The IoMT still has to be approved by global healthcare regulatory bodies worldwide. This will take time and may keep many innovations at bay just because of some formalities.**

**ADVANTAGES AND DISADVANTAGES OF IOT IN HEALTHCARE**

**Considering the above-mentioned challenges of IoT in healthcare, there are, indeed, downsides as well as benefits when it comes to the medical IoT.**

**Advantages of IoT in healthcare**

**The ‘all-consuming’ connection of health devices and data centralization brings many significant benefits to the table, such as:**

**All-around technological enhancement. Rendering hospital visits unnecessary, passively accumulating and deeply analyzing important health data, etc. We’ve already pondered on all these advanced tech capacities galore enough. The IoMT provides space for fantastic long-term innovations.**

**Cost savings. One of the greatest advantages of IoT in healthcare is that efficient autonomous systems will cost less to manage and ‘employ’ in the long run. Things are even better when it comes to patient cost savings due to fewer hospital journeys as well as accelerated diagnostics and treatment.**

**Accessibility. Doctors can view all the necessary data on command and check real-time patient conditions without leaving their office.**

**Disadvantages of IoT in healthcare**

**Alternatively, some downsides that come along with the massive implementation of the IoT in healthcare include:**

**Privacy can be potentially undermined. As we’ve already mentioned, systems get hacked. Lots of attention will need to be focused on data security, which requires significant additional spendings.**

**Unauthorized access to centralization. There is a chance that dishonest interlopers may access centralized systems and realize some cruel intentions.**

**Global healthcare regulations. International health administrations are already issuing guidelines that must be strictly followed by governmental medical establishments integrating the IoT in their workflow. These may restrict possible capacities to some extent.**

**IOT TRENDS IN HEALTHCARE OF 2019**

**In 2019, there can be defined several IoMT trends implemented by majorities of startups worldwide.**

**Wearables continue to top the market. Major mobile technology providers like Apple and Android are enhancing and updating their authentic wearables, adding them with more health tracking features. And the rest of the world isn’t shy to follow the tendency, spawning numerous various-purpose mini devices.**

**Surgical robotics become a common reality. AI-powered, robotic surgical means show to be more precise than real doctors on more than one occasion. There are still limitations and risks involved, but the technology is definitely in the spotlight and is looking to become more widespread in the nearest future.**

**Integration of other prominent technologies with the IoT expands the horizon. AI, AR, Machine Learning, Big Data, blockchain, and smart contracts — all of that fuel up and expands the IoT powers even further. AI is already better and far more precise in predicting, for one instance, women’s breast cancer.**

**FUTURE OF IOT IN HEALTHCARE**

**Full-blown smart hospitals by 2020, mHealth as a regular, common thing on a global scale, and reduced physical visits to hospitals — this is only an approximate picture of the IoMT success. With that being said, as young as the concept is, it isn’t really regarded to be that novel by progressive hospitals of the now. Most of them are either implementing major IoT techniques and capabilities or already have enhanced parts that are in their calibration stage.**

**SUMMARY**

**Let us emphasize once more that the IoT can be nothing short of a revolution in the field as important on the global scale as healthcare. there are still many difficulties, peculiarities, and technological obstacles to overcome. And even though there are, currently, downsides as well as advantages to the concept, things seem to go very well for this technological innovation.**

**We are pretty confident that if you ask most medical professionals about their opinion on the subject, they will say that full IoMT integration and adaptation is the only logical way of development for advanced medicine of the future.**

**With that being said, enjoy the life-saving, health-improving fruits of the massive technological progress.**

[1] I. Erguler, “A potential weakness in RFID-based Internet-of-Things systems”, Pervasive and Mobile Computing, vol. 20, pp: 115-126, 2015.

2. Piet. J.M.Bakker Monique W.M.Jaspers, “Journal of Biomedical Informatics”, Volume 44, Issue 2, April 2011, Pages 372-383, Received 27 March 2010, Available online 17 December 2010.

3. Alain Yee-Loong ChongFelix TS ChanKeng-Boon Ooi,” Predicting RFID adoption in the healthcare supply chain from the perspectives of users”, Article in International Journal of Production Economics 159 January 2014 with 139 Reads DOI: 10.1016/j.ijpe.2014.09.03