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IoT applications and its security in the field of health

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Abstract

With the spread of technology and the advent of the Internet, a great change has taken place in the world, and with the increasing acceptance of the people, technology and technology activists are thinking of using the Internet in various areas of people's lives. The use of the Internet of Things in healthcare is growing day by day. Remote monitoring and clinical trial reporting have attracted new attention. Not only are patients looking for better solutions, but medical institutions are also looking for solutions to improve economic activity, reduce costs and risks, and increase security to improve the quality of health care. Undoubtedly, IoT technology has significantly changed the health industry. The IoT is constantly offering innovative tools with a variety of capabilities that aim to create an integrated health care system with the vision of ensuring better patient care and reducing costs. In this article, we review the applications of the Internet of Things and its security in the field of health, based on the latest publications and products available in the industry market. The results presented can be used as an important source of information for healthcare providers, researchers, technology professionals and the general public to improve the Internet of Things for healthcare.

Keywords: IoT, Internet Security, Health, Wireless Sensor Network.

Introduction

The Internet is a powerful global communication medium that provides access to information in various geographical, cultural and temporal areas. The Internet is a global system of connected computer networks that uses the Internet Protocol standard (IPV6 / IPV4: TCP / IP) to serve billions of users worldwide (2015, Madakam). The spread of the Internet has affected various dimensions of work areas. With the help of technologies such as locators, wireless communications and related sensors, it is possible to communicate between people and objects in any location. Following this trend, a wide range of new products and services have been created in various fields (Tawakoni et al., 2017). The development of powerful technologies such as Nano electronics, sensors, smartphones, cloud networks, network virtualization and software has given rise to the Internet of Things (IoT) phenomenon, which has been able to have a significant impact on many industries (2014). , Vermesan). The Internet of Things is a new evolution of the Internet in which objects are interconnected (2015, Farooq). This allows objects to perceive, communicate, and share

information over public or private networks using the Internet Protocol. These interconnected objects regularly collect and analyze data and provide information for planning, management, and decision making (2016, Patel). Devices can be identified and controlled through a new Internet called the Internet of Things. This new Internet connects the objects of the physical and virtual worlds to improve the quality of human life and provides better services (2014, Cubo-2015, Pasluosta). Objects in the physical world, such as devices and tools, have the ability to sense, activate, and interact, while objects in the virtual world, such as multimedia content and software applications, have the ability to store, process, and access (2020). , Behmanesh). Objects can be identified by EPC (Electronic Product Code) and accessed via the Internet (Uckelmann 2011). Today, thanks to widespread technologies such as communication technologies and smart portable devices, the Internet of Things has become a hot topic in all fields (2015, Catarinucci). Especially in healthcare, which is estimated to cover 40% of IoT devices by 2020 (2016, Dimitrov). The impact of the Internet of Things on human life is as great and significant as the impact of the Internet in recent decades, so that the Internet of Things is known as the "second Internet" (Montazeri et al., 2014). Due to the prevalence of information and communication technology in the health care industry, providing the same services to patients has increased with the increasing use of health care resources (2017, Bhatia). The IoT as a connected set of people, objects, Services and networks at any time and place (2015, Islam and2011, Bandyopadhyay). The Internet of Things is the most promising solution for the healthcare industry (2017, Joyia) that can transform the healthcare industry by improving operational efficiency, increasing the quality of various services and optimizing healthcare costs (Rghioui 2018). IoT-based systems are used for inpatients whose physiological conditions require constant intensive care. These monitoring systems send data from sensors to collect data wirelessly to the caregiver for further analysis and review, and the health professional monitors the patient's vital signs at regular intervals. This allows us to have an automatic and constant flow of information, thus increasing the quality of care due to constant attention, which in turn reduces the cost of care and the caregiver no longer needs to be actively and always Data collection and analysis should be present (Nouri and Mohammadian, 2016). Currently, an increasing number of patients are treated at home, mainly in countries such as Japan, the United States and Europe. Also, the number of older people has increased significantly in the last fifteen years, and these people are often present when they need treatment or care at home (2016, Mano, et al.) And the use of the Internet of Things can be of great help to such people. The Internet of Things (IoT) for healthcare systems today is essentially defined as a network of devices that communicate directly with each other and deliver critical data via a secure service layer (SSL) to a command server. And the central controller is connected and lets it share those needs with a closer look (Newley, 2013). Medical devices are producing various health data that should be stored in health information systems. Classified as Drug Monitoring, Vital Signs, Activity, Safety Signs, Patient Identification, and Laboratory Monitoring, these devices provide large chunks of data required by health information systems (2014, 2014). Fambon). The Internet of Things can be used in a variety of medical fields, including remote patient care systems, emergency alert systems, fitness programs, chronic illness, and geriatric

care. These can include health monitoring systems, artificial beats, wearable sensors, and hearing aids (Ghasemi et al., 2016 and 2017; Salunke and 2017; Baker). The Internet of Things (IoT) connects various types of sensors and smart devices using the Internet to collect data. The adoption of IoT technology in the field of medical care is very appropriate for physicians and patients, and disease monitoring and diagnosis will be more effective. Given the high value of medical data and the open nature of the IoT, the confidentiality of information is critical (Whitmore, 2015; Deng). The Internet of Things has made significant progress in recent years. Physical sensor networks are among the IoT-based devices that have made significant contributions to this technology. After being placed in the patient's body, these sensors collect information and send this data to the processing unit, thereby providing remote monitoring of the patient and the necessary measures to control in sensitive and critical situations. Performs patient health (2015, Dikman and 1396, Gholamnia). In healthcare, sensor and communication technologies, integrated with the Internet of Things, seek to strengthen traditional communication with patients to provide more efficient care (Atzori, 2010). On the other hand, in most research studies, the use of IoT in areas such as combining physiological wireless sensors and smart devices in daily activities, health monitoring, locating and tracking health-related objects, detection and collaboration Examined (2016, Jeong). In order to empower patients, the Internet of Things seeks to shift health care from centralized to ancillary, that is, to e-health. . By moving medical services from centers to homes, especially for the elderly or the elderly, in order to save time and reduce treatment costs (Pasluosta, 2015). According to the analysis, not all health systems are capable of providing security. The issue of security in health systems is very valuable and needs further analysis in this area (Gholamnia et al., 2017). Lack of rapid access to effective health monitoring systems may lead to many of the health risks that the entire world is struggling with today. But small and powerful wireless solutions with IoT connectivity have made it possible to monitor the patient without having to go anywhere. Using these strategies, patient health data can be collected with confidence, a variety of sensors and sophisticated algorithms are used to analyze the data, and as a result they are shared via wireless communications and physicians. Specialists give appropriate health suggestions to the patient remotely (Nouri and Mohammadian, 2016). Hospitals and health centers and health policy makers in countries have always sought to use new information technologies, the Internet of Things as an emerging information technology, has gained its special place in the health sector (health) has brought. IoT technology has a variety of applications in the healthcare sector, IoT applications in the healthcare sector (smart health) are:

1- Falling diagnosis: This application is focused on the elderly and disabled and seeks to help their lives, so that they can live independently.

2- Monitoring the physical activities of the elderly: By installing special devices, the physical activities and physiological condition of the people (especially the elderly) can be monitored.

3-Medical refrigerators (internal temperature control of protectors): Some organic elements must be stored in containers with special temperature conditions. The Internet of Things can do this well and create object interaction.

4- Athlete care: This application is used to measure weight, sleep, exercise, weight, blood pressure and other important parameters for professional athletes.

5-Patient monitoring: It is used for in-hospital monitoring, remote (especially elderly) or home care.

6- Management of chronic diseases: Caring for patients with chronic diseases, without the need to be present at the location of this technology reduces the presence of people in hospitals and the result is lower costs, reduced hospital stays and reduced travel. Is looking for.

7- Ultraviolet rays: Measure the ultraviolet rays and inform people not to enter certain areas or to avoid exposure to ultraviolet rays at certain hours.

8- Pollution control (hand hygiene control): By connecting devices such as RFIDs designed to measure contamination, environmental contamination or hands and body can be identified.

9- Sleep control: Devices that connect to the person, detect symptoms such as heart rate, blood pressure, etc. during sleep and this data can be analyzed after collection.

10-Dental health: Bluetooth-enabled toothbrushes that record people's brushing information with the help of smartphone applications, and based on it, a person's brushing habits can be checked as personal information or statistics can be checked with the dentist. Shared (Ghasemi et al., 2016).

IoT is predicted to activate many health care services, each of which offers a set of healthcare solutions. There is no standard definition of IoT services in health care. Therefore, there may be cases in which services can not be separated from a particular solution or application. The public services and protocols required for the IoT framework are likely to require minor improvements to their proper implementation in the healthcare and healthcare sectors. These services include alert services, resource sharing services, Internet services, communication protocols between heterogeneous devices, and link protocols for primary communications. Quick, easy, safe and low consumption of these devices and services can also be added to this list (Nouri and Mohammadian, 2016). Some solutions have been developed with low-cost technology, such as the prototype proposed by Lima et al. (2016, R. Lima et al). Upon receiving the preprocessed information, the monitoring system displays it in a simple and integrated way. The results show the improvement of people's quality of life. An embedded system capable of measuring blood with low-cost technology proposed by (2016, E.C.S.Dantas). By a host device, the stored data is displayed properly on a web page. Health care providers can easily access information by accessing the Internet. A remote monitoring system of body pressure has been proposed by Matar et al. (2016, G.Matar et al). This system is suitable for studying sleep studies, surgical procedures and anesthesia, and other issues that want to determine the position of the body while lying down. Non-invasive glucose levels are provided by Istepanian et al. (2011, R.S.H. Istepanian et al)., Who is responsible for sending patient information to health care professionals in the shortest possible time. A system that examines knee curvature in all patients with knee arthroplasty has been proposed by Msayib et al. (2017, Y. Msayib et al). Angle curvature data generated during activity are sent for remote analysis and avoid the need to go to the hospital several times a week. Also, an mHealth platform that is able to monitor patients seeking cardiac rehabilitation has been discussed in a review by Kitsiou et al. (2017, S. Kitsiou et al). The data collected for remote access is sent to the cloud by healthcare providers. The body sensor platform is discussed by Khan. The sensors are connected directly to the user's smartphone to receive the collected information. Data is processed and stored in the cloud to enable

access and monitoring by healthcare providers (S.F. Khan, 2017). Qi et al. Have published a comprehensive IoT review that can personalize healthcare systems (PHS), current work at the IoT, and successful technology and studies in healthcare. In addition, it considers the main challenges and future perspectives on IoHT (2017, J.Qi et al).

However, the technological features commonly used in current IoT applications are not clear to everyone. In other words, the existing capabilities or weaknesses of IoT applications have not yet been explored. Therefore, it is necessary to clarify the current technological features of the IoT by examining the IoT literature. IoT security: The Internet of Things is making significant progress in our ecosystem in terms of social development, economic benefits, and mental activities. On the negative side, the Internet of Things can be used as a platform for large-scale, distributed and destructive cyberattacks, which can have serious consequences. If left unmanaged, they can be left astray and lose the right path. n 2015, for example, researchers at a security company called Rapid x found that twelve child monitor camera models from eight manufacturers had significant weaknesses. These vulnerabilities can be exploited by hackers to perform malicious actions such as monitoring live video, feeds, changing camera settings, capturing saved video clips, and even giving remote control to other hackers. Thus, by seizing a significant number of connected devices, cybercriminals can build large botnets and exploit them to launch security attacks. Large-scale information systems are often distributed in the form of a denial of service attack (2020, Guardian).

Research method

The present study falls into the category of applied studies in terms of purpose. This type of research is a research that uses the results of basic research to improve and perfect the behaviors, methods, tools, tools, products and patterns used by human societies done. In fact, the purpose of applied research is to find a solution to an essential problem that society or commercial and industrial organizations face. The principles and methods of conducting applied research are similar to basic research, which means that in this type of research, the studied samples are selected randomly and the results of the research on the sample group are generalized to the community from which the sample was selected. It will be given. In terms of how to collect information among quantitative research, it is a non-laboratory descriptive type, and since to weigh the applications of the Internet of Things in the health sector, the hierarchical analysis process is a one-time survey descriptive. The statistical population of the study includes the field of health and treatment of people familiar with IoT technology. Due to the limited number of experts and people familiar with this field, the snowball method was used.

In the present study, in order to collect information, library methods and questionnaire methods were used. The method of the questionnaire is that the questionnaires were designed in the form of hierarchical analysis technique and paired comparisons. Therefore, in some cases, they were completed in the presence of the researcher and during the interview. Sufficient time was also given to the respondents to complete the questionnaire. The IoT questionnaire has four sections. The first part includes personal information and social status, which includes age, occupation, gender, education, specialization, level of work

experience. The second part includes the IoT information brochure, which provides a brief description of the IoT for respondents with little knowledge of the field. The third part includes the attitude questions or intellectual preferences of the respondents to the category of IoT technology, which includes 4 questions. In setting it, the five-point Likert method (from very low to very high) is used. The fourth section contains a guide to answering questions. The validity of the tools used in this research is in a sense a kind of logical validity or content that is related to the method used. Since the questionnaires were based on hierarchical analysis, an index called incompatibility index is used for the reliability of the questionnaire. If the incompatibility index is less than 0.1, the resulting execution can be cited.

Findings

In the first part of the research questionnaire, the personal characteristics of the respondents are asked. At first, we draw many tables and diagrams using the output of SPSS software. Personal characteristics include gender, specialty, age, education, respectively.

Table 1: Sample frequency distribution by gender status

Cumulative frequency percentage	Frequency	Abundance	Level	Qualitative variable
55	**55**	**11**	**Man**	**Gender**
100	**45**	**9**	**Female**	
	100	**20**		**Total**

Table 1 shows that 55% (11 people) of the study sample were male and 45% (9 people) were female respondents

Table 2: Frequency distribution in the sample by specialty

Cumulative frequency percentage	Frequency	Abundance	Level	Qualitative variable
45	**45**	**9**	Working in a hospital	Expertise
85	**40**	**8**	University professor	
100	**10**	**3**	Information Technology	
	100	**20**		**Total**

Table 2 shows the distribution of expertise of selected individuals in the sample, which are divided into 3 groups. In this table, 9 people (45% frequency) have a job in a hospital, 8 The infrastructure built by the body wireless network, personal server using intelligent digital assistant, and medical server classes people (40% frequency) are university professors, 3 people (15% frequency) has worked in the field of information technology.

for the remote care system is shown in Figure 1.

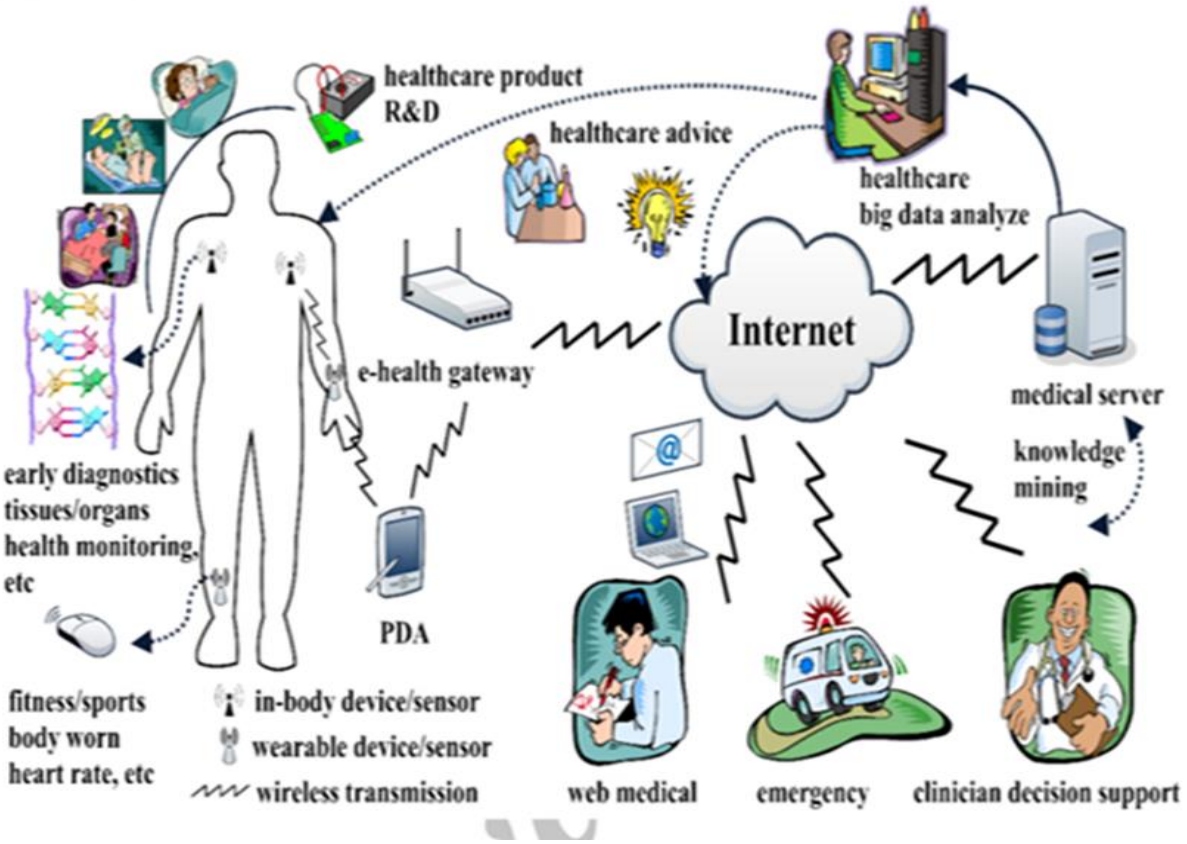

Figure 1: Remote health care monitoring System

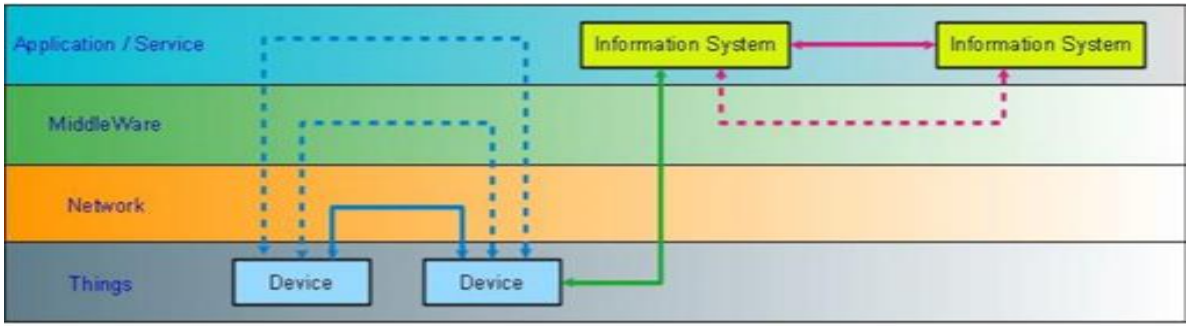

Figure 2: 4-layer IoT model (connection of devices with information systems)

According to Figure 2, there are three types of communication between IoT-based devices and information systems:

2-1 Machine-to-machine communication: When Woo-sensors communicate with each other to send, receive data, and control commands, the network layer receives information about the sensors and transmits information to standard communications protocols. Another device appears. More complex devices may need to use middleware to transfer the generated data or send control commands, which is done with the help of the middleware layer. Also, in order to use services and services in more advanced devices, the service application layer is used.

2-2 Machine communication to the information system: This communication will be two-way in order to receive the data generated from the devices as well as more advanced controls through the information systems. The information received from the devices enters the middleware layer through the network layer. If necessary, data filtering, semantic analysis and other necessary operations to prepare information for the application layer, the operation will be performed in the middleware layer. The application layer also provides the services required to provide the information system.

3-2 Information system communication to information system: In this model, communication between information systems to exchange information, integrate and produce the required services is done through the application / service layer. The middleware layer will also be used if you need to access cloud storage databases; Because some device manufacturers use their own cloud storage system to store data received from devices (2020, Ayani).

Currently, IoT security relies heavily on security mechanisms provided by existing network infrastructure and technologies. We can say that all the security issues of the Internet and computers have become the security issues of everything because the Internet of Things turns the security of the Internet into the security of everything. Therefore, there is a serious need for a comprehensive study of IoT security issues in general and IoT attacks in particular.

Discussion and conclusion

The findings of the present study showed that health care systems can be placed in three dimensions including "community communication levels", "diagnostic and treatment protocols" and "IoT infrastructure".

According to these findings, in the field of health care, there can be three types of communication from information system to other information system, machine to information system and machine to IoT-based objects. The importance of IoT applications in the field of health care contributes to the policy and investment of institutions and higher authorities in the field of health care at the macro level and medical centers and hospitals at lower levels. Compared to the results of other studies, it can be said that in the research of Ghasemi et al. (2016, Ghasemi), among the ten applications mentioned by the European IoT Research Cluster (IERC), chronic disease management, patient monitoring and pollution control have priority. They were and the importance of chronic disease management is in line with the results of this study and the importance of factors such as drug incompatibility and child care and access to patient data is the distinguishing feature of the findings of this study. In the research of Tavakoli et al. (Tavakoli et al., 2017), Using a survey of nurses and physicians of Shahid Rajaei Hospital in Tehran, it was found that periodic collection of patients' vital signs, chronic disease parameters, information management and remote services affect organizational performance. The impact

of IoT applications on hospital performance is in line with the importance of healthcare applications. The study by Baker et al. (2017, Baker) provides an overview of the challenges and technologies in the field of Internet of Things for achieving smart health. The applications mentioned in this study were in line with the applications of the present study. In the research of Salun Nek Wankar (2017, Salunke), Islam et al. (2015, Islam), the capabilities and technical cases of using the Internet of Things in the health and architecture industry and its executive infrastructure have been mentioned. The use of remote control technology for patients and the evaluation of their information has been in line with the important aspects of the use of the Internet of Things as a leading outcome.

According to the subject and purpose of this study, which is the identification and applications of IoT and its security in the field of health, it is suggested for future research that feasibility studies of IoT technology and its executive infrastructure in the field of health at the national level. Be evaluated. Also, to review and compare the use of IoT technology in Iran with other countries.

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