The Role of the Internet of Things to Enhance the Medical and Health Fields

Mokhtar Shouran[1,2], Jabir Massoud[3]

[1] Department   of Control Engineering, College of Electronic Technology, Bani-Walid, Libya

[2] Wolfson Centre for Magnetics, Cardiff University, Cardiff, United Kingdom

[3] Faculty of Computing, Engineering and Science, University of South Wales, Pontypridd, United Kingdom

Abstract

This paper focuses on the use of Internet services to provide better health facilities to patients. It also includes a brief description of the various ways in which the Internet can be used to increase medical facilities' efficiency and effectiveness, in other word better health facilities. The potential disadvantages of introducing the Internet in medical services are likewise explained. This paper shows various measures that can be taken to improve the quality of medical services by eliminating loopholes from the Internet of Things (IoT): the system of internetworking devices to exchange and gather data.

Keywords: Internet Services, Medical Services, Health Facilities, Internet of Things (IoT).

1. Introduction

New technology research has evolved the ways in which the Internet is used. It impacts how humans live, and how we carry out tasks – whether large or small, and whether personal or professional. The interconnection of multiple devices through the Internet – with the aim of managing various devices, digital equipment, and other tools to accomplish multiple jobs – is called the Internet of Things (IoT). The Internet of Things impacts every aspect of life, spanning all the way from how life is led to the ways in which work is done. Due to technology developments in the medical and health field, the Internet of Things is now applied to all sectors of the industry. The introduction of technology has paved the way for the enhancement of medical services, allowing providers to offer their patients better health services via smart devices and systems that work automatically according to pre-fed commands. Smart devices are enabled to connect to the Internet, allowing them to search for relevant data and information and download it efficiently, whenever this is required. In the sector of medical and health services, the Internet of Things is providing a wider scope of and even hope to doctors, facilitating their ability to render safer and better health services to patients even in their absence. Given this context, the researcher will apply information collected from various case studies to this study, along with providing details that are relevant to the medical and health services sector.

The primary aim of this work is to study the significance of the Internet of Things, and its role in the field of medicine and healthcare. Future perspectives on the Internet of Things – in terms of its ability to provide proper assistance to the evolution and development of the medical and healthcare field – are also evaluated. Potential hindrances, risks and dangers associated with the use of the Internet of Things are likewise discussed, along with suitable solutions.

To achieve the study's overall aim mentioned above, the authors have accomplished the following objectives:
1- Identifying the significance of the role of the Internet of Things, in the medicine and health field.
2- Describing the related hindrances, risks, and dangers of using the Internet of Things.
3- highlighting relevant methods and solutions to eliminate the issues that may arise when using the Internet of Things.

2. Methods of Research and Analysis

In this study, a systematic review was completed to determine which methodology was most suitable to derive the data and accomplish the aims and objectives of the research study. In order to retrieve the relevant data, the researcher has

scrutinized multiple research studies and finally selected a few of them to apply to this research study. The entire process is further discussed in detail, to provide the exact information for the research study [1].

For this research work, the authors have reviewed multiple journals and conference papers that are published across the globe. The motive for assembling the data from multiple research journals is to facilitate the study with a generous amount of authentic information. The databases used to derive information to address the research question include: Web of Science, PLOS ONE, IEEE Explore, IEEE Conference Publications, and Science Direct Journals. These databases were all searched to retrieve articles, relevant data has been assembled from selected number of them.

In this paper, relevant data is evaluated to explore the significance of the Internet of Things in providing improved medical and health services. The availability of data from different regions shows that the Internet of Things is accepted on a large scale around the globe, and that is adaptable to various contexts. The manner of implementing the Internet of Things into the system is also a matter of concern. This preoccupation is revealed in the journal articles, as are various other perceptions of people involved in the system [2].

The variety of tools and analytical methods have been adopted for the research paper that have guided the work to deliver such data which was helpful in achieving the aims and objectives of the work. Upon completion of this paper with the adequate amount of information, the authors have discovered that the process of implementing and adopting the Internet of Things has brought up various problems and challenges, which may be experienced when IoT is implemented into medical and healthcare systems [3].

3. Literature review

An explanation of 'how and when' of the introduction of Internet and technology to provide medical aid and ensure better health for patients is stated in [4]. At the initial stage, technology was used to reduce the number of errors and enhance efficiency by installing automated systems. In addition, health services are facilitated via multiple devices that are available with IoT. Indeed, IoT is enabling doctors to handle activities such as diagnosing, remote surgeries and monitoring the health of patients via Internet connections. Figure. 1 gives a brief picture of utilizing IoT in health care.
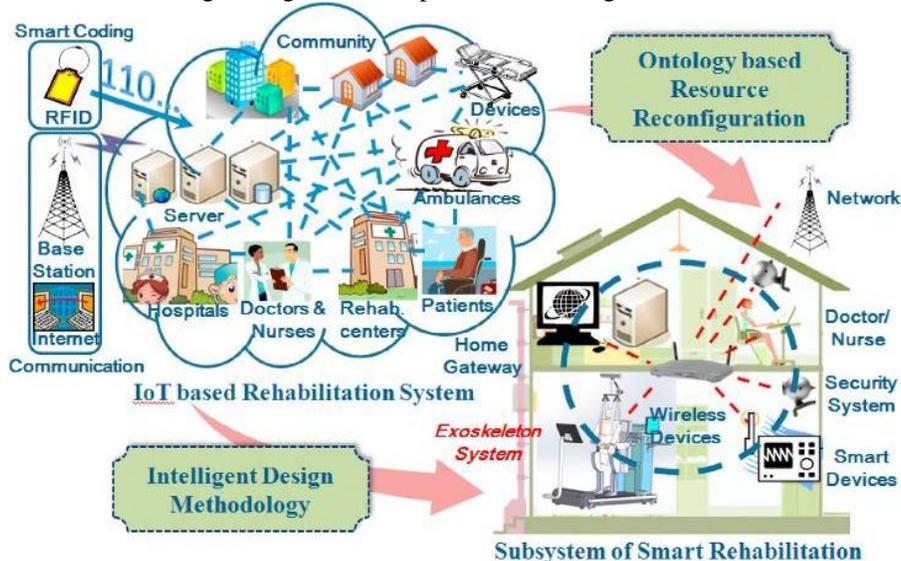

Fig.1 The framework of IoT.

Atzori, Iera, and Morabito originally described the concept of the Internet of Things. They have described it as a version of the Internet that is unified with various technologies and devices. These may be wired or wireless, and can connect to other networks, along with improved communication protocols. Technology and the Internet are intertwined in fields such as telecommunication, social science, medicine, electronics and information. IoT is a concept that includes two components: one is a network (the Internet), while the other is an object (devices or 'things'). The connectivity or relation between these

two is the Internet of things. Connecting various devices through the Internet is the prime motive of this paradigm, and their connection is not confined to a limited area or place but involves the entire world. Each IoT device is provided with a unique IP address, so that it can be properly represented whenever needed the same idea for medical equipment [5]. Figure.2 The relationship of Internet of Things and Health Administration.
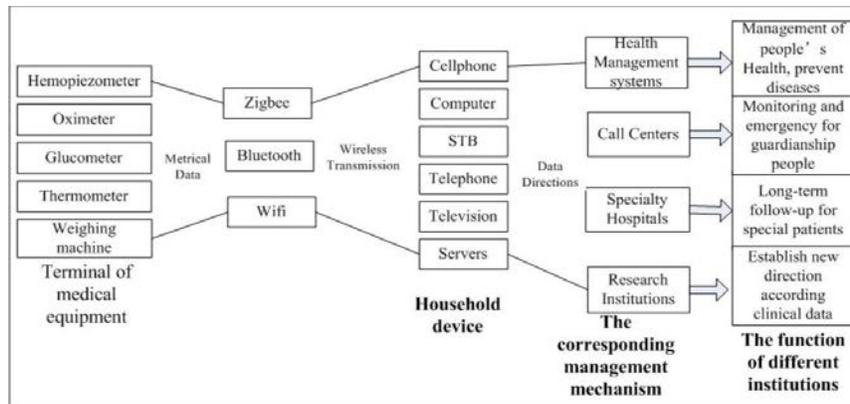

Fig.2 The relationship of Internet of Things and Health Administration.

3.1 Role of the Internet of Things in Industries

The implementation of the Internet of Things in medical and health industries and its utilization – alongside radio-frequency identification (RFID), sensor devices and mobiles – is suggested by Xu, He and Li. The use of IoT in industries has increased in recent years. Various industries have foreseen the benefits attached to IoT and have started integrating it into their systems, connecting devices through the Internet and enabling industries to operate smoothly with minimal human interference. The system of IoT involves four levels or layers that allow industries to adjust to the new technologies and networking systems. The first level includes recognizing the existing devices, whereas the second level involves connecting and transferring data through wired or wireless connections. The third level involves providing services to the users, as per their needs. The final, or interface, level focuses on providing users with multiple methods through which they can interact and connect with other applications [6]. IoT process is shown in Figure. 3.
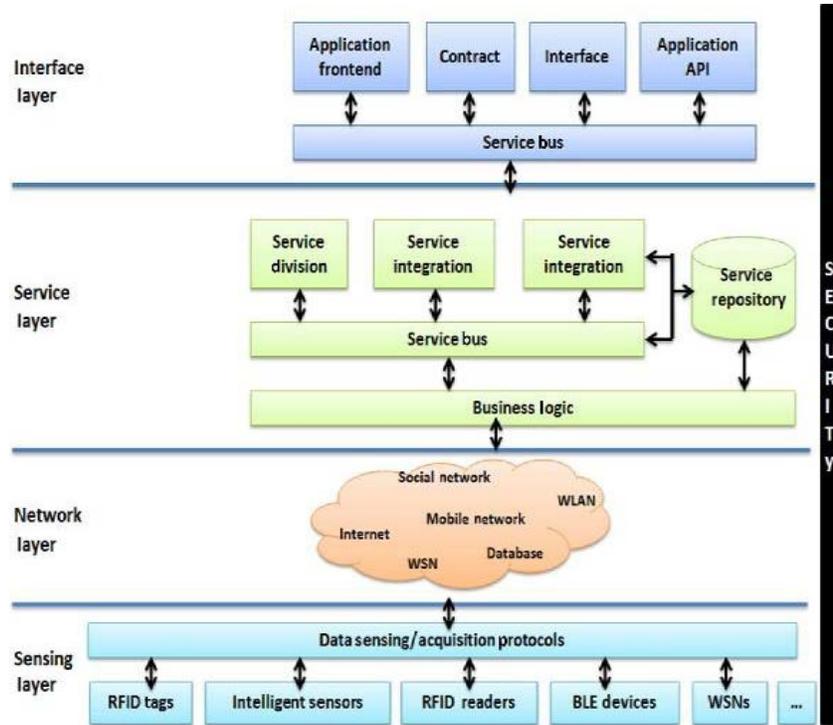
Fig.3 IoT Process.

3.2 Application of IoT

Hu, Dan and Shen have highlighted the ways in which the Internet of Things is included in the system of medical and health services, along with its application to the system to enhance the quality of services provided. It provides details about how the Internet of Things is applied, in the health and medical care fields, to the management of both medical equipment and methods for controlling medication. Integration of IoT into these systems can ease the work of managing patients' details and medical histories, as well as details related to the medication with which they are provided. In addition, medical emergencies can be managed with the aid of RFID technology, which can efficiently identify the exact information a doctor needs to know about a patient at the time of emergency, without taking up much of their time [7]. Figure. 4 Medical and health services Via IoT.
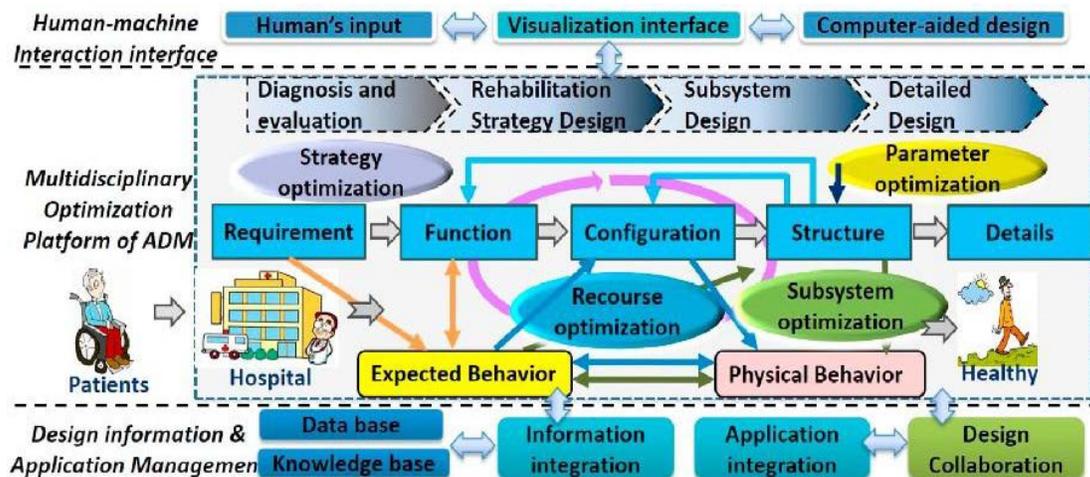

Fig.4 Medical and health services Via IoT.

3.3 Exploiting IoT technologies to enhance healthcare services

Koop et al. have discussed the model for distributing medicines and other health services from centrally-located hospitals to neighbourhood homes and patients, using computers. They use computers to connect with patients via a telemedicine system, which can efficiently provide health services at low costs to a large number of citizens, using fewer efforts. Moreover, the resources of the country are saved, this will help provide real-time information to concerned individuals as this will be helpful to avoiding biological natural disasters by allows to the patients [8].

Mano et al. have discussed the issue of the increased number of patients in countries like the USA, Japan and Europe. In these countries, the number of patients has increased, and includes more elderly people. The need of in-home treatment has likewise increased, and IoT technology is facilitating appropriate opportunities to provide health services at home. Devices that can efficiently recognise faces and emotions are installed in mobile phones or computers, helping medical personnel to identify a patient's condition and to provide proper in-home health care in a timely manner [9].

3.4 Virtual Cloud Carer Project

As described by Gachet et al., the Virtual Cloud Carer project (VCC) is a system that focuses on providing medical facilities to elderly people. This project will develop devices that are integrated with inbuilt sensor technology to detect patients' exact medical conditions, in a way that is adaptable and easy to understand for elderly patients. The system is efficient at conveying the data to the Internet through a sensor placed on a mobile phone. For patients with physical disabilities, the sensors have subsystems that are enabled with detection systems that are helpful in their rehabilitation. The integration of the Internet of Things with the VCC project has facilitated the system of providing in-home medical and health care services [10].

3.5 Effective Ways to Use the Internet of Things

Ullah, Shah and Zhang have provided information on how the Internet of Things can be efficiently used to facilitate integrated, interconnected systems that aim to effectively manage and provide data to doctors. The authors' paper covers key points related to the existing data that is available about the IoT. It also discusses specific practices that are involved in facilitating medical and health services. This work focuses on interpreting effective ways to deploy IoT technology to manage the data online and record the condition of the patient. A new semantic model is suggested to medical personnel who will then apply the new model to better serve their patients for enjoying the benefits arising out of IoT, which is called e-Health [11].

In their work, Yu et al. have shown the demand and charges associated with electric vehicles such as an "ambulance" and data centers. The methods for controlling the charges and saving energy are discussed in this paper. To manage the overall cost of the transactions and maintain the system, the data is collected related to the workload, electric vehicle energy demands and electricity prices. The calculations related to the relevant data are collected and presented in this paper [12].

3.6 The Cloud-assisted Industrial Internet of Things

Hossin and Muhammad in [13] shows how patient information is collected and then fed into a cloud system, from where it can be accessed by doctors to manage the health of their patients. Reports related to ECG's, along with other issues related to the health of a patient, are collected through a mobile phone sensor and delivered to the health care professionals. This system is evaluated with the help of experimenting it and provided with sufficient aid in monitoring the health of patients as showing in the Figure.5.
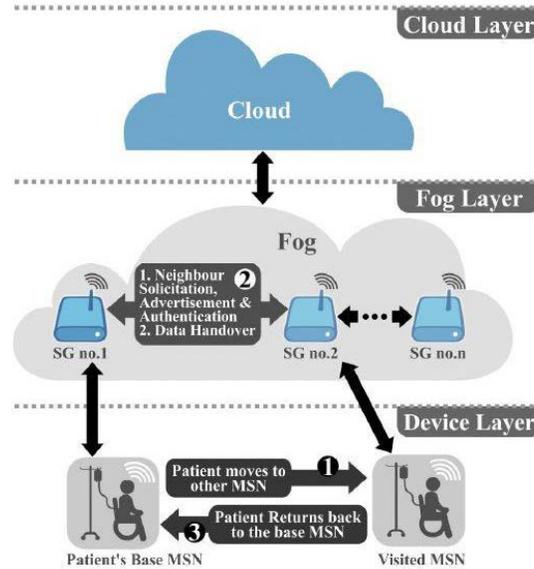
Fig.5 Cloud-assisted Industrial Internet of Things.

4. Discussion of the Advantages of the IoT and outstanding Issues

In the initial stage, as noted, technology was used primarily to reduce errors and enhance efficiency by installing automated systems that facilitated improved health care in a cost-effective manner. Health services are now being further facilitated by the continual development of a combination of IoT devices. To date, for example, the Internet of Things has enabled doctors to handle various tasks, such as proceed remote surgeries and keeping a regular check on patients' health via Internet connections. The Internet of Things can thus play a vital role in medical and health care services [4].

The Internet of Things has been defined as the result of integrating physical objects (e.g., smartphones) with technology that is capable of exchanging data. As noted, it can be used to develop more efficient healthcare systems, in terms of cost, time and energy. By embedding specialised technology in IoT-enabled devices, healthcare professionals will be in a position to monitor their patients more efficiently, and to utilise data extracted from the devices for more effective patient care. IoT can also enable healthcare professionals to develop a system of proactive management, as prevention is always better than cure [14].

The incorporation of Internet of things in different sectors of healthcare has also been suggested, as has its use along with radio frequency identification (RFID) and sensor devices. Various sectors have begun to experience the benefits associated with incorporating the Internet of Things into their systems one of which is health sector. They have thus started making consistent efforts to integrate their systems with Internet-enabled technological devices, to facilitate smooth functioning with minimal human interruption [15]. The system of the Internet of Things consists of four layers that permit industries to adjust their operations to networking systems and innovative technologies. The initial level includes identification of existing devices. The second stage involves establishing connectivity and then transmitting data through wireless connections. The third level is committed to rendering services to the users, according to their needs. The final level provides users with multiple methods by which they can connect and communicate with other applications [6].

Higher-quality services are a key objective for the use of the IoT in healthcare. IoT can simplify the management of patients' personal details and medical records. Through the use of RFID, medical emergencies can also be managed in a well-organised manner. RFID has proven to be efficient in identifying accurate information in a time effective manner through IoT; this is vital for doctors in emergency situations [7]. These applications likewise contribute to the importance of IoT in healthcare.

As noted, the demands and charges associated with the use of Internet of things are high. However, certain methods can be used to minimise charges and save energy related to data centres and electric vehicles. To manage the system and control overall costs, relevant information should be collected, regarding electric vehicle energy demands and electricity prices. After collecting the relevant data, appropriate strategies should be developed and implemented to optimise the use of technology and deliver the best results [12]. Information related to patients' health can also be collected and stored in an IoT cloud system, from which healthcare professionals can retrieve data to monitor patients' condition. ECG reports and information related to patients' health are collected with the help of mobile phone sensors [13].

Although IoT has improved the efficiency of health care services, there are several challenges that are encountered by IoT users. As noted, one of the major issues with IoT is that these devices are unsafe to use if and when patients' information, stored on the Internet, is easily accessed by a large number of people. Criminals may then use this data to fulfil their own illegitimate objectives [16]. Thus, along with an awareness of the benefits of IoT – both current and potential – for healthcare, healthcare providers and doctors should also search for possible issues that may affect the performance and of the systems and sensors that are used, and should work to ensure the security of patient and other data [17]

4.1 Outstanding Issues

Many challenging issues still need to be addressed and both technological, as well as social knots, have to be untied before the IoT idea being widely accepted and used. Most individuals are worried about the disclosure of their personal information, and they have many concerns, such as what is the data that will be collected about them and who will this data. For instance, just the information that related to their health or everything about them. To date, there has been little agreement about utilising of the internet of thing due to the concern have been raised about the safety and security of prolonged use of Internet of things in Health and medical field. Although, there are many actions that have been taken and many solutions are proposed to tackle these issues, they still stand out.

4.2 Data Management Problem

IoT organisations will create vast amounts of information that should be handled and analysed in real time. Preparing extensive amounts of IoT information continuously will increment as an extent of workloads of data centres, leaving suppliers confronting new security, capacity and examination challenges.

4.3 Security Problem

The IoT is to some degree powerless against attacks for several reasons. To start with, often its elements invest a large portion of time unattended; and for this reason, it is not difficult to attack them physically. Second, a large portion of the communications is wireless, which makes spying very possible. At long last, the greater part of the IoT segments is described by low abilities as far as both vitality and processing assets (this is particularly the case for aloof segments) and accordingly, they can't actualize complex plans supporting security.

4.4 Privacy Problem

One of the key concerns that accompany the Internet of Things is the privacy breaches, when everything is on the internet it will be continuously there. Obviously, there are security actions that are made to keep the information safe, but there is always opportunity for the hackers to exploit the system weaknesses and manipulate or steal the data. Hence, people could hack into it, if all of the information is stored on the internet and find out almost everything about persons lives. Likewise, businesses could misappropriate the data that they are assumed to access. This is a shared mishap that happens inside businesses all the time.

4.5 Insecure Cloud Interface

Insecure cloud interface is existing when easy to detect identifications are utilise or account list is probably. Unconfident cloud interfaces occasionally are easy to disclose by just revising the connection to the cloud interface and determine whether the type of connection SSL is in use or by utilising the password reset mechanism to recognise effective accounts which could lead to account enumeration.

4.6 Insufficient. Authentication /Authorization

Authentication could not be adequate when easy to predict passwords are used or are protection not strong enough. Inadequate authentication/authorization is predominant as it is assumed that interfaces will only be visible to users on inner networks and not to exterior users on different networks. Shortages are regularly found to be present among all interfaces. Several Issues with authentication/authorization are easy to determine when investigating the interface manually and could also be exposed through automatic testing.

4.7 Research Gap, Future Research Suggestion, and Recommendations

A thorough analysis of the various researchers' reports has been conducted, and it can be concluded that these research studies are rich in content and are able to address many issues related to the use of IoT in healthcare. However, they fall short in thoroughly covering a few of the issues, such as the practical implementation of IoT in the health sector. For example, it may not be easy for all patients and staff to efficiently use computers and other IoT-enabled devices. Another issue that was insufficiently explored in the reports was related to the proper functioning of IoT at various levels, ranging from hospitals to companies, industries, homes for the elderly patients, etc. Improper coordination amongst these levels can have a powerful negative impact on the performance of doctors and on their patients' health outcomes, wellbeing and comfort. Further research would be useful, to cover these gaps in the existing literature.

The following recommendations are proposed to enhance the use of the Internet of Things in health and medical care:

1-The healthcare industry is facing many challenges and pressures in almost every aspect of operation – from equipment and time management, to inventory monitoring and tracking patients – and accountability levels must by nature be very high. Hospitals and other health care providers should implement efficient IoT solutions such as mobile scanners and RFID technology, by connecting with cloud technology. This will help provide real-time information to concerned individuals, which is essential to ensuring the right data and tools are available to medical professionals and hospitals, at the right time and place.

2- Health care professionals and staff members need to have access to the right equipment at the proper time, to provide the best possible care. Along with this, hospital staff members should have the capability to allocate proper time to addressing patients' needs, rather than being forced to spend large amounts of time on documentation. Health care professionals should therefore make use of wearable technologies, mobile devices and comprehensive electronic medical data stored in such devices. This can help ensure that they devote less time to performing unnecessary documentation tasks and eliminating errors, and that they have sufficient time to focus on patients' illnesses. Through the efficient and thoughtful use of IoT solutions, healthcare institutions can gain access to relevant information on a real-time basis, to improve patients' experiences and health. IoT can also simplify the task of integrating data from consumer devices, like IoT-enabled hospital bands, helping organizations to collect more of the right kind of data and to provide quality care.

3- To gain a competitive edge over others functioning in the industry, health care organizations should implement technological solutions to capture and analyze data that helps them to recognize common patterns and anticipating what is to come, and gives an accurate diagnosis. The use of IoT technologies is gradually maturing; the healthcare industry should attract benefits from this advancement, in terms of improving performance and innovation. As noted, IoT can help healthcare professionals dedicate more time to patient care and design more effective operational strategies. IoT users should ensure that their systems are able to collect and understand data in respect of its surroundings. Further, they should make sure that it is anonymous and that all data collected is communicated to the central location securely and automatically.

Along with this, the collected data should be actionable. For example, if a patient's blood sugar level is observed to be at dangerous level, then the system should automatically generate an alert and clinical action should be taken accordingly.

Conclusion

The primary outcomes of this study were based on the direct findings that are derived from the case studies taken under consideration, The primary assumptions related to the adoption of the IoT, IoT can play the main role to provide the medical and health sector with easy accessibility and providing proper treatment in the absence of information from the patient are stated in this research study, it can help individuals to get their own specific health care system in their houses or undergo professional treatment. Besides, allow doctors to monitor the situation of their patients in real time.

The secondary findings were in association with the case studies and the personal findings of the researcher as the following although the internet of thing can enhance the health and medical care are, there are many issues that related to IoT itself and can affect the implementation of this idea. The problems that need to be considered are: Insufficient Authentication/Authorization, Security Problem, Privacy Problem, Insecure Cloud Interface, and Data Management Problem. There are various solutions have been introduced to sort out most of these issues. It can be stated that the traits of a systematic research review have benefited the research as they are equitable, clear, and methodological and can be recreated with time. Furthermore, the research study has concluded that the factors that are influential in implementing the Internet of Things are well projected with the help of systematic review and provided the research with two types outcomes those are the primary and secondary outcome.

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