

Advancement of the Internet Of Things (IOT) and Point Of Care (POC) in Biomedical Engineering and Healthcare

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Abstract

This article is based on the advancement of the point of care and the internet of things in the healthcare system and biomedical engineering. This study has mentioned the advantages and benefits of the POC or point of care and IoT and the internet of things in the healthcare system and biomedical engineering process. From this study, it has been seen that, internet of things develops the process of treatment and it makes a huge impact on the technologies. Nowadays, medical professionals are using various kinds of gadgets and devices that help to track the patient's movements and recognise the disease easily. These kinds of devices are made up of high quality and updated sensors. Hitech quality software and premium quality sensor, strong hardware and high process chip help to recognize the frequencies, or body activities such as blood pressures, heart rate and others. This technology has some limitations that hamper confidential data and that is why it is required for high-protected data security processes. Advancement of the POC also makes an impact in the drug management also. Accordingly in biomedical engineering process gives the opportunities to take a high-power networking system that helps to get the actual and desired result from the technology. Point of care and the internet of things both are interconnected with the system and it makes a major impact on the field of the biomedical engineering process. At last, it can be said that, point of care applications internet of things make a renaissance in medical world.

Index Terms

Chip, Devices, High-Capacity Sensor, IoT, Monitoring, Silicon Sensor, Updated Software

INTRODUCTION

IoT or the internet of things explains the network as a physical object and is embedded with software, sensors, and also other kinds of technologies. The main purpose of the IoT is to exchange and connect data with other different types of systems and devices through the internet service. There are 4 kinds of IoT networks such as cellular, personal and local area network, mesh network, and LPWAN, or “*low power wide area networks*”. IoT is the process that assists to connect each and every physical object by using the internet and it is much more user-friendly and controllable also.

POC or point of care is one kind of application that is based on the IoT and this application provides the opportunities to observe and monitor the entire healthcare system. On the other hand, these modern technologies also help to provide the facility to keep the patient safe and healthy. Accordingly, it can be said that in biomedical engineering, POC and IoT play a major role and also impact the innovation process also. This study will highlight the advancement of IoT and POC that allows various opportunities to develop the healthcare system and medical engineering process.

Moreover, IoT and POC provide exceptional benefits and the system provides zero error outcomes. This kind of application allows the physicians to empower them and also provides a high level of satisfaction to the patients. On another hand, it increases patient engagement and makes an outstanding impact on medical engineering. Accordingly, it

can be said that point-of-care applications also contrite some space in the surgical sectors. This study will try to highlight on the entire system process and also discuss the Internet of Things and point of care and its relation with the high range of devices and gadgets. On the other hand, there are various kinds of sensors and other technologies that help to improvise the process of working such as data transformation, collecting data from the various processes or sensors, and also recognizing the solutions for hardware and software. From several studies, it has been seen that artificial intelligence makes a wide range of transformations in medical engineering and it also includes the diagnosis of disease, predicting patient prognosis, determining the optimal treatment, and inventing advanced devices that help to make improvements in the medical field. This study will shed light on the impact of IOT and POC in the healthcare system and medical engineering process.

LITERATURE REVIEW

Connections of IoT and POC with biomedical engineering and healthcare

Internet of things and IoT are interoperate with multiple fields and also interconnected with various kinds of industry such as healthcare, medical engineering, and others. In the modern era, medical devices are essential for patients and all medical professionals. It provides various opportunities that help to diagnose the problems and patients easily. Accordingly, there are various applications that provide the

facilities to monitor the patients and their bodily reactions through technology and devices [1]. POC applications basically run through the internet of things. It is able to exchange and transform medical data and also participate in improving the quality of life of a patient. Moreover, this kind of application all makes a huge impact on the surgical sector also. In modern days professionals use many kinds of robots and surgical tools that are based on the IoT. These kinds of tools are able to connect with other devices or systems. It assists to improve the work and production flow with zero human error and these applications are easier to use [2].

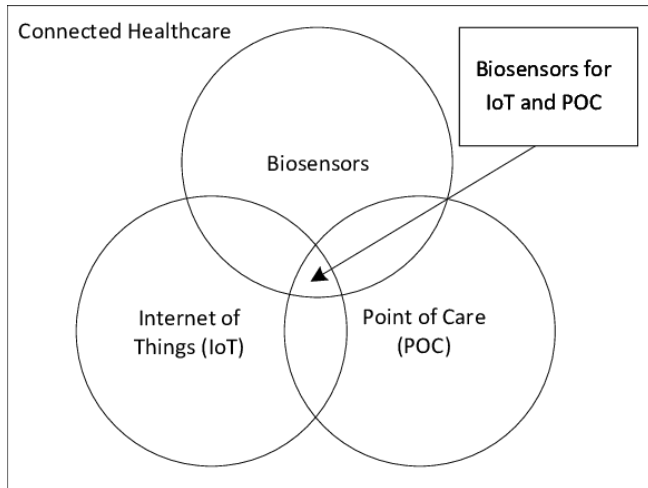


Figure 1: Connections of IoT and POC with biomedical engineering and healthcare [3]

Accordingly, point-of-care technologies and applications have their own network system that helps to connect all the data and also provides the logical conclusion or result for the process of working. In the medical engineering process, POCT works in a systematic way, and in the human intervention process, POC plays a valuable and versatile tool. The medical engineering process uses various kinds of principles that can solve and improve healthcare opportunities. POC application helps to make life safer and healthier [3]. There are various applications such as IoT asset monitoring, wearable IoT devices, remote monitoring, bed, and patient monitoring, and surgical devices such as robots, gadgets, frequency readers, and others. The medical professionals use Ai technologies and various IoT devices that help to track and monitor the patient's health conditions such as blood pressure, glucose trackers, and asthma monitors. Nowadays fitness watches are an innovative concept of medical engineering that helps to track the heart rate, body temperature, and other movements of the body. It also connects the smart phones with the watch that provides the daily health status by using IoT applications.

Impact of IoT and POC in biomedical engineering and healthcare

As mentioned previously POC is an application that helps to track the body function and also is able to monitor the patient's healing and record. The internet of things and point-of-care technologies are interconnected and it helps the

patients to diagnose the issues and threats quickly. In other words, it can be said that in modern days this application improves the treatment process and also makes a huge impact on the patient and medical [4]. These applications used some high-quality and effective software and sensors that helped to track the hospital, patient records, and movement of the patient. In order to easily recognize the issues, the medical professionals use updated technologies so that they can begin the treatment process easily.



Figure 2: Gadget and Devices [5]

This application uses various circuits and high-range sensors such as interdigital sensors that help to get the actual or desired outcomes from the system. On the other hand, there are different kinds of analysis tools that help to analyse the data and also monitor all kinds of operating principles [5]. There are some applications that use silicon sensors due to their high sensitivity. Electrochemical biomedical uses a small chip that is one type of point of care. It can change the sophisticated and costly laboratory system. In the field of clinical diagnosis, POC technology helps to create access to the application. Some kinds of POC devices carry a real-time testing process that helps to provide the exact outcome of the process. In the healthcare system POC devices make a huge impact to access the health and patient-related data [6]. In this context, it can be said that cloud service and wireless transmission server allows transmission and sharing of the measured data as per the requirement. On the other hand, with these kinds of technologies, it supports and enhances the sensing system to monitor the patients through the internet of things. POC technology reduces the diagnosis cost and provides real-time information that makes a positive impact on the process of treatment.

From several studies, it has been seen that silicon-based sensors generally integrate into microfluidic systems with the 3D printing system. IoT process also gives a large amount of storage capacity that is highly required for storing the data and transferring the data to the end users [7]. On the other

hand, biomedical applications are also able to measure the different kinds of conclusions and also find out the pathological report that is more essential for the medical sector also. IoT and POC technology make a huge impact on the medical engineering process and upgrade the system of healthcare also [8].

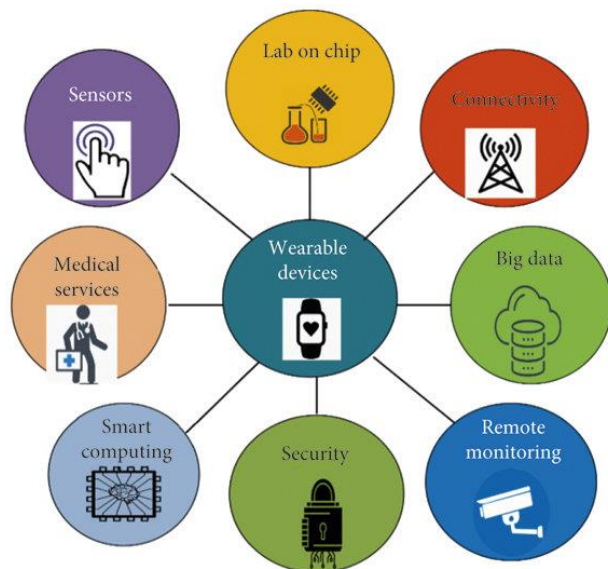


Figure 3: IOT Related gadgets [9]

These kinds of gadgets and applications empower the patients and medical professionals so that they can also make positive effects on the work process and increase the working capacity. At last, it can be said that POC and it gives a high number of benefits that make a modern impact on the medical grounds and it improves the psychology of individuals. Accordingly, IoT technology provides various kinds of opportunities such as it can predict the chronic disease and also make an impact on the drug management and keep the tracking of hardware maintenance.

In the medical sector there is various equipment and it is not to maintain all the things for the employees or staff. The IoT system allows to maintain all the equipment and generate the database. It helps to reduce the breakdown risk and helps the medical sectors to arrange all the things in the crucial time. On the other hand, this facility also improves the tracking capacity of employees and patients and their movement [9]. Accordingly, drug management is a process that is interconnected with the medical sectors. With POC and Internet of Things devices patients are able to receive real-time alerts and also generate bills and other necessities from their Smart phone.

In the genetic engineering process, the engineers use various kinds of chips, sensors, and updated software that increase the provision of high storage capacity of sensing power and it also controls the temperature and tampering protection.

Challenges of IoT and POC in biomedical engineering and healthcare

In technological advancement, there are various kinds of limitations and challenges that cannot be ignored. There are various kinds of challenges on POC and IOT in health care and biomedical engineering process that are listed below:

Data Security: In the medical sector one of the biggest threats is data security and privacy. There is a large amount of health-related data and this system stores, transmits and shares a massive amount of data on a regular basis [10]. In this context, hackers create fake accounts and also hack all the data and so buy medicines and drugs for misuse. In the medical industry, there is a huge amount of confidential information about patients and drugs. This technology has a greater chance of data breach that makes a huge impact on the society and entire medical and health system

Protocols integration: POC applications and devices always connect with multiple gadgets or devices and all the systems require various functionality and protocols. In this context, there are not any kinds of single solutions to maintain and communicate all the standards and protocols [11]. In order to create medical software, the producer needs to maintain the Hitech and HIPAA complaints. These protocols are able to contain various kinds of rules and regulation that helps to protect the data from a breach.

Data overload and Accuracy issues: IoT healthcare devices or POC applications process and collect a lot of information on a daily basis. Medical professionals face accuracy and issues in their process of working. On the other hand, the health care applications also create various difficulties in the decision-making process during the process of treatment [12]. Sometimes this technology is not able to provide the accurate information, and it is responsible for an incorrect diagnosis. In addition, the devices and sensors are always not accurate and it can have incomplete and mismatched data sets.

Cost: From this study, it has been seen that IoT can reduce the cost of treatment, and all. Though, all hospitals and companies are not able to afford the IoT system. It has a huge amount of implementation cost that makes an impact on the economic portion of the medical sector. That is why implementation cost is the major factor on the biomedical engineering. On the other hand, sensors, parts, gadgets, or devices are more costly, and it makes an economic impact on the field of biomedical engineering.

Conceptualization of futuristic approaches for IoT and POC

IoT has lots of opportunities that may develop the treatment process in the medical sector. From various research, it has been seen that many IoT healthcare companies try to introduce new ways of working with technologies that improve the medical world [13]. Every POC and IoT has some particular limitations and challenges though it will not stop the up gradation and it can help the industry also. On the other hand, in the future, this application and technological process helps doctors to

connect with patients worldwide. Patients are able to take the advice and suggestion from doctors from any geographical location. In the modern era, this technology is able to reduce the time and cost of diagnosis. In the future, the IoT system and POC are able to improve the entire functioning capacity of medical doctors and the automation process will also make an innovative impact on the future medical department and also provide a smart environment to the future generation. From this analysis method it has been seen that the internet of things and point of care may improve the future treatment process. It helps the individual to get the treatment at the right time and right situation. Accordingly, it also increases the rate of recovery of the patient and the applications of the technologies also help the medical professional to increase the rate of solutions of major problems. This factor helps the next generations and individuals to take the technological and first treatment procedures for their family and own.

METHODOLOGY

This study used a secondary qualitative method to get the desired outcome from the study. This research has used the existing data that helps to get various kinds of advanced information about the internet of things and point of care in the medical engineering and healthcare system [14]. This research study uses previous and ethical data to recognize the answers to the research question. The secondary process of research uses the data that was previously gathered and is also previously accessed by the researchers. This process of research and process of data collection is much easier than other processes of research and process of data collection. In this research, process observation is the fundamental key. It helps to notice all the things that help to gain knowledge for further research.

Accordingly, it provides the provision to make a difference between observation and previously collected data. This process of collection of data uses novels, newspapers, journals, government reports, magazine, radio, and television outputs [15]. It helps to provide the authentic data for the study. On the other hand, secondary qualitative data collection methods provide a heavy large amount of data on the subject matter. This process has a technique that helps to extract the data from a large amount of data. On the other hand, it also assists to recognize the relevant data from the data set. In addition, the secondary process gives a clear structure to the data set that makes a positive impact on the analysing process. Accordingly, it provides the provision to interpret the data and this is cost-effective due to this process not requiring outer study. On the other hand, this study does not require a high amount of technical skill [16]. It is one of the biggest advantages of this research process and the other benefit is this process is more time-saving. On the other hand, it saves expenses and efforts that assist to finish the research with interest and great effort. In addition, it provides a fine analysis process of data from the data and samples. Furthermore, this process helps to understand the physiological status of the author and gives the chance to gain

depth knowledge on the subject matter.

DISCUSSION

From the above-mentioned study it can be observed that internet things refer to the network as a physical object and it connects with the sensors, software, and other different kinds of technologies. The actual purpose of the IoT is to connect, collect, and transfer the data in different kinds of systems and devices that attach the devices and gadgets through the internet connection. From this study, it can be said that IoT is a crucial process that can assist to attach an invisible connection with every physical object through the internet. This is user-friendly and more controllable than other processes and it helps to provide a suitable pathway for creating the innovation [17]. On the other hand, biomedical engineering creates various innovative things that help to check the human physiological condition and it also makes an impact on the healthcare system. From this study, it can be recognized that there are some crucial connections between IoT and POC. POC application helps health professionals and individuals to take a record of their physical condition and monitor their health by checking blood pressure, glucose, heart rate, digital thermometer, and many more. It has been seen that these kinds of gadgets and devices also transform medical data and make a huge impact in the surgical sector. Nowadays robotics is one of the innovation processes that play a significant role in the surgery [16]. Individuals also try to adopt this process of surgery on their bodies. This technology has various facilities such as it can provide the actual data set, and transfer the data as per requirement. Accordingly, this process has a zero percent human error solution to proceed with the surgical process. Accordingly, bio-engineering technology uses a variety of sensors that helps to catch the high and low frequencies of the body. In addition, it can be said that point-of-care application and technologies have their own network system and it helps to connect all the data. On the other hand, IoT has the capability to maintain the data as per the data patterns. This is a huge resource of information and data that help individuals and medical professionals to use in their innovation process. In the aforementioned study, it has been seen that POCT works in a much more systematic process and it also makes a huge impact on the biomedical engineering process [17]. In the field of biomedical engineering, there are various sensors that use by the artificial intelligence technologies. It provides automation facilities and it also can measure real-time data as well.

The internet of things and POC application helps medical professionals to recognize diseases and difficulties in a short time by using of various kinds of circuits and different kinds of sensors. From this study, it has been seen that each and every tool has its own operating principles and also improves the hospital and employees' arrangements. Biomedical engineering provides facilities to the hospital authorities and also tracks the employee record and performance also through the help of the internet of things. From this article, it

has been seen that technologies have different kinds of challenges that make an impact on the entire healthcare system. Data security is the major thing in the healthcare industry, there are different kinds of confidential data that helps with the purpose of treatment [17]. In the hospital industry, millions of data are transferred in a single day, it requires a high-security process of the data. Accordingly, POC applications and devices are also attached to the different kinds of gadgets and devices. All the devices have maintained the significance protocols that an expert to communicate with other kinds of devices. The other major problem is cost and individuals are not able to afford the gadget to communicate and maintain the HIPAA, AND HITECH complaints. On the other hand, POC and IoT healthcare devices and applications process can able to generate lots of information and also face issues related to IoT technologies. Every POC and IoT has some particular limitations and challenges though it will not stop the up gradation and it can help the industry also. The IoT system and POC are able to improve the entire functioning capacity of medical doctors and the automation process will also make an innovative impact on the future medical department and also provide a smart environment to the future generation.

CONCLUSION

From the above study it can be concluded POC and the internet of things in the healthcare system and biomedical engineering and it can able to make a huge improvement in the medical industry. In the field of the biomedical engineering process, there are various kinds of factors that can improve the entire procedures of treatment and it has made a sophisticated platform in the medical field. There are various devices that are made up of high-quality and updated sensors and advanced technologies that are able to track the frequencies and other measurements such as glucose, blood pressure, and heart rate. Medical professionals also use the gadget to recognize heart conditions, brain conditions, and frequencies of nerves and also find the pathways of the neurons their signalling process. IoT is the process that assists to connect each and every physical object by using the internet and it is much more user-friendly and controllable also. IoT and POC provide exceptional benefits and the system provides zero error outcomes. It can be said that point-of-care applications also contrite some space in the surgical sectors. Medical professionals use Ai technologies and various IoT devices that help to track and monitor the patient's health conditions such as blood pressure, glucose trackers, and asthma monitors. These machines used high-quality and effective software and sensors that assist to keep records and track the hospital, patient records, movement of the patient, and many more. cloud service and wireless transmission servers allow the transmission process and sharing of the measured data. IoT and POC technology make a huge impact on the medical engineering process and upgrade the system of healthcare. POC and IoT also make a huge impact on drug management is a process that is

interconnected with the medical sectors. Patients are able to take advice and suggestion from doctors from any geographical location. This study has used a secondary qualitative method to collect the data and it provides the provision to interpret the data and this is cost-effective. On the other hand, it also helps to gain more knowledge on the subject matter. At last, it can be said the IoT and POC can be blessing for the whole health care system and biomedical engineering process.

RECOMMENDATION

- Medical sector needs to implement industry 4.0 which helps to improve the patterns of treatment efficiently
- Medical industry should use new technologies that assist individuals to get better facilities and care for the welfare of the patients

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