

Review on IoT in Healthcare

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Article Info

Page Number: 864-869

Publication Issue:

Vol. 72 No. 1 (2023)

Abstract

The Internet of Things is used to connect smart things to the Internet in a transparent way. This provides an exchange of data between all objects and make users information transferred in a more secure way. The Internet of Things (IoT) contain embedded technologies and enables them to communicate and sense or interact with the physical world, and also among themselves. The Internet of Things (IoT) is a concept that reflects a connected set of anyone, anything, anytime, anyplace, any service, and any network. The Internet of things (IoT) describes groups of objects that are embedded with sensors, processing ability, software, and other technologies that connect and exchange data with other devices and systems over the internet or other communications networks. The IoT is utilized in several fields of human life. This paper gives a review of IoT in several healthcare applications.

Keywords: Internet, IoT, sensor, healthcare, IoMT.

Article History

Article Received: 15 October 2022

Revised: 24 November 2022

Accepted: 18 December 2022

Introduction

An IoT system consists of smart devices that use embedded systems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or other edge device where data is either sent to the cloud to be analyzed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices -- for instance, to set them up, give them instructions or access the data.

The connectivity, networking and communication protocols used with these web-enabled devices largely depend on the specific IoT applications deployed. IoT can also make use of artificial intelligence (AI) and machine learning to aid in making data collecting processes easier and more dynamic.

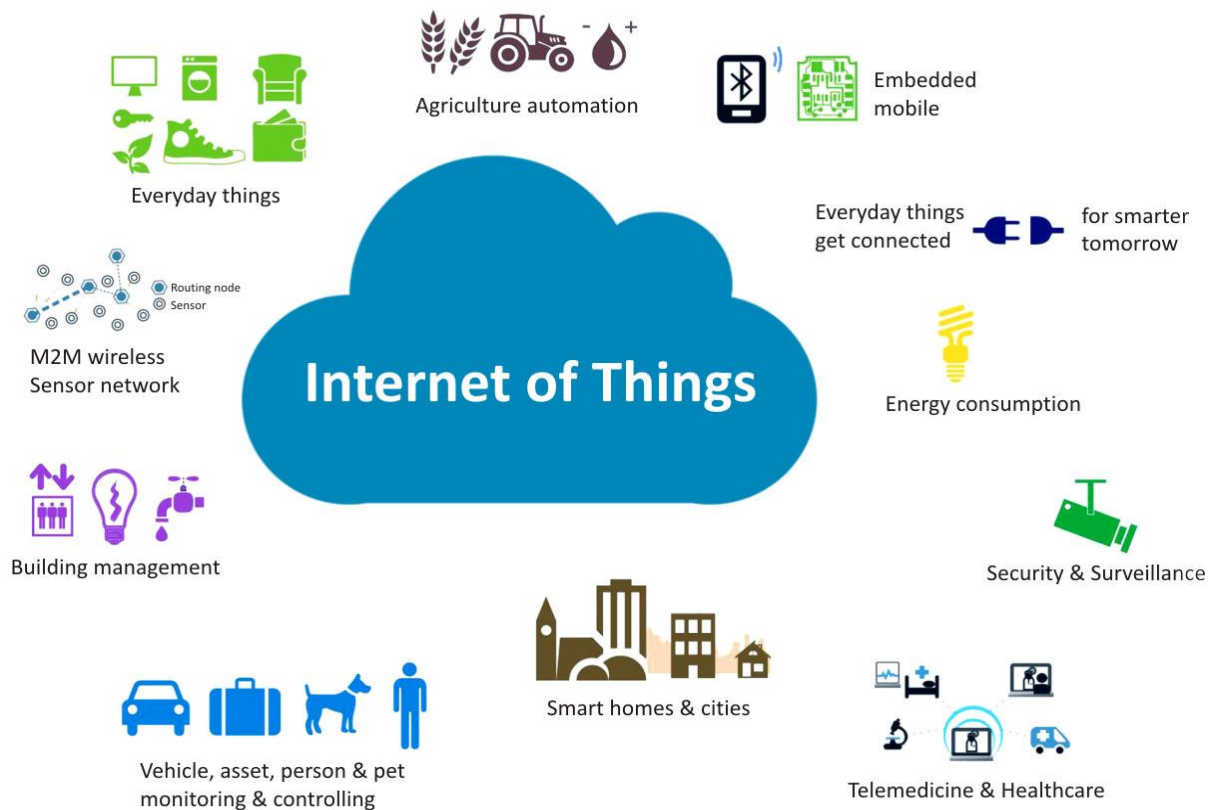


Fig:1. Areas of IoT

Healthcare is one of the main priorities for all governments, basically related to population growth, rural urbanization, declining birthrate, population aging, economic growth and social unbalanced resource utilization. Some social problems have become increasingly apparent in the healthcare field. Some of these issues in healthcare that IoT may prevent or can combat in a most effective way are following: 1) Health management level and the incapability of responding to emergency. 2) serious shortage in medical staffs and institutional facilities especially in rural areas, lack of medical facilities, low level of treatment, inadequate healthcare system. 3) Imperfect diseases prevention system cannot meet the national strategy requirements to safeguard the health of the citizen resulting in an heavy burden on economy, individuals, families and State 4) Inadequate disease prevention and early detection capability; But there are some challenges, that IoT can help to solve: I).To break geographic barriers, providing rapid clinical responses; ii) Medical consultation and communication links of medical images and video data; III) A unique ontology for all things among IoT-based healthcare. There are a lot of applications in the healthcare field, including the possibility of using Smartphone capabilities as a platform for monitoring of medical parameters that advise patients of medical issues.

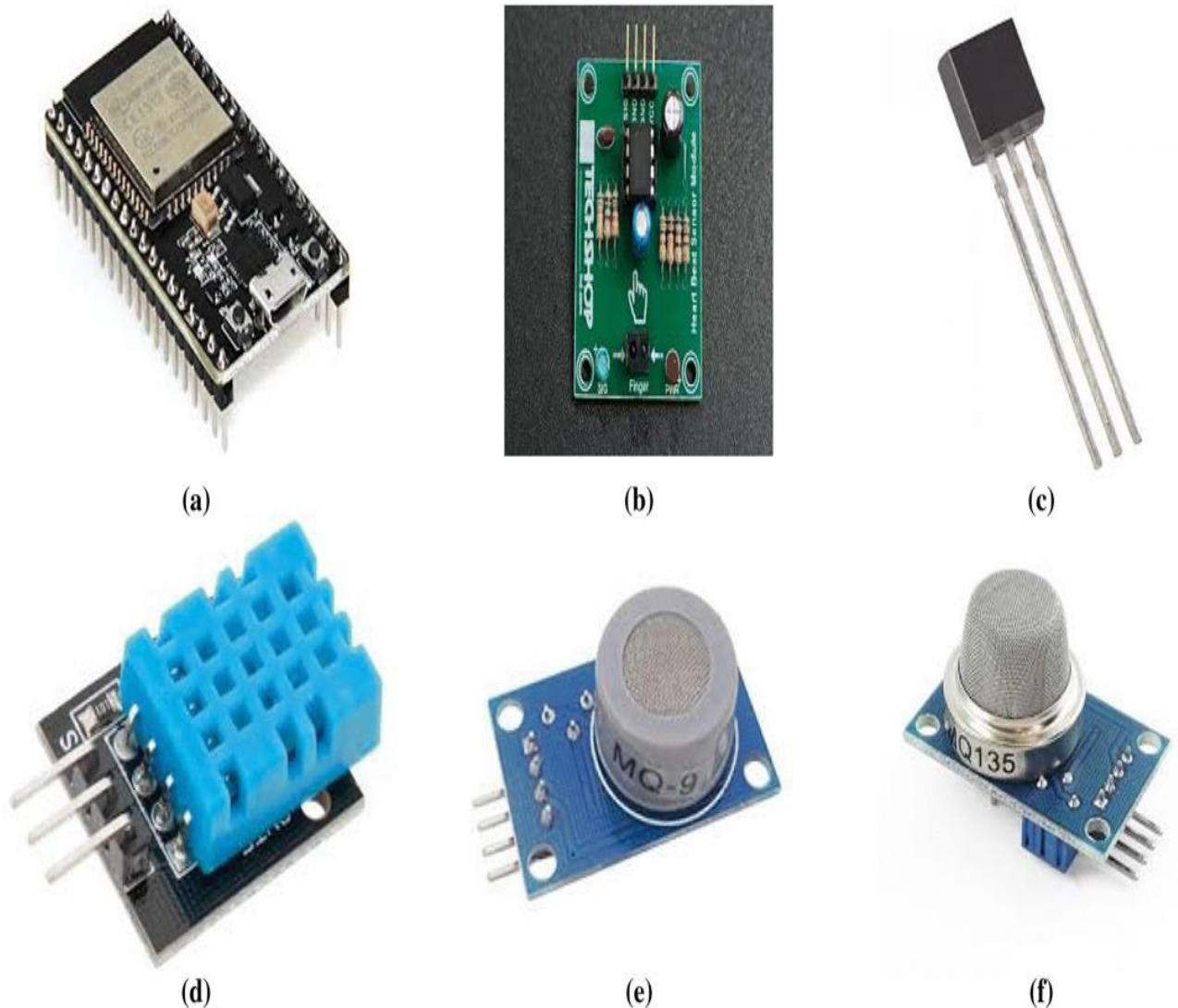


Fig:2. SENSORS USED IN HEALTHCARE SYSTEM (a) communicating sensor (b) heart beat sensor (c) body temperature sensor (d) room temperature sensor (e) CO sensor (f) CO₂ sensor

Literature Survey

Healthcare monitoring systems with emerging technologies are becoming great concern to many countries worldwide nowadays. A smart healthcare system is proposed [1] in IoT environment that can monitor a patient's basic health signs as well as the room condition where the patients are now in real-time. In this system, five sensors are connected to capture the data from hospital environment named heart beat sensor, body temperature sensor, room temperature sensor, CO sensor, and CO₂ sensor. The error percentage of the developed scheme is within a certain limit ($< 5\%$) for each case. The developed prototype is well suited for healthcare monitoring that is proved by the effectiveness of the system.

Among the applications that Internet of Things (IoT) facilitated to the world, Healthcare applications are most important. In general, IoT has been widely used to interconnect the advanced medical resources and to offer smart and effective healthcare services to the people. The advanced sensors can be either worn or be embedded into the body of the patients, so as to continuously monitor

their health. The information collected in such manner, can be analyzed, aggregated and mined to do the early prediction of diseases. The processing algorithms [2] assist the physicians for the personalization of treatment and it helps to make the health care economical, at the same time, with improved outcomes. Also, in this paper, we highlight the challenges in the implementation of IoT health monitoring system in real world.

Presently Internet of things is one of the hottest topics right now in information field of technology. This connection of day to day things is internet of things. system in past was merely based on the decisions made by the doctor on the basis of domain knowledge, the patients symptoms and the reports which come through diagnosis. What if with the help of Internet of things the doctor can constantly monitor the patient or can monitor the environment around the patient using sensors. The Internet of Things[3] permits objects to be detected and controlled remotely crosswise over existing system foundation. The Internet of things is empowered by the most recent improvements in RFID, smart sensors and communication tech.

Any country with Social, technological and economical advancement needs enhanced healthcare system. Telemedicine healthcare system provides the medical treatment from a remote distance. In the proposed and implemented model[4] a separate interface for medical experts and remote Centre's and introduced a new algorithm for implementation .Features like live video streaming, chat boxes, automatic prescription generation and push notification are included.

In [5], an model is designed to enhance the integration of wireless sensor network (WSN) in IoT environment with cloud computing for health care system. IoT is a dynamic network infrastructure, that interconnects different sensor networks through Internet, acquire sensor data/information, transmit and receives data/information for further processing. The related sensed data/information will be sent for the necessary information exchange together with the design and optimized parameters. This research paper is focused on integrating the architecture of WSN in an energy efficient manner in IoT perspective, cloud computing for a healthcare application. The proposed architecture, the health care system could be improvised with Quality of Experience (QoE), trust management, decision making and energy management. The health care services could be implemented to all the hospitals collectively, with insurance companies to provide centralized, secure access to patient information with the health monitoring of every patient. This proposed integration seems to be an aid for the IoT applications where the energy, QoE is in demand.

The internet of things (IoT) refers to a framework of interrelated, web associated objects that can gather and move information over a remote network without human interference. With a quick development in the arrangement of IoT gadgets and expanding want to make medical care more financially savvy, customized, and proactive, IoT is ready to assume a solid function in all perspectives of the healthcare industry. In this context, IoT based healthcare provides several benefits such as instant and reliable treatment, cost reduction, improved communication, etc. by using different new technologies. Wireless Body Area Networks (WBAN) technologies can enhance the quality of data gathering and data transferring in smart systems. Machine Learning (ML) are put to use at every level of smart healthcare systems. Cloud computing reduces communication cost and provides low latency. Software Defined Networking (SDN) and Network Function Virtualization (NFV) technologies provide less complex and more flexible network structures. Blockchain technology offers a better way of protection of users' sensitive information. In [6], comprehensive descriptions of ongoing research projects are described and the utilization of the above-mentioned technologies in smart healthcare systems.

An overview of IoT on the healthcare field is presented [7]. Due to the increasing of IoT solutions, healthcare cannot be outside of this paradigm .The contribution of this paper is to introduce

directions to achieve a global connectivity between the Internet of Things (IoT) and the medical environments.

The integration of smart devices with sensors increase energy efficiency. This work is carried out according to a mixed approach[8], with a literature review and an analysis of the impact of the Sustainable Development Goals on the applications of the Internet of Things and smart systems.

Healthcare, the largest global industry, is undergoing significant transformations with the genesis of a new technology known as the Internet of Things (IoT). An extensive collection of medical sensors and associated infrastructure creates IoMT(Internet of Medical Things). The IoMT has many benefits like providing remote healthcare by monitoring health vitals of patients at a distant place, providing healthcare services to elderly people, and monitoring a group of people in a particular region or country for detection and prevention of epidemics. In [9], the technologies for delivering smart healthcare are provided, followed by some of the key applications of IoT in healthcare. Next, a fog-based architecture containing three layers for IoT-based healthcare applications is proposed. Finally, we focus on some of the open challenges of IoT in healthcare, like fault tolerance, interoperability, latency, energy efficiency, and availability. Existing solutions for these challenges are also discussed.

Among many of applications enabled by the Internet of Things (IoT), smart and connected health care is a particularly important one. The impact of IoT in healthcare, although still in its early stages of development has been significant. Networked sensors, either worn on the body or embedded in our living environments, make possible the gathering of rich information indicative of our physical and mental health. The opportunities and challenges for IoT[10] were explained in realizing the vision of the future of health care.

In [11], a smart and secure framework is presented for hospital environment using Internet of Things (IoT) and Artificial Intelligence (AI). This system overcomes the drawbacks of the current system of hospital information such as fixed point of information and inflexible modes of networking and so on. Factors such as application framework, logic structure, basic network environment construction, and data security are considered in detail. This work also helps in overcoming the existing problems of diagnosis, treatment, patient monitoring and maintenance of hospital records in electronic format effectively. It presents a profound positive impact on the current methods followed in the hospital environment.

Conclusion

The field has evolved due to the convergence of multiple technologies such as embedded systems, ubiquitous computing, commodity sensors and machine learning. In the consumer market, IoT technology creates smart home including devices such as smartphones and smart speakers. The IoT can also be used in healthcare systems. This paper gives a review of IoT in healthcare field. The hospital managemne system can make use of Inter of Things to monitor patient's health condition and give a report to doctor regularly and during emergency conditions. IoT can be combined with cloud computing, Artificial intelligence and machine learning.

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