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A Review of Internet of Things (IoT) Enabling Technologies in Healthcare Applications

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ABSTRACT

The term "Internet of Things" (IoT) describes a system of interconnected, web-connected things that may exchange data via a wireless network without human involvement. The Internet of Things (IoT) includes a variety of application domains, including telecommunications, informatics, electronics, and social science. It also has applications in the fields of health care, organisational services, security and monitoring, and industrial controls. IoT technology is made for modern, technologically advanced, and economically sounds health care systems. The improvement of human health is the ultimate goal of all economic, technological, and social growth. One of the major forces that will profoundly alter the globe is the population's rapid rise and ageing, which has put tremendous strain on the global food supply, health care systems, and emerging technologies. One of the major forces that will drastically alter the globe is the fast ageing and growing population. It has put tremendous strain on the global food supply and healthcare systems, and the Internet of Things, an emerging technology, is expected to offer hopeful remedies. This essay provides an overview of several healthcare technologies and delivery systems.

Keywords— IoT , Healthcare,

Introduction

This essay discusses webbed healthcare and the entirety of the internet of things. IoT, as described by Kelvin Ashton, is an evolving global services architecture that reflects a connected any set of everyone, anything, anytime, anywhere, any service, and any network. IoT healthcare apps have the capacity to precisely track individuals, pieces of equipment, samples, and supplies. They can also take care of a variety of stakeholders, such as nursing homes, hospitals, and the local community. Important sensor data or biometric information is employed to obtain greater quality and efficiency.

The Internet of Things (IoT) is a modern paradigm in which everything you own, including everything you wear, read, see, drive, and interact with, will be addressed, connected, and controlled remotely [1]. Many of these actual physical objects are linked to the internet via means of cyberspace. [2] . IoT devices will be used in a variety of application sectors, as predicted by the researcher [3]. Many survey papers are released in relation to various IoT applications, There are numerous solutions in the fields of structural health, emergency services, and a wide range of IoT applications. This paper examines many healthcare studies and makes use of various medical innovations.

This review provides the following in this regard:

A survey on technologies used in IoT-based healthcare

- A smart health system with IOT-aware architecture that uses sensors like ECG, temperature, and barometric pressure has the ability to manage and monitor emergency scenarios [4].
- Using IOT in smart homes to provide individualised healthcare provides layered technology and services[5].
- Wireless sensors and smartphones are being used in the development of heart monitoring devices. When it hits a specific threshold value, it detects the potentially dangerous arrhythmia and warns the patient [6].
- Wireless sensor networks, which have the advantages of lower energy usage and increased communication range, are mostly used in healthcare monitoring systems[7].

• Some sensors have been created for the continuous monitoring of physiological parameters in geriatric or chronic patients. [8] The function of the system is [9].

One issue that developing nations deal with is less inventive technology, as well as a lack of smart objects and technologies that are essential for healthcare [10].

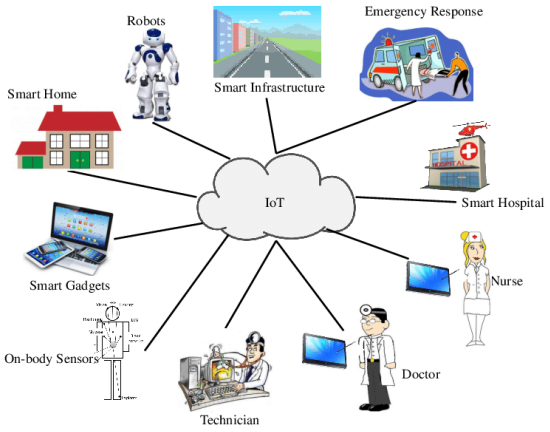


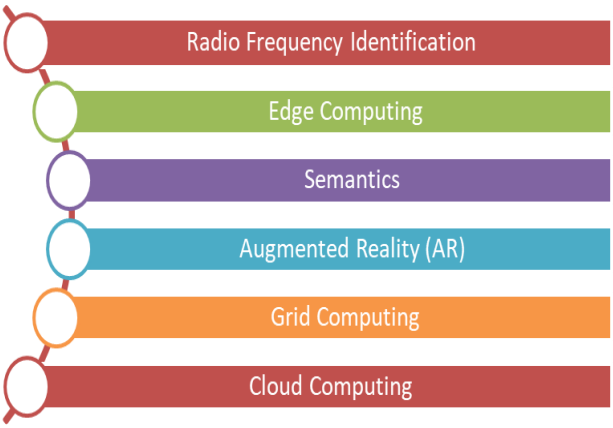
Figure 1. Internet of things and healthcare

The inability of the current healthcare system to gather specialised data, real-time approach capability, data integration through cloud service, etc., as well as decreasing challenges and complexity, are all overcome by IoT-based healthcare apps and devices. A healthy way of life can be improved and maintained with the help of m-health and e-health programmes [11][12].

Table 1 shows the summary of healthcare technologies

Technologies /Methodologies	**Merits**	**Limitations**
cloud computing for mobile devices Wearable Augmented Reality Device	Data can be appropriately stored and used. improves patient perception and amuses them wrist-worn gadget monitoring and patient alert system	calls for a lot of memory expensive to create AR-enabled devices Not all wearables function independently.
Networks of RFID-enabled body sensors for monitoring IoT Reference Security Model for Open Systems (OSiRM)	keeping track of patients' medical histories at hospitals WSNs Facilitate Long-Distance Data Transmission and Collection isolates services, interfaces, and protocols precisely.	Costly owing to the use of batteries prone to nefarious security attacks duplicates services across different tiers
Resource Preservation Net (RPN) framework utilising Pedi Net and Consumer Security Index (CSI) and Intelligent Medicine Box	Improved security and consumer decision-making Patient wait times on average are minimised provides timely patient notification of the medication	more time is needed for implementation takes up a lot of storage space Incorrect programming may be present in drug delivery devices.
Healthcare monitoring system for soldiers Ambient Assisted Living Security model of block chain, PoW	Tracking solders location and secure their cloud data Get help with daily Activities Data are highly resistant to technical failures and malicious attacks	The battery might drain out Costly Lack of data modification private keys
Internet-based Healthcare Monitoring System with WSN Security Model (HCMS)	secures the information gathered keeping track of hospital patients' medical histories	While data is being secured, it gets stolen Maintenance for hospital management is quite expensive.

IOT HEALTHCARE METHODS



2.1Radio Frequency Identification

2.1 Radio Frequency Identification

Medical equipment with passive RFID tags can be moved thanks to radio frequency identification (RFID) technology. Real-Time Location System (RTLS) permits real-time tracking of tagged items and aids in building a network of interconnected devices that automatically transmit any status change regarding their location, circumstances, and quantity. An open platform based iMedBox (intelligent Medicine Box) is suggested and built in [13] for the integration of devices and services in the platform with the highest level of connection and interchangeability. [49] presents a survey on the RFID application to body-centric devices that collects data on the user's living space (temperature, humidity, and gases). The radio access network's edge computing architecture allows for the placement of computational and storage resources, which helps to increase network efficiency and the delivery of content to end users (RAN).

2.2 Semantics

An IoT-SIM (IoT-based Semantic Interoperability Model) is suggested in [14] to enable semantic interoperability across heterogeneous IoT devices in the healthcare sector. Data annotations are provided by this model. The Resource Description Framework (RDF), a semantic web framework, is used to annotate the patient data in order to make it semantically interoperable.

2.3 Cloud Computing

Real-time sensor technologies will be able to collect e-storage of all patient records, including documents, photographs, and videos, from various sensor devices thanks to the integration of cloud computing with IoT, the Internet of Things, and the smart hospital information system. Platform as a Service (PaaS), Software as a Service (SaaS), and Infrastructure as a Service (IaaS) are the three main services that are described as being offered by cloud technologies in healthcare systems in [15].

2.4 Big Data

Adopting current technology is important for the sustainability of healthcare systems as well as for providing patients with high-quality care. The five V's of big data are volume, velocity, veracity, variety, and value. [16][17] proposes a data storage paradigm for emergency medical treatment that makes use of the amount and variety of medical data. During an emergency, heterogeneous physiological data is organised using IaaS and SaaS, making it available to the appropriate healthcare practitioners.

2.5 Grid Computing

A viable solution to some of the most complex problems facing e-Health, such drug discovery, is developing as grid computing. Grid computing easily outperforms traditional IT systems due to the high demands placed on computer processing power and the volume of real-time data transmission. For IoT-based next-generation ubiquitous healthcare solutions, a mobile grid management architecture is proposed [15].

CONCLUSIONS AND FUTURE DIRECTIONS

Researchers from all over the world began to explore methods for enhancing the healthcare system by introducing their potentially ground-breaking hardware and software. The Internet of Things (IoT) healthcare system served as the review's primary tenet. The most crucial features of IoT healthcare systems are security, privacy, authentication, energy, power, resource management, quality of services, and real-time wireless health monitoring systems. However, these features are problematic in different IoT healthcare frameworks because there is no clear architecture. Numerous IoT healthcare technologies have been addressed, together with their uses, difficulties, and unresolved problems, in order to supply the secure IoT

healthcare system. The highest level of services are anticipated to be offered through IoT healthcare. Real-time monitoring, home healthcare, and medicine are also supported. It will have a big impact on future periods if researchers and legislators can lower the cost and size of IoT healthcare equipment.

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