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Prospective Benefits, Opportunities, And Challenges In The Internet Of Medical Things In The Indian Healthcare Industry

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Abstract

Healthcare systems based on the Internet of Medical Things (IoMT) are developing a cutting-edge health ecosystem for the benefit of people globally. This method creates a link between patients, physicians, diagnostic facilities, and hospitals. Through a variety of applications, the internet of things (IoT) is helping customers, medical practicians, and related sectors in the health care sector in exclusive and creative ways. It supports increasing the productivity of healthcare and manufacturing firms, as well as medical practitioners. All of this will raise the health care sector to new heights. after COVID-19. The authors reviewed the literature to explore the opportunities and challenges in IoT-based health technology because in India modern high-tech health facilities are available only in big cities. The purpose of this study is to identify the opportunities and challenges in marketing, deployment, and adoption of e-based health care technologies in the Indian market. This paper also explores how IoT cloud computing and big data are altogether capable to provide better health care solutions. Results show that in India there is a need to build up capacity, infrastructure, and database to implement advanced technologies, especially in tear II and tear III cities.

Keywords: Internet of things, Healthcare, artificial intelligence, health monitoring system, Big data, Healthcare wearables

1. Introduction

The Internet of Medical Things (IoMT) integrates medical devices, computer networks, cloud platforms, wireless data transmission, and artificial intelligence. It is a system that provides an application that connects the patient's records and observations with the medical informatics system through an online or wireless computer network. All information stored in the cloud can be shared by medical experts all around the world (Rehman et. al 2019).

With innovative technologies including wearables with sensors and storage, networking, wireless data transmission, and advanced intelligence, IoT (Internet of Things) helps stakeholders by delivering medical information like diagnostic reports, medical history, outputs of medical wearables and devices, etc. IoMT-based healthcare system creates an innovative healthcare ecosystem to benefit people worldwide. This system connects health service providers and patients in a chain. IoT/IoMT helps both consumers and healthcare-related industries in an unobtrusive and innovative way through far-reaching applications (Digvijay and Patil, 2019). It is useful to improve the efficiency of healthcare professionals, especially in manufacturing and healthcare units. All of these will take the healthcare industry to the next level.

Health facilities are an essential part of social infrastructure, for which the state is responsible. According to the IBEF report, in developing countries like India, the state of the health sector is very poor. The healthcare infrastructure in India is mainly developed by the government, but private sector participation is also increasing, including Primary Health Care Centers (PHCs) in regional areas. villages, government hospitals, and (AIIMS) All India medical institutes in cities. The private sector provides health services mainly in Tier 1 and Tier II urban cities. India has developed its competitive edge with low-cost, high-quality medical services backed by professional medical professionals, located in major cities and run by the government. and medical corporations. The cost of surgery in India is about a tenth that of the United States or Western Europe. According to Allied Market Research 2020, "the global IoT in the Healthcare market was valued at $113.75 billion in 2019 and is expected to reach $332.67 billion by 2027. Signing CAGR of 13.20% from 2020 to 2027. The use of electronic databases and IoT is in its infancy in India, it is rarely practiced in urban cities". India's IoT base healthcare space is in the elementary stage, this requires a converging talent pool of expert doctors, scientists, mathematicians, engineers, and designers. Major hospitals are starting to use electronic health records (EHRs) especially the research institute and private corporate hospitals (Sarkar and Saha 2017).

With the ubiquity of mobile devices across the country, digital communication is now available in the most remote rural areas, establishing connections between different medical facilities. The Internet of Medical Things (IoTM) has created a new opportunity for healthcare companies, hospitals, professionals, and patients. Following the COVID-19 pandemic, the need for a telehealth monitoring system emerged as an immediate concern in several countries around the world. Technological advancements in the Internet of Things (IoT) present opportunities for designing and implementing user-friendly IOTH, gadgets, and Android applications. IOTH monitoring system is used to measure pulse, oxygen level, body temperature, etc. both at home and in the hospital (Yeh 2016). This system transmits data through the cloud to the host computer in real-time. In this study, authors reviewed the literature to identify challenges that have slowed smart health deployment and adoption.

The aim of this study is to explore the current scenario of hi-tech health facilities and to identify opportunities and challenges in the marketing, implementation, and adoption of e-healthcare technologies in the Indian market. This article also explores how IoT cloud computing and big data have the potential to provide better healthcare solutions. The results show that in India there is a need to build capacity, infrastructure, and databases to deploy advanced technologies, especially in Tear II and Tear III cities (Dwiedi et. al, 2003).

Internet of Things (IoT) is well-defined as a network of medical devices that use connectivity to enable the exchange of data. In healthcare, IoT is used to store, retrieve data and analyze it for research purposes, and track electronic health records of patients. This data consists of personally identifiable information and protected health information. and other machine-generated health data. Before IoT, patient interactions with doctors were restricted to visits and communication via phone and text messages (Kumbi et. al 2017). There is no way for doctors to monitor the remote patient in a regular manner and make recommendations accordingly. Certainly, IoT is transforming the healthcare sector by redefining the device-human interface in providing healthcare solutions. During the COVID-19 pandemic, IoTM has significantly helped in diagnosing disease symptoms, in many countries, IoT technology has played a vital role in preventing the spread of the COVID-19 virus by treating, inducing, controlling, and treating people who are already infected (Selvaraj and Sundaravardhan, 2020). IoT applications in healthcare facilitate vital tasks such as improving patient conditions and also relieve pressure on healthcare specialists. It also improved patient satisfaction, as interactions with doctors become convenient and more efficient. Key factors behind the growth of the IoT in the health care sector include innovative technology, 4G-5G high-speed Internet, growing demand for cost-effective treatments and disease management, availability of smart medical devices and wearables, and health awareness.

2. Applications of IOT in the Health sector

For patients: Patients can use various kinds of wearable devices which are connected wirelessly with input devices to measure heartbeats, blood pressure, pulse rate, oxygen level, etc. All these types of devices give personal attention to patients and are linked with doctors through cloud storage. These devices are very much suitable for elderly people suffering from chronic diseases like hypertension, diabetes, etc.

For Doctors: Doctors can restive the history of patients from cloud storage very easily, the output of wearables and home monitoring devices embedded with IoT enables them to track the health condition of patients. Diagnostic reports are also available on the database to provide the best treatments. All this is helpful in quick decision-making.

For Hospitals: IoT systems enable to locate real-time location of medical equipment. Patients infected with communicable diseases can be diagnosed from imaging devices. This

also enables the hospital to manage pharmacy inventories, room temperature, humidity, and monitoring devices

IoT systems reduce the cost of monitoring and managing material as well as people.

Health Insurance Companies: Insurance companies can capture the case history of patients through AI technology. All types of medical documents like prescriptions and reports remained in the database. This is helpful in the investigation of documents and detecting fraud claims. IoT systems bring transparency among patients, hospitals and customers.

3. The architecture of IoT base health system

IoT Architecture is having basically four stages, all these four stages are well connected to capture data and processed to yield the value in the next stages. These integrated values bring intuitions to the process and carry out dynamic business projections.

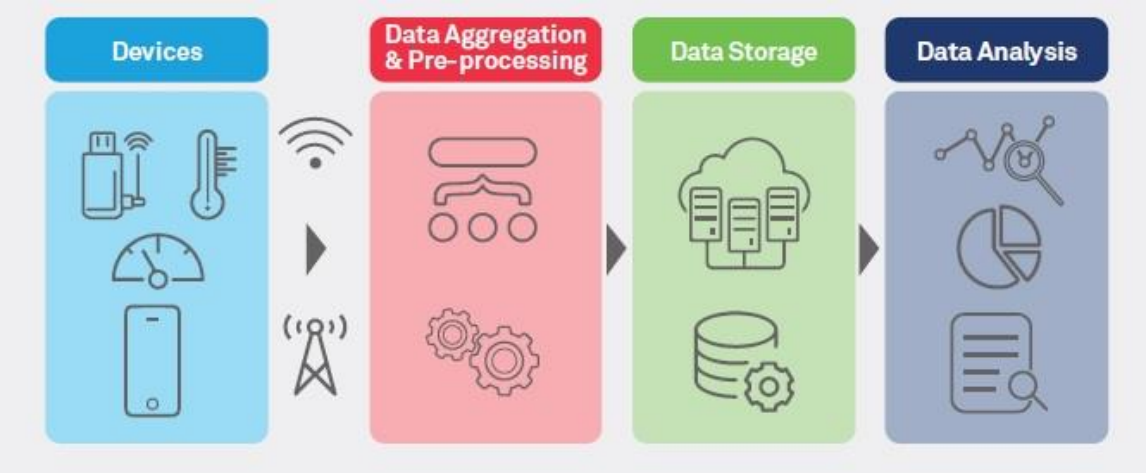
Stage 1: Initial step consists of the positioning of interconnected devices that comprises sensors, actuators, monitors, detectors, camera systems, etc. all these are data collecting devices.

Stage 2: In this stage, data is received the analog form, and get converted into digital form for further processing.

Stage 3: This is a stage of digitization and aggregation of data which is known as pre-processing, required data is moved and get stored in cloud storage.

Stage 4: In the final stage data is managed and analyzed. With the help of advanced analytics systems and logic, data is procced. The outcome of the data analysis is now ready to make the right decisions.

Fig. 1: The four stages of IoT base health solutions



Source: https://www.wipro.com/business-process/what-can-iot-do-for-healthcare-/

4. Scenario of IoT bases health care system in India

IoT-based healthcare startups are rising sharply in the Indian healthcare market most of them are using artificial intelligence (AI), deep learning algorithms, and, big data tools. These startups are restructuring the Indian healthcare sector. Advanced deep learning and artificial intelligence information technology are used to analyze, this technology enables to provide medical services like remote monitoring and diagnosis, storing and sharing of data through cloud computing, sensor-based medical wearables, wireless transmission of data, etc. IoT-based systems integrate patients, doctors, and hospitals in a common thread. This is expected to bring a dynamic change in the Indian healthcare sector.

According to Research and Market Report, "the application of AI in the healthcare industry in India will be valued at Rs 431.97 billion by 2021, growing at a rate of about 40 percent. This is all the more significant for a country like India since the doctor-patient ratio in the country is 1:1456, way lower than the World Health Organization's recommended 1:1000 ratio. The report further suggests that with the increasing use of AI in healthcare, India is expected to reach 6.9:1000 in 2023, as compared to 4.8:1000 in 2017". There are mainly six segments in health care where AI can be applied these are:

- Diagnostic centers
- Pharmacy
- Hospitals
- Medical equipment and devices manufacturers
- Health insurance
- Telemedicine

The use of AI applications in health systems is likely to improve doctors' effectiveness, it will help in undertaking challenges like declining doctor-patient ratio, by providing rural populations high-quality healthcare, and providing guidance and training to medical practicians to handle complex medical procedures (Rahman et. al 2019).

Table:1 Major players in IoT-based health care sector in India.

S. No.	Name of Health Care enterprise	Health services offered	Use of Technology
1.	Niramai Health Analytix	Diagnosis of breast cancer in initial stages	AI and a high-resolution thermal sensing device. based on ML algorithms
2.	Qure.ai	Diagnosis of COVID infections and tuberculosis.	Deep learning algorithms, imaging and scanning, CT scans, POQUS

3.	HealthifyMe	app provides dietary recommendations and solutions. in 10 different languages.	AI-based virtual assistant
4.	PharmEasy	Online medicine delivery across 1200 plus cities in the nation.	Big Data and ML tools: Tensorflow, Kafka, Spark and Hive
5.	SigTuple Technologies	pathology and ophthalmology, offering an automated digital microscope and AI platform as solutions.	Use of AI
6.	OncoStem Diagnostics	Examine the Growth of tumors	Vector machine-based statistical models, linear and radial basis function kernels, elastic net, and random forest.
7.	Artelus	Offers diabetic retinopathy screening	developed an AI-powered contactless diabetic retinopathy screening system that can conduct an eye examination in less than three minutes.
8.	Tricog	Instant ECG reports	Use of cloud connecting devices, echocardiogram diagnosis.
Source: https://analyticsindiamag.com/8-indian-startups-advancing-healthcare-with-ai/			

Table 1 shows that IoT-based startups in India are growing rapidly, these startups are using verities of technologies for medical solutions. India has vast opportunities because of a large number of people having expertise in information technology, Indian IT infrastructure also support the growth of startups but the issues like big data management, security of information, adoption of IoT application, and high cost of medical devices remained a challenge for startups (Panwar and Ghambir, 2016).

Following are the major challenges and opportunities for the implementation of IoT-based healthcare systems in India:

Challenges

- High costs associated with the development of IoT infrastructure,
- Maintaining privacy and data security issues,
- Lack of public awareness in developing regions
- Limited technical knowledge how
- Government initiatives to support IoT platforms,
- Lack of healthcare infrastructure in the country
- High costs of Research and Development.
- It involves multiple devices in the network in order to transmit, store, retrieve and
- communicate information.
- Requires integration of several devices and protocols

Opportunities

- Diagnostic centers and pathology labs to test chronic disease and located only in big cities in India IoT based health system will help to people living in distant areas.
- Cost of visiting doctors, admission charges, and hospital stays are very high, which enables the reduction in cost.
- Experts' doctors are not available in rural and town areas. It enables doctors to make evidence-based information and brings absolute transparency to treatment.
- Poor drug and medical device management, with the help of this technology, medical experts can manage and utilize devices and equipment efficiently.
- Expert doctors and hospitals are overloaded in India, continuous patient monitoring and real-time data help to cure patients from a distance which will save time and money.
- Diagnostics labs are not equipped with modern machines, IoT-based equipment will reduce error and help in effective decision making.
- India is not having a health-related database, data accumulated can be used to generate a national health database to provide better health facilities.

5. Conclusion

The Indian health sector needs an IoT-based healthcare system to deliver better health services. IoT is redefining medical services by ensuring improved healthcare, low cost, prompt and efficient medical treatment. Challenges are to buildup medical infrastructure and facilities allied with IoT requirements and deliver low-cost medical treatment in rural

areas. Hi-tec medical startups are growing rapidly in the Indian medical sector, government support is needed for the success of these startups. IoMT helps in providing affordable and high-quality care to people by eliminating time and distance limitations.

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