APPLICATION OF IOT AND AI IN HEALTHCARE BUSINESS ADMINISTRATION BY HOSPITALS: A FUTURISTIC APPROACH

Abstract

Healthcare in this century is dynamic, and multidimensional, and depends onmultilateral actors that affect the efficiency andeffectiveness of the hospital and other healthcare providers. The modern business environment is termed as VUCA: (1) Volatility, (2) Uncertainty, (3) Complexity, and (4) Ambiguity. All these four terms characterized the uniqueness of the modern business system, and it proved during the pandemic period. The use of the Internet of Things (IoT) and Artificial Intelligence (AI) is normal and a must for business entities, especially in healthcare. Hospitalsuse ICT (Information, Communication, and Technology) tools years ago in various positions of patient care, like the telemedicine segments. Every modern innovation affects the healthcare sector, and it adopted various technological and scientific innovations whenever it has a chance. From patient care, medicine, intervention techniques, and medical records to billing, management information systems, insurance, and cashless services the hospital uses modern technologies. In this chapter, the discussions are based on the importance and applications of the Internet of Things (IoT) and Artificial Intelligence (AI) in inpatient care management, mainly in corporate hospitals to adopt the new business models which are based on more personalized care, continuous monitoring for diagnosis & treatment, and online platform. It showcases the areas of business administration in the healthcare field, which has a direct impact on the services provided by hospitals and the consumer behavior of the patients or patient relatives. Continuous improvements and quality assurance by

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hospitals are also related to the Internet of Things (IoT) and Artificial Intelligence (AI) applications and are hereby discussed in this chapter.

Keywords: Internet of Things (IoT), Artificial Intelligence (AI), Hospital, Patient Care.

I. INTRODUCTION

The healthcare industry in India recorded a compound annual growth rate (CAGR) of 22% between 2016-2022 [1]. It covers the pandemic periods too, which deliberately push the Indian healthcare sector to adopt a new era's management system to cope with the fragile healthcare ecosystem to deliver efficient services. In the year 2021, the Indian healthcare sector employing 4.7 million employees and become one of the largest recruiters [1]. These scenarios show the Indian healthcare sector's strength and adaptability in front of modern challenges. As per the IBEF report, as of 24th November 2022, a total of 219.88 Crore covid vaccination was administered in India [1], which is now more than 220 crore as of 24th July 2023 [2]. The record is available in the Cowin portal of the Indian government, and all the vaccination is linked with a unique identification number of India for cross-reference named Aadhaar [3]. This is a mammoth task, and Indian healthcare service providers adopted and administrated it successfully amid of covid pandemic situations. But this is not just one example, there are multiple examples of online portals and android based applications from both government and corporate healthcare service providers where patient management, doctor booking, vaccination schedule, telemedicine, online pharmacy, online processing of health insurance, government's social health insurance scheme, blood bank inventory status, bed vacancy in hospitals, online registration for Out Patient Department (OPD), e-OPD under Ayushman Bharat Health Account [4], etc. From this discussion, it is easily identified that India is running towards e-India and here the application of the Internet of Things (IoT), Medical Internet of Things (M-IoT), and Artificial Intelligence (AI) comes to support.

1. The applications of IoT and AI are discussed as follows:

- Internet of Things (IoT) in Healthcare: The Internet of Things is described as a physical system that is ingrained with different sensors, software, and other technological advancements which communicate with other devices and systems through the Internet to control, collect, or exchange data in an embedded ecosystem [5]. Here, the IoT device communicates and exchanges valuable data with other devices and can control or monitor remotely through the internet. Like, the smartwatch can monitor the heartbeat of a patient in real-time and send the data to the doctor, so the doctor can monitor the data in real-time and take necessary action if any health-related issues occurred. The applications of IoT in the real world are wide. It uses Wireless Sensor Networks (WSN), Radio Frequency Identification (RFID), and other tools to connect the physical worlds using ubiquitous sensors and the internet, making human-machine interactions easier [6]. Various uses of IoT in Healthcare are as follows:
- Wearable Device Access (WDA) helps physicians to monitor the patient's health condition in real-time. The wearable device like a smartwatch or sensor collects the vital statistics of the patient and sends it through a secure channel to the physician or AI-enabled device, and any red flag for health is notified well in advance. It helps to take advanced decisions and early diagnosis and intervention for a patient, and save life [6].
- Adverse Drug Reaction (ADR) is also a system that monitors the reaction of a drug that is administrated to a patient, and quickly beware the physician about any adverse reaction or effect of that drug. This helps the healthcare provider to monitor the vital health of the patient and can save the patient's life to reduce adversity [6].

- Ambient Assisted Living (AAL) is helpful for old aged and specially-abled people. The system tracks the movements of the patient or people efficiently and prevents any accidents. It assists the patient to find directions or remind them of any medication. People with prostheses also take the help of this AAL inside the home [7].
- An Embedded Context Prediction (ECP) system uses in smart healthcare concepts where it mitigates any mishap and takes necessary actions on time to save the life of the patient. It can work with machine learning software to predict the accident area, nearest ambulance, and nearest hospital with emergency care and blood bank storage data. In a smart hospital or city concept, ECP can be revolutionary [8].
- The Medical Internet of Things (m-IoT) is a smartphone application-based service that provides vital healthcare data like blood pressure, blood glucose, etc to the receptor device. It is used by hospitals to monitor the patient in real-time using WDA technology. Physicians can monitor a patient from home, even if the patient is admitted to the hospital [8].
- Community Health (CH) and Children's Health Information (CHI) are mainly used through online medical records and telemedicine area. Using Information, Communication, and Technology (ICT) tools in telemedicine, the doctor can easily diagnose the disease and can initiate remote treatment procedures using IoT facilities [9].
- Emergency Healthcare (EMH) also does a similar thing in emergencies. It mitigates the effect of any disaster and helps healthcare providers to identify patients' injury categories, triage systems with proper tracking, medicine required, blood bank inventory, Operation Theatre availability, etc.
- Embedded Gateway Configuration (EGC) connects client and server through the internet. Here the patient and medical equipment are connected and the physician has direct access to the server and can control or monitor the vital stats [10].
- Semantic Medical Access (SMA) is a protocol by which the patient gives access to the medical history or medical records to the physician through EGC or other technology. It can be used to share confidential medical data with the right person and maintain the privilege of communication [8].

2. **Artificial Intelligence (AI) in Healthcare:** Artificial Intelligence (AI) has huge potential in the Healthcare field. It uses mainly in diagnosis, and decision-making assistance in treatment, and it completes the ecosystem with IoT and m-IoT to treat patients efficiently and effectively. AI-enabled healthcare services even can detect any upcoming health issues and can take preventive actions to save the life. There are a few applications of artificial intelligence in healthcare:

    - Image Analysis of radiological diagnoses like CT Scans, X-Ray, Mammograms, Magnetic Resonance Imaging (MRIs), etc. are important. AI does the medical image analysis more accurately and immediately to radicalize the diagnosis process, and help the physician to identify the cause and initiate treatments [11].
    - AI contributes the drug discoveries and virtual clinical trials and makes it easier to administrate drugs more accurately and safely.
    - AI can personalized treatment plans based on the patient's current health status and past medical history up to a certain level. Thus it helps physicians to take decisions

whenever critical complications arise. AI simulates the entire illness period well in advance and thus it predicts the dosage or suggests the diagnosis.

- AI can be embedded with the AAL and act as a personal health assistant. It can help anybody with any lifestyle disorder and suggest corrective measures. But it has certain limitations too. AI is based on a database that is implemented through machine learning and it needs huge data. Unknown problems may not be solved easily using AI, but accurate predictions can be done.
- Robot-assisted surgery can be done using AI. It will be revolutionized the entire process of invasive treatment, and human errors can be removed [12].
- AI can detect healthcare fraud and can be used widely by healthcare insurance companies and patient rights activists or the Government to take necessary actions.
- Natural Language Processing (NLP) technology allows the AI to accumulate and extract information from clinical notes, research papers, medical history, and hospital medical records to analyze and interpret evidence-based health care [13].
- AI not only supports physical health, but it can be supportive of mental health. It recognizes the facial behavior of the patient, and social media post analysis, and can easily detect or at least predict possible mental health conditions such as depression or suicidal tendencies. AI can predict the cognitive behavior of people and suggest healthcare providers possible solutions.

II. USE OF IOT AND AI IN THE FUTURISTIC TRENDS OF HEALTHCARE BUSINESS

The use of IoT has extensive areas in a corporate hospital. The patient first visits the hospital in the front office area where they collect all the relevant information on the hospital procedures, do registration, and billing for the same or the patient visit the hospital for admission or emergency purpose. But during the pandemic, home-based healthcare delivery started flourishing and the future is related to the conveyance of the facilities.

The home-based healthcare system is mostly based on IoT and m-IoT. It regulates through AI implementation with the system. The system is simple, yet required complex setups. The emergence of a home-based healthcare business is due to some factors like the emergence of lifestyle diseases, expansion of the tier-II and tier-III cities, the emergence of telemedicine, adaptation of AI, raising digitalization, etc [1].

The futuristic healthcare system will be completely personalized. The patient will take care of by the hospital remotely. It is possible due to internet connectivity and emergence of the smart cities. Every patient is provided with biosensors or wearable sensors which track the vital statistics of the health of the patient and send real-time data to the healthcare providers. The data will be analyzed by the AI-enabled software and sent a necessary warning if any red flag is noticed or identified. If any emergency is identified, then the provider immediately tracks the location of the patient and arranges necessary arrangements like ambulances, emergency medications, oxygen, blood bank requisitions, etc. The insurance companies can get immediate notification about any hospitalization and they can do the needful. The patient's medical record can be accessed through some unique identity number so the emergency healthcare providers can easily know the past medical history, any prevalent diseases, allergy history, etc. to take care of the patient without any unidentified

conditions. It is a 24x7 monitoring system, adding great value for the patients as well as service providers.

The system will be based on a cloud-based database, where each patient has their unique identification and the service providers can access the cloud database. All the live information has been uploaded to the cloud and AI-based software can analyze each data. Patient's medical records are also inclined with this database and updated each time the patient has any consultation or hospitalization. The online e-medical record will be secured by blockchain technology, as well as the unique identification of the patient. It will enhance security and smooth the processes. The patient need not carry all the documents with him/her and is easily tracked by the service providers who will arrange all the necessities. Healthcare insurance providers also get help from this business model, where they are automatically informed about any health-related issues and easily disburse the insurance amount or cashless facilities provided to the patient without any hustle.

The patient with active medication is easily informed about the availability of the medicine, reminded of medication time, and informed of remedies if any vital statistics have changed. Pharmaceuticals can make an easy business to be entitled as the medicine supplier for the patient. It will be completely patient-centric and future belongs to value-added personalized care.

III. CONCLUSION

In the intricate tapestry of modern healthcare, the fusion of IoT and AI has woven a transformative fabric that holds the potential to revolutionize the way we diagnose, treat, and care for patients. As these cutting-edge technologies continue to evolve and interlace, the healthcare business is on the precipice of a profound metamorphosis—one that promises enhanced efficiency, personalized medicine, and empowered patients.

With IoT devices gathering an unprecedented wealth of patient data and AI algorithms lending their unparalleled analytical prowess, healthcare professionals can embark on a journey toward proactive, preventive care. The ability to monitor patients remotely, predict disease outcomes, and offer personalized treatment plans heralds an era where healthcare is no longer a reactive response but an anticipatory one. Moreover, as AI-driven medical imaging, drug discovery, and robotic-assisted surgery become increasingly refined, we stand at the threshold of a new age of precision medicine. By harnessing the potential of AI to unlock patterns in vast datasets, medical researchers are unearthing groundbreaking insights, leading to novel treatments and cures that once seemed insurmountable.

Yet, amidst the awe-inspiring strides forward, we must not lose sight of the human touch—the compassion, empathy, and intuition that have always defined the essence of healthcare. While IoT and AI pave the way for progress, the ultimate success of their integration will lie in harmonizing technological prowess with the art of healing.

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