An Overview of Smart Healthcare

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ABSTRACT: ***The concept of smart healthcare has gradually gained popularity as information technology improves. Smart healthcare uses a new generation of information technologies, such as the internet of things (IoT), big data, cloud computing, and artificial intelligence, to fundamentally alter the traditional medical system, making it more efficient, simple, and personalized. With the aim of presenting the concept of smart healthcare, we list the major technologies that allow smart healthcare and examine the current status of smart healthcare in several important areas in this research. Then we go over the existing problems with smart healthcare and try to come up with solutions. Finally, we take a look ahead to evaluate smart healthcare's future potential. Healthcare is an important aspect of life. Unfortunately, the steadily aging population and the accompanying increase in chronic illness is putting considerable pressure on contemporary healthcare systems, and the demand for resources from hospital beds to physicians and nurses is very high Evidently, a solution is needed to lessen the strain on healthcare systems while continuing to offer high-quality treatment to at-risk individuals***

KEYWORDS: Disease prevention, Health management, Internet of things, Smart healthcare, Virtuassistants.

1. INTRODUCTION

Today's epoch is one of digitization traditional medicine, which has biotechnology at its heart, has started to digital and informationize as technology and scientific theory have advanced[1]. In addition, smart healthcare has developed, integrating a new generation of information technology. Smart healthcare is more than simply a technical breakthrough; it is a multi-level transformation. Medical model changes (from disease-centered to patient-centered care), informatization construction changes (from clinical to regional medical informatization), changes in medical management (from general to personalized management), and changes in the prevention and treatment concept are all examples of this change (from focusing on disease treatment to focusing on preventive healthcare)[2].

These improvements are focused on fulfilling people's unique requirements while increasing the efficiency of medical treatment, significantly enhancing the medical and health-care experience, and representing contemporary medicine's future growth path. This review will begin with an introduction to the concept of smart healthcare, followed by a brief overview of the key technologies that support smart healthcare, as well as their achievements and challenges, followed by a review of the status of these technologies in key medical fields, and finally, a discussion of smart healthcare's future prospects[3]. Smart healthcare arose from IBM's (Armonk, NY, USA) idea of "Smart Planet" presented in 2009. Simply stated, Smart Planet is an intelligent infrastructure that detects information with sensors, transmits it through the internet of things (IoT), and analyzes it using supercomputers and cloud computing. It has the ability to coordinate and integrate social processes in order to achieve the dynamic and sophisticated administration of human civilization.

Smart healthcare is a health-care delivery system that utilizes wearable devices, the internet of things, and mobile internet to dynamically access information, link people, materials, and institutions in the healthcare industry, and then intelligently controls and reacts to medical ecosystem requirements[4]. Smart healthcare may foster interaction among all stakeholders in the healthcare industry, ensuring that participants get the services they need, assisting parties in making informed choices, and facilitating resource allocation. In a nutshell, smart healthcare is a higher level of medical information building[5].

Multiple players, such as physicians and patients, hospitals, and research institutes, are involved in smart healthcare[6]. It's a multi-dimensional organism that includes illness prevention and monitoring, diagnosis and treatment, hospital administration, health decision-making, and medical research. Smart healthcare is built on

the foundation of information technologies such as the Internet of Things, mobile Internet, cloud computing, big data, 5G, microelectronics, and artificial intelligence, as well as contemporary biotechnology. In all areas of smart healthcare, these technologies are extensively utilized[7]. Patients may utilize wearable gadgets to keep track of their health at all times, seek medical help via virtual assistants, and use remote houses to implement remote services; physicians can employ a range of sophisticated clinical decision support systems to aid and enhance diagnosis[8].

Doctors may handle medical data using an integrated information platform that incorporates tools like the Laboratory Information Management System, Picture Archiving and Communication Systems (PACS), and the Electronic Medical Record. Surgical robots and mixed reality technologies may help with more accurate surgery[9]. Radio-frequency identification (RFID) technology may be used to manage staff materials and the supply chain in hospitals, with integrated management systems collecting data and assisting decision-making. Patients' experiences may be improved by using mobile medical platforms. From the standpoint of scientific research institutes, methods such as machine learning may be used instead of manual drug screening, and big data can be used to identify appropriate individuals[10]. Smart healthcare can effectively reduce the cost and risk of medical procedures, improve the utilization efficiency of medical resources, promote regional exchanges and cooperation, push the development of telemedicine and self-service medical care, and eventually make personalized medical services ubiquitous through the use of these technologies.

1.1 Application of smart healthcare :

- *Health management*: Chronic illnesses have progressively risen to the top of the human disease spectrum and have become a new pandemic since the beginning of the twenty-first century. Chronic illnesses have a lengthy course of disease, are incurable, and are costly;as a result, chronic health management is critical. The conventional hospital- and doctor-centered health management paradigm, on the other hand, seems to be incapable of coping properly with the growing number of patients and illnesses. Patient self-management is emphasized more in the new smart healthcare health management paradigm. It stresses patient self-monitoring in real time, rapid feedback of health data, and prompt medical behavior modification. IoT-connected implantable/wearable smart devices, smart homes, and smart health information platforms offer a solution to this problem.

  Advanced sensors, microprocessors, and wireless modules in third-generation wearable/implantable devices can intelligently sense and monitor various physiological indicators of patients while reducing power consumption, improving comfort, and allowing the data to be combined with health information from other channels. This method entails making the transition from scenario monitoring to continuous perception and integrated care. It lowers the disease's related dangers while also making it simpler for medical institutions to track the disease's prognosis. The advent of smart phones, smart watches, and other similar devices has provided a new vehicle for this kind of surveillance. Biosensors have been tried to be integrated into cellphones.

  Users may utilize a high-performance smartphone to monitor the surroundings and their body more readily while increasing portability. The aged and handicapped may get help at home with smart homes. Smart homes are houses or flats that include sensors and actuators built into the residential infrastructure that monitor the inhabitants' physical signals and surroundings. Smart houses also perform functions that enhance the quality of life. Home automation and health monitoring are the two major elements of smart homes' involvement in healthcare. While gathering health data, these devices may offer certain basic services, allowing individuals who need care to decrease their dependence on health care professionals and enhance their quality of life at home.

  Patients may use applications and a health information portal to self-manage their conditions. The Stress Detection and Alleviation system, for example, employs a wearable medical sensor to constantly monitor human body pressure levels and automatically assist the body in stress reduction. It's also feasible to combine health data from several portable devices into a clinical decision support system to build a hierarchical health decision support system that can make full use of the data for accurate illness

diagnosis. It can anticipate potential hazards for patients and provide advice in advance using the cloud calculator and big data while helping clinical decision-making. Another option is to develop an open health framework that enables physicians, patients, researchers, and others to collaborate with one another by lowering entrance barriers. Patients may readily obtain telemedicine guidance and services, while physicians can keep track of their patients' progress in real time. Peer experts and researchers may also help clinicians. Mobile architectures, such as m-Health, may assist minimize medical mistakes, make medical treatment easier, enhance medical service timeliness, and offer a cost-effective alternative for health services.

- *Disease prevention and risk assessment*: Traditional illness risk prediction relies on health authorities taking the effort to gather patient data, comparing that data to authorized organization standards, and then disseminate the prediction findings. This technique has a temporal lag and does not offer people with precise information. Disease risk prediction is dynamic and customized in smart healthcare. It allows patients and physicians to take part, proactively monitor their illness risk, and implement tailored preventive strategies based on their own monitoring findings. The new illness risk prediction model gathers data from wearable devices and smart applications, uploads it to the cloud through a network, and analyzes the findings using big data-based algorithms before sending the projected results to users via short messaging service in real time.

  These strategies have been shown to work. They assist physicians and patients in making changes to their medical behaviors and lifestyles at any time, as well as decision-makers in developing regional health plans with the aim of lowering illness risk. For example, in a study aimed at preventing diabetes by predicting the postprandial blood glucose response, researchers used algorithms that integrated blood glucose parameters, eating habits, anthropometry, physical activity, intestinal microbiota, and other factors to successfully predict changes in glycemic response after monitoring the blood glucose response of 800 people for 46,898 meals per week.
- *Virtual assistants*: A virtual assistant is an algorithm, not a person. Virtual assistants utilize voice recognition to interact with users, depend on big data for information sources, and react based on the user's preferences or requirements after computations. Virtual assistants include Microsoft Cortana (Redmond, WA, USA), Google Assistant (Mountain View, CA, USA), and Apple Siri (Cupertino, CA, USA). Virtual assistants utilize session experience and language-understanding technology to assist users with a variety of activities, such as creating reminders and automating their homes. Virtual assistants in smart healthcare primarily serve as a communication link between physicians, patients, and medical organizations. They make medical care more accessible.

  For patients, the virtual assistant can quickly translate ordinary, daily English into medical terms through their smart device, allowing them to more correctly seek the appropriate medical treatment. For physicians, the virtual assistant may reply to pertinent information automatically based on the patient's fundamental information, making it easier for them to manage patients and organize medical procedures, allowing them to save time. Virtual assistants may help medical institutions save personnel and material resources while also responding to the requirements of all parties more quickly.

  Nuance technology may also be utilized to establish communication between various virtual assistants, particularly between general and highly specialized assistants, significantly enhancing the experience of medical service users. Virtual assistants may also be utilized to help with illness treatment, for as using virtual assistants to enhance human mental health, alleviating the shortage of human psychotherapists and bringing spiritual health to more people.
- *Ingenious hospitals*: Regional, hospital, and family healthcare are the three main components of smart healthcare. To enhance current patient care procedures and add new features, smart hospitals depend on information and communication technology-based settings, particularly those based on IoT optimization and automated operations. Smart hospitals provide three kinds of services: services for medical personnel, services for patients, and services for administrators. In hospital management choices, the needs of these service consumers must be taken into account. The information platform in

hospital administration links digital devices, intelligent buildings, and people by integrating various digital systems based on the Internet of Things.

This technology may also be used to identify and monitor patients in hospitals, manage medical personnel on a daily basis, and track equipment and biological material. In the pharmaceutical business, smart healthcare is used for medication manufacturing and distribution, inventory management, anti-counterfeiting, and other operations. A unique RFID tag may be given to each person and the information can be recorded in a database that can be readily monitored and accessed through mobile devices to ensure safe, reliable, stable, and efficient circulation of hospital materials. In terms of decision-making, establishing an integrated management platform may enable activities like resource allocation, quality analysis, and performance analysis, as well as minimize medical expenses, optimize resource usage, and assist hospitals in making development choices. Patients have access to a variety of services, including physical examination systems, online appointments, and doctor-patient contacts. 35 These computerized technologies shorten the time it takes for patients to get medical care. Patients wait less time and get more personalized care. To summarize, smart hospitals' future directions include integration, refining, and automation.

- *Assisting with drug development*: Drug research and development will become more exact and easy with the use of big data and artificial intelligence in scientific study. Target screening, drug discovery, clinical trials, and other aspects of the drug development process are all included. In order to identify effective action sites, traditional drug target screening manually crosses known medicines with different possible target molecules in the human body. This technique is not only time-consuming, but it is also often ignored. Artificial intelligence-assisted automated screening of medication and target effects has significantly improved screening speed. The Watson method was used to identify ribonucleic acid-binding proteins in amyotrophic lateral sclerosis and genomics research on tumors, for example.

  Furthermore, the artificial intelligence system can gather real-time data from the outside world and can improve or rectify the screening process at any moment. Drug discovery is mostly based on high-throughput screening, in which a huge number of compounds are produced and tested one by one. However, as the number of chemicals available grows, so does the expense and danger of using them. This issue may be successfully solved by using artificial intelligence for virtual drug screening. The number of medication molecules that are actually tested may be decreased thanks to computer pre-screening. It can also enhance lead chemical discovery efficiency, forecast therapeutic molecule activity, identify promising compounds, and ultimately build a collection of compounds with acceptable characteristics.

2. DISCUSSION

Smart healthcare has spawned mature ideas and systems since its inception. However, with the introduction of new technologies and issues, there is still a lot of space for improvement, and there are a lot of new challenges on the horizon. Smart healthcare now lacks macro direction and programmatic guidelines, resulting in a lack of clarity in development objectives and, as a result, a waste of resources. Furthermore, medical institutions lack consistent standards across various areas and organizations, and data integrity has to be improved. The quantity of data is too complex and big, which makes data exchange and communication difficult. Compatibility issues exist across various systems and devices as well. Smart healthcare, from the patient's viewpoint, lacks appropriate legal standards, and there are dangers associated with personal information and privacy breaches. Some people have trouble navigating the technology. Technically, certain smart healthcare technologies are still in the experimental phases and need a significant amount of money to maintain and improve. If used incorrectly, there is potentially an unknown danger.

3.CONCLUSION

In conclusion, smart healthcare has a bright future. Individual users may benefit from smart healthcare since it allows them to better control their own health. Medical services will be available when they are required, and

the substance of those treatments will be more customized. Smart healthcare can decrease expenses, alleviate staff strain, accomplish unified material and information management, and enhance the patient's medical experience for medical facilities. For research institutes, smart healthcare may save research costs, shorten research time, and increase overall research efficiency. Smart healthcare may enhance the status quo of medical resource disparity, drive the medical reform process forward, encourage the adoption of preventive measures, and decrease societal medical expenses in macro decision-making. 42 The development process, however, is still plagued by issues. The solution to these issues is contingent not just on technical advancement, but also on the collaborative efforts of patients, physicians, health-care organizations, and technology firms.

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