Tuijin Jishu/Journal of Propulsion Technology
ISSN: 1001-4055
Vol. 44 No. 5 (2023)

The Future Of Healthcare: Artificial Intelligence 's Role In Smart Hospitals And Wearable Health Devices

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Abstract: The contributions of technology to bettering human existence, especially in medical treatment, cannot be overstated. In recent years, there has been a huge increase in the usage of artificial intelligence (AI) and the internet of things (IoT) for the goal of connecting diverse medical resources and offering trustworthy and efficient intelligent healthcare. This is due to the fact that these two technologies are more capable of supplying accurate and timely information than traditional methods. As a result of the rise in popularity of wearable technologies as useful tools for healthcare applications, numerous products that cater to a variety of requirements in this field are now commercially available. This research was conducted with the intention of providing a complete overview of the most recent improvements in the field of wearable medical IoMT for healthcare systems. These advancements were evaluated based on how successfully it was thought that they could detect diseases, prevent diseases, and monitor diseases. There is also coverage of contemporary medical concerns like COVID-19 and monkeypox. This paper provides a comprehensive analysis of the many strategies offered by the authors to enhance healthcare delivery using wearable technology and AI. In addition, AI encourages patient participation in healthcare via virtual assistants, chatbots, and remote patient monitoring systems. Healthcare providers are aided in developing evidence-based judgements and individualised treatment plans with the use of AI-driven clinical decision support systems, which leads to better patient outcomes. While the adoption of AI in smart hospitals offers enormous benefits, it also raises issues involving data privacy, algorithm bias, legal compliance, and the need for interdisciplinary collaborations. In order to guarantee the ethical and responsible deployment of AI in healthcare settings, these issues are highlighted in this review and emphasised as crucially important.

1. INTRODUCTION

The increasing population of the world has an impact on the standards that traditional healthcare institutions have to meet in order to serve the general public [1]. The general population does not have easy access to affordable or high-quality medical treatment despite the fact that there is a well-developed healthcare infrastructure and advanced medical technology. It is anticipated that the overall expense of providing medical care would rise as a direct result of the increasing median age of the world's population. In 2016, China spent about 4,634 billion yuan, which equal to approximately 6.36 percent of the country's total GDP, according to the most recent statistics that was made available. It is anticipated that China will spend 7.231 quadrillion yuan in 2021, which will be equivalent to around 7.1 percent of the country's total GDP. In order to triumph over these challenges, we need a smart healthcare system that can inform the public about important health issues and keep them abreast of developing medical conditions in real time. This is the only path to success in achieving our objective.

Users that have access to smart healthcare can handle a variety of their own medical concerns on their own. It allows for the patient to be remotely monitored and tracked, which results in a reduction in the patient's overall healthcare costs. Another advantage is that it frees clinicians from the geographic constraints that previously limited their ability to provide their services. Smart wearable devices, smart homes, smart cities, and a fully functional smart healthcare system that can support elderly citizens in leading a healthy life have been increasingly popular over the past decade [3]. The Internet of Things, or IoT for short, is a dynamic interactive paradigm that facilitates human and nonhuman interaction in the present day's digital world [4]. This model

involves enormous networked devices that interact with one another to carry out this communication. When discussing healthcare, the term "Internet of Things" (IoT) refers to any device that collects information about people's health, whether it be through phones, smart wearable gadgets, bands, surgical equipment implanted in the body, or other portable devices that can monitor health.

In order to do remote patient monitoring, the Internet of Things is employed not just in hospitals and other medical facilities but also in private homes. The use of remote patient monitoring in the medical industry has the potential to significantly cut down on the number of unnecessary trips to medical professionals, lengths of hospital stays, readmissions, and overall costs associated with medical treatment [7]. This is accomplished by identifying and treating potentially dangerous illnesses and problems at an earlier stage. At the moment, the patient's hospitalisation till the treatment length contributes significantly to the high cost of our healthcare system. Intelligent technology that enables remote patient monitoring is one potential solution to these problems. The Internet of Medical Things (MIoT) helps to reduce down the cost of delivering medical care by enabling the collection and sharing of real-time patient health data with clinicians. Because of this, it is now possible to address health problems before they develop into serious illnesses [8]. There is no doubt that people's lives will become better as a result of the MIoT. The creation of integrated tools has the potential to result in a wide range of beneficial developments in integrated information system services, system processing, and communications, all of which can be controlled in a variety of different ways. As a direct result of this, the field of medicine requires a multitude of digital, wearable devices and applications that are based on the Internet of Things (IoT) (as illustrated in Figure 1) in order to recognise, track, and prevent a variety of chronic and infectious illnesses [9].

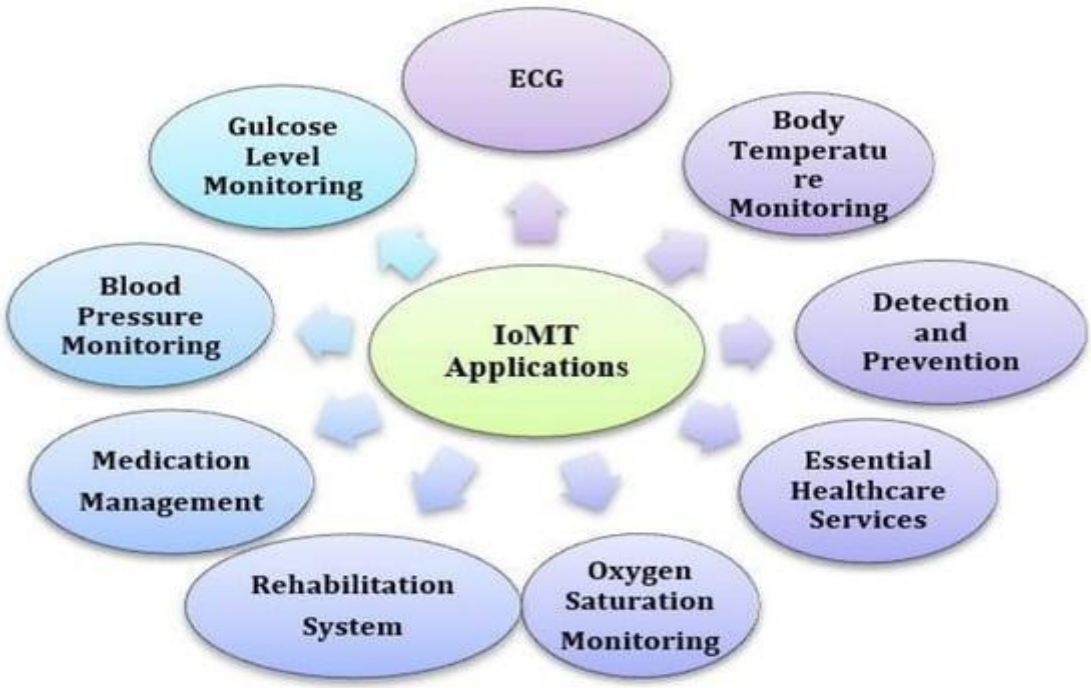

Figure 1. The Internet of Medical Things (IoMT) and its various application areas.

Wearable technology is quickly becoming one of the most significant components of the Internet of Things [10]. Wearable devices are currently at the forefront of every discussion on Internet of Things-related advancements in the healthcare sector because of the major paradigm change that they have the ability to bring about. In the field of healthcare, they are also regarded as the technique that is best suited for monitoring, tracking, and identifying persistent and infectious diseases. Wearable technology, which is a key component of the Internet of Things, enables patients to receive the appropriate medical care at the appropriate time [11]. Customers have indicated a high level of readiness to purchase and wear these devices, which demonstrates that they have the potential to improve the standard of living of humans in the present day in ways that cannot be

reached only through the use of smartphones. Customers have also expressed a high level of readiness to purchase and wear these devices. IoT devices with sensors allow for the tracking of medical workers and equipment in hospitals. This includes the deployment of medical personnel. These machines are widely used in the medical field to perform patient monitoring and to generate warnings for those who have potentially life-threatening diseases.

2. Literature Review

It is now possible to gather data relevant to medical issues by making use of mobile devices, shared networks, and even sensors that are attached to the human body [12]. This accessibility was not possible in the past because of the rapid and prolific spread of the gathering and storing of massive amounts of data as well as improvements in AI health technology; however, these developments have made this accessibility possible. However, these developments have made it possible.

The public's awareness of the need to protect the confidentiality of their personal information has increased alongside developments in information storage and retrieval technology. There is a growing concern that breaches of patient confidentiality could lead to a decrease in public confidence in the healthcare system [13]. This anxiety is growing as a result of recent events.

Patients may be vulnerable to privacy invasions, fraud, algorithmic bias, information leakage, and identity theft as a result of the acquisition and use of personal health data by AI and analytical algorithms, which gives birth to serious issues. This is because the acquisition and use of personal health data by AI and analytical algorithms gives rise to severe challenges. Additionally, this may result in information being stolen from patients. The primary reason for this reluctance to exchange health information is because there is always a possibility that any information that is shared or transmitted could be stolen or could inadvertently be made public. In point of fact, when people in the UK were questioned about their attitudes about providing their personal health data for the goal of building algorithms that would improve the quality of care, 49% of those polled stated that they were unwilling to do so. In particular, breaches of data might result in discrimination or criminal behaviour in communities that are already stigmatised or vulnerable [14].

A data governance panel comprised of a cross-section of the target population, including patients, clinicians, and AI, ethics, and law specialists, is advocated as a means of combating the bias that can be generated by AI. The panel's mandate would be to keep tabs on and evaluate the AI training datasets and algorithms. This is done to guarantee that the data being used for training AI is representative, and that the techniques being used for training AI are objective and provide adequate information to inform needed model conclusions. In order to avoid discrimination and achieve ethical obligations to vulnerable individuals, stakeholders need to be clear about which communities and individuals are being watched. It is important for community leaders to be involved in this process so that they are able to identify and report any negative incidences that occur within their community [15].

The patient-provider relationship is undergoing a fundamental communication paradigm shift as a result of digitalization. Patients are concerned that AI-based health systems may affect the way in which they interact with their physicians, which may have repercussions for both the cost and the quality of healthcare services. In order to overcome this issue, scientific communities and governmental organisations have the ability to play a crucial role in facilitating inclusive communication between members of the general public and those who provide medical treatment [16]. To further reduce the impact of unintentional biases, the design of AI solutions should involve a wide range of stakeholders (including AI companies, healthcare organisations, regulatory bodies and policy makers, and patients) from a variety of fields and cultures, speaking a range of languages and using a range of communication methods.

3. Methods

3.1 Design, sample and time period

Patients with COVID-19 who were admitted to our institution for treatment between January 2020 and December 2022 were included in this retrospective cohort study. The time period covered by this study was from January 2020 to December 2022.

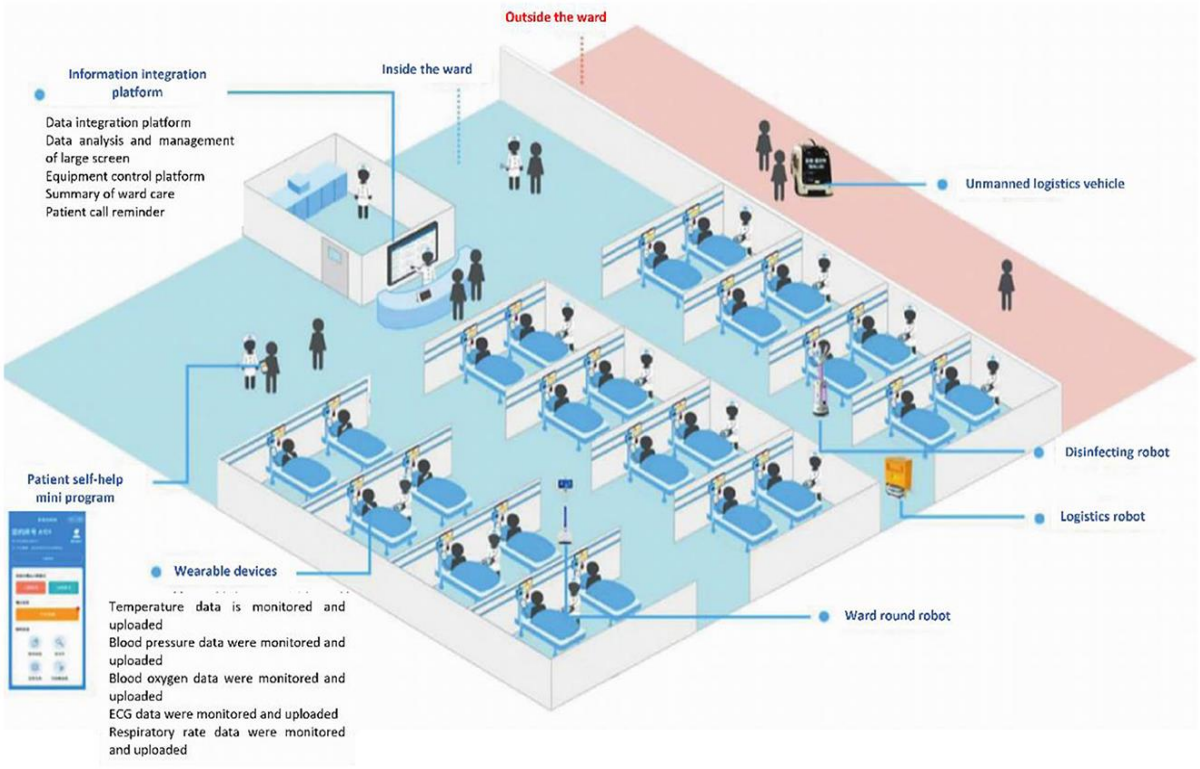

Figure 1. A diagrammatic representation of the intelligent hospital management mode

The process of improving the construction and maintenance of high-quality hospitals is becoming increasingly dependent on the generation of new information and the strategic use of huge quantities of data. Legislation is the primary force behind this tendency. It is no longer possible for electronic medical records that are still in the beginning stages of information building to fulfil the needs of efficient hospital management in the new era. Therefore, in order to boost productivity and increase the amount of space available for development, it is essential to reorganise the in-depth strategy of growth, to promote the establishment of a hospital management mode, and to create a top-level information framework based on big data.

Therefore, the purpose of this study is to explore the possibility of creating an intelligent hospital management mode (Figure 1) based on AI and 5G, the Internet of Things (IoT), wearable devices, robots, small programmes, and other cutting-edge technologies.

3.2 Inclusion criterion

Patients were only eligible to take part in this investigation if they satisfied all three of the following requirements: (1) they had a diagnosis of COVID-19 infection that was confirmed by a PCR assay; (2) they adhered to and cooperated with their treatment; and (3) they gave their written agreement to take part in this investigation. Patients were only eligible to participate in this study if they met all three of these requirements.

3.3 Exclusion criterion

Patients were not considered for involvement in this investigation if either (1) they had any major comorbidities or (2) they had not given their informed consent to take part in this experiment. Patients were not considered for participation in this investigation if they had either of these conditions.

3.4 Equipment and technology

This research aimed to analyse and develop a smart hospital management system that makes use of AI and other emerging technologies including 5G, the IoT, wearable devices, robots, and microprogramming. These technologies were used in conjunction with one another.

3.5 Device and Body Safety

The user should not suffer any injuries as a result of using the equipment, nor should the gadget itself sustain any kind of damage. It is necessary for the system to include built-in safety protocols. Table 1 is a discussion of some of the potential dangers that are linked with the use of wearable technology. Smart wearable technology-based devices carry with them a variety of risks despite the fact that they have the ability to dramatically improve a user's lifestyle.

Table 1. Potential risk associated with wearable technology.

Wearable Device	Possible Risks
Burning	Sometimes during usage these wearables cause burns on human body parts such as on skin due to the high temperature of batteries.
Electric shock	Wearables have direct contact with the user's body or are sometimes planted in the clothes; in such cases, a minor electric shock brings a great risk.
Fire, Explosion	Battery explosion causes fire and high temperature that damage the skin.
Skin damage	Some wearables cause cuts, scratches, and wounds on human body parts, such as wearable masks that caused skin damage during COVID-19.
Reactions	Sometimes wearable cause chemical reactions, such as when chemicals in the fibers or metals that have contact with skin cause rashes.

3.6 Wearable/Implantable

Batteries are typically the first choice when it comes to selecting a power supply for any implantable or wearable medical equipment. The amount of battery life that a device has will determine its price. Unlike implanted devices, wearable devices can use rechargeable batteries, but replacing the batteries that power implanted devices requires a surgical operation. This is because implanted devices rely on batteries as their major source of power. Inductive charging is an alternate method; however, in order for it to work, the user or patient must remain in constant contact with the charging device, which has its own set of risks. When put through its paces, a rechargeable battery should be able to hold out for at least 8 hours before it needs to be charged again.

4. AI Improving Patient Care In Hospitals

AI has the potential to greatly improve patient care in hospitals by streamlining operations, boosting diagnostic accuracy, facilitating the development of personalised treatment plans, and encouraging patient participation. The following are some of the ways that AI can accomplish these kind of improvements:
Diagnostics that are both Rapid and Accurate. Diagnostic technologies driven by AI can do analysis on patient data, medical imaging, and laboratory findings to assist medical professionals in establishing diagnoses that are both quicker and more accurate. This may result in diseases being discovered and treated at an earlier stage. Personalised Intervention Strategies and Plans. AI is capable of analysing patient data, medical history, and treatment outcomes to produce personalised treatment regimens that are tailored to the exact requirements and features of each individual patient.

4.1 Analytics for Making Predictions

Using AI, hospitals are able to analyse vast datasets to make predictions about patients' states, the evolution of diseases, and the possibility of consequences. This enables both reactive and proactive measures to be performed in response to the situation. The abbreviation for "Remote Patient Monitoring" (RPM). RPM systems that are driven by AI are able to continually monitor patients' health outside of the surroundings of a

hospital, and they can send timely notifications to healthcare practitioners if any health metrics depart from the norm.

4.2 Medication Management

AI can assist in ensuring that correct medication management is carried out by providing patients with reminders to take their pills as well as alerting healthcare providers about the possibility of adverse reactions or interactions between medications. Optimisation of the Hospital Workflow. Artificial intelligence has the potential to optimise hospital workflows such as patient scheduling, bed management, and resource allocation, which will result in increased efficiency and decreased waiting times. Automated conversational agents and digital assistants. Chatbots and other types of virtual assistants that are powered by AI may interact with patients, respond to their questions, and give them with fundamental health information. This improves patient engagement and eases the workload of hospital staff.

Prediction of the Risk of Readmission. The chance of a patient being readmitted can be predicted by AI algorithms, which enables healthcare practitioners to take preventative steps and offer appropriate follow-up treatment in an effort to lower the overall rate of readmissions. Avoiding and preventing falls. Artificial intelligence has the ability to analyse patient data and identify individuals who are at a high risk of falling. This enables hospitals to execute targeted interventions and reduce the number of injuries that are caused by falls. Processing of natural language (also known as NLP). The use of NLP that is powered by AI makes it possible to extract useful information from electronic health records, which improves the effectiveness of data analysis and the quality of decisions made. Quality Control and Error Reduction. The identification of probable errors and anomalies in patient data and medical records is one of the ways that AI can assist in quality control operations.

Patient Education and Participation is Essential. Patients can be provided with individualised health information as well as educational content by applications that are powered by AI. This gives patients the ability to take an active role in their own treatment. The health outcomes of patients can be improved, resource utilisation can be optimised, and the overall patient experience can be improved if hospitals make use of AI technologies in various ways. It is essential, however, to implement AI into pre-existing healthcare workflows in a responsible and ethical manner, protecting the confidentiality of patient information while also striking a healthy balance between the use of automation and the involvement of humans in patient care.

5. Conclusion

To summarise, the implementation of artificial intelligence (AI) in smart hospitals has the potential to radically alter the structure of the healthcare business as a whole and greatly enhance the quality of treatment provided to patients. Traditional healthcare facilities are aiming to be transformed into intelligent and responsive ecosystems that place a priority on patient-centered care and expedite processes. This transformation will be driven by cutting-edge technology such as artificial intelligence (AI). Throughout the course of this analysis, we have discussed the various ways in which artificial intelligence can be utilised in smart hospitals. These applications range from medical imaging and diagnostics to predictive analytics, patient interaction, and clinical decision support systems. AI-powered diagnostic technologies have shown an excellent level of accuracy in the detection of anomalies and the acceleration of diagnoses, whilst predictive analytics helps in the optimisation of clinical workflows and the improvement of patient outcomes through proactive interventions. The Internet of Things has the potential to ease the strain placed on public sanitation systems while simultaneously enhancing the quality of life for individuals through the provision of individualised medical care. There is the possibility that health management systems that are based on intelligent medical devices may improve the overall performance of healthcare. As a result, the most popular Internet of Things applications and medical wearables that are utilised in the present period for the diagnosis and avoidance of multiple diseases are analysed, discussed, and contrasted in this article. In addition, the authors have provided a comprehensive analysis of the difficulties connected with the use of medical wearables, which are factors that need to be taken into account while developing superior wearable devices and working towards the goal of attaining enhanced medical care in the future.

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