Unleash the Power of Metaverse:The New Era of Digital Health Technologies

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Table of Contents

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Abstract

The Metaverse is a virtual shared space that combines virtual reality (VR), augmented reality (AR) and blockchain technology to create an immersive social and interactive experience. In the medical field, Metaverse can provide simulation training, patient education, remote diagnosis and treatment and other functions to promote the interaction between doctors and patients.

Smart medical care uses advanced data analysis, artificial intelligence (AI), Internet of Things (IoT) and other technologies to improve the efficiency and accuracy of medical services. Smart medical care can achieve personalized diagnosis and treatment, real-time monitoring and predictive analysis, and improve patient health management.

The combination of the two has the potential to change the traditional medical model and make medical services more convenient, accessible and efficient. For example, patients can have virtual medical consultations in the metaverse, and doctors can use smart medical tools for diagnosis and treatment. This not only improves the utilization of medical resources, but also enhances patients' sense of participation and satisfaction. In the future, with the further development of technology, the integration of Metaverse and smart medical care will likely create a new medical experience and service model.

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Unleash the Power of Metaverse：The New Era of Digital Health Technologies

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Abstract

The post-COVID-19 era has sparked an unprecedented acceleration in the adoption of emerging technologies and sharply highlighted our vulnerabilities in managing the health of the global population and the opportunities offered by the deployment of innovative solutions powered by these emerging technologies . Among them, smart healthcare may be one of the solutions to several global healthcare challenges. All aspects of the global healthcare ecosystem require profound digital transformation and inversion in terms of requirements, use cases, service processes, practices, and delivery practices. This article starts with a clear definition by gaining a deep understanding of the metaverse, and then studies, discusses, and analyzes all the essential elements and their impact on smart healthcare in the healthcare ecosystem. Here we propose a metaverse application service framework that defines the metaverse by using seven functional building blocks, including: VR/AR, cloud computing, big data, IoT, AI, 5G, blockchain, and targeting a variety of the service situation of the metaverse application, explaining the impact and importance of each metaverse functional building block in smart medical care. However, given the current epidemic situation, we hope to reveal the impact and future potential of the innovative connection between smart medicine and the metaverse on healthcare. All in all, this article proposes how smart medical care should develop strategies to monitor, understand, and respond to different metaverse activities, and combine technology and human nature to assist medical care, starting with disease treatment, and improving patient medical experience.

Key words: Metaverse; Healthcare.

1. Introduction

Smart health care is the use of advanced network, communication, computer and digital technology to realize the intelligent collection (Thielst, 2007), conversion, storage, transmission and post-processing of medical information, as well as the management of various medical business processes. Digital operation, so as to realize the interaction between patients and medical staff, medical institutions, medical equipment, and gradually achieve medical informatization. Digital healthcare is moving towards empowering patients, driving the evolution of wearables, mobile health and telemedicine. Advances in big data and cloud computing have enabled more timely healthcare solutions such as biosensors, resulting in increased patient engagement. With the advancement and rapid rise of the Internet of Things technology, smart medical care is not only a simple collection of digital medical equipment, but also a new type of modern medical method that applies contemporary computer technology, communication and information processing technology to the entire medical process. Smart medical care can not only improve the work efficiency of hospitals and medical personnel, reduce errors in work, but also solve the problem of uneven regional distribution of medical resources through telemedicine and teleconsultation. Among them, "smart healthcare" is defined as "the application of information and communication technology (ICT) in the medical and health fields, including medical care, disease management, public health surveillance, education and research" (Hamalainen et al., 2007; Fares et al., 2021). In the information-intensive environment of healthcare, a network-centric approach allows for the free and rapid sharing of information and efficient knowledge building for the development and rapid realization of coherent goals. Some scholars believe that "smart medical care" is the intersection of medical information (Chiasson et al., 2007), public health, and business, and refers to the provision or enhancement of health services and health information through the Internet and related technologies. In addition, in accelerating the integration of partners in the IoT ecosystem (Ukil et al., 2016), timely collection of data and analysis and application can greatly reduce the cost of smart medical projects, and promote the collaborative operation of people, objects, and systems, and become a medical big data. The basis of data, as a generalized use of the combination of the Internet of Things and artificial intelligence, allows smart medical products and services to be launched into the market faster. In the new HIPPA (Health Insurance Privacy and Accountability Act) guidelines (Moore, 2007), the Metaverse will empower patients and physicians to use medical wearables to ensure patient privacy and confidentiality.

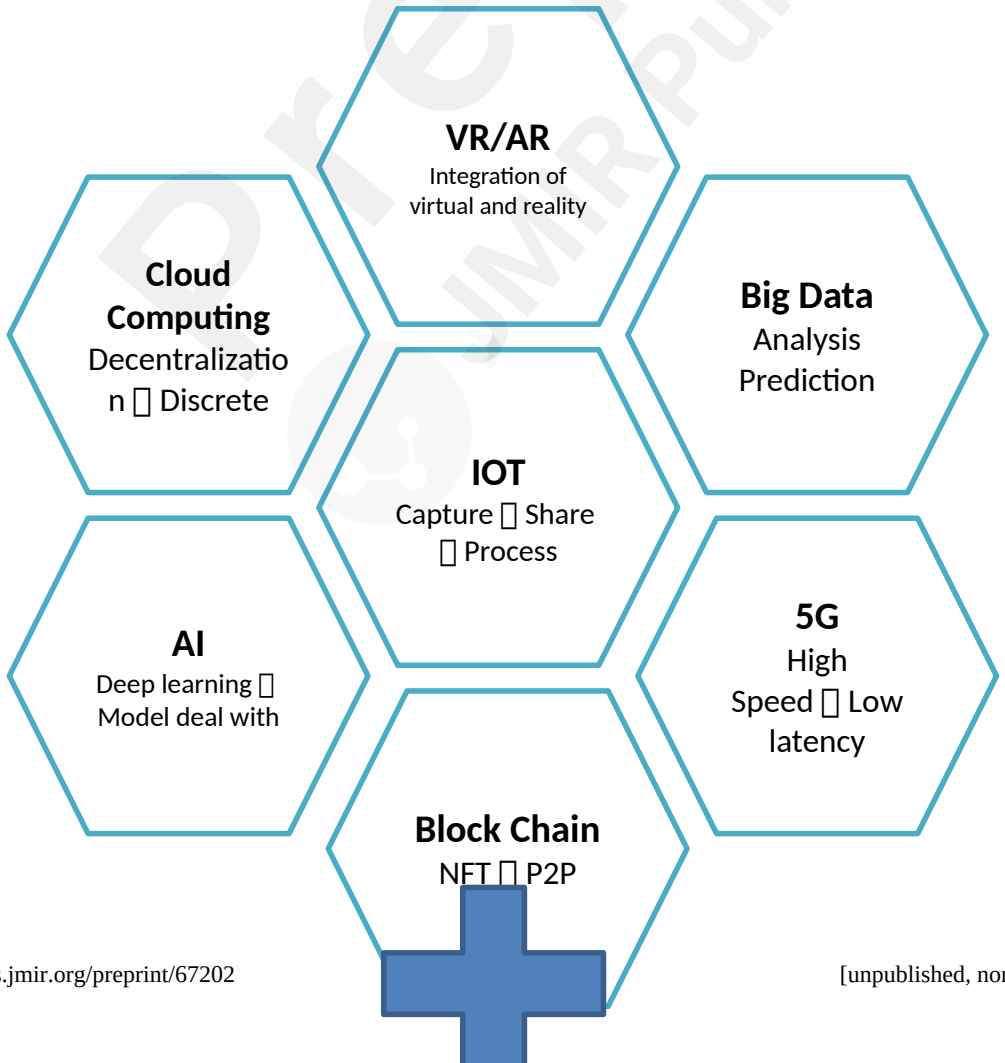
Metaverse is a persistent and decentralized online three-dimensional virtual environment in the future (Suzuki et al., 2020). It describes a virtual space that is not separated from reality. People can interact with virtual characters in various virtual environments through virtual identities. (Nevelsteen, 2018) or item interaction. To put it simply, it is to enter another super illusory virtual world through VR (virtual reality) glasses or mobile phones. People can buy houses and cars in another world, and carry out the same daily life behaviors as the real world. The Metaverse is an interactive and immersive experience (Ning et al., 2021), a virtual three-dimensional world that can be shared in collaboration and cooperation, and is a new type of Internet application and social form. Just as the physical universe is a collection of spatially connected worlds, so during the global COVID-19 quarantine policy, videoconferencing tools connect colleagues in the diaspora (Duan et al., 2021), teachers teach and students learn also had a profound impact. As a result of this crisis, teachers have had to adapt quickly and move to distance learning (Barry et al., 2021), which also hints at where the future is headed. Metaverse is a huge technical concept, which can be described as a comprehensive concept of various popular technologies, including technical applications such as virtual reality, 5G/AI, new social platforms, blockchain/cryptocurrency, Internet of Things (Suzuki et al. , 2020), etc., although the development of the metaverse still takes some time, it also makes human beings look forward to the future development of science and technology.

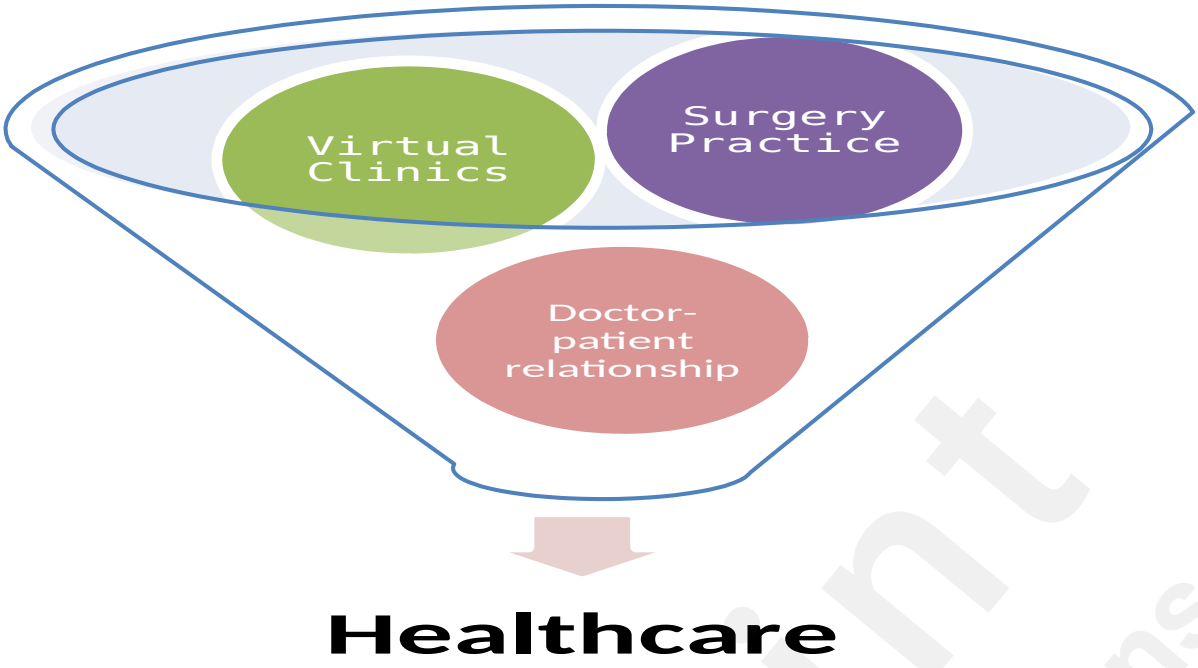
Given the amount of exposure to the metaverse in today's popular mainstream media, we seem to be in an entirely new ecological environment. The landscape of metaverse technologies and services began to take shape more than a decade ago. With the rise of the metaverse, with its varied

scope and functions, businesses must decide whether to take the rise of the metaverse seriously and participate in it, or continue to ignore it, which will have a huge impact on the business. Despite the obvious intentions, it is undeniable that the metaverse is indeed very powerful, and one reason behind the unwilling or inability of many senior executives to devise strategies and allocate resources to participate effectively is a lack of understanding of the metaverse. Of course, the Metaverse will not be a "centralized" world controlled by one or a few companies, because neither the Metaverse itself nor the data and assets owned using the digital space will be stored in an applicable (applicable) decentralized storage system To achieve perpetual preservation. Therefore, in the Metaverse, people around the world can communicate and collaborate efficiently, fully networked smart devices will be effectively linked, and industrial chain collaboration will become more transparent and efficient. In terms of the entire mechanism: digital technologies such as blockchain, artificial intelligence, and the Internet of Things realize the cooperation and transaction of things, and also realize the fair distribution of benefits, and bring about the improvement of overall efficiency. Efficiency improvements will accelerate the construction of large-scale collaborative systems.

Therefore, here we present and propose a framework comprising seven metaverse building blocks. Used individually or together, these building blocks can help healthcare managers understand and engage with the metaverse ecology. Finally, as the different metaverse activities are defined by the degree to which some or all of the building blocks are concerned, these blocks can be used individually or together to help managers understand the ecology of the metaverse and understand patients, physicians and hospital tripartite participation needs. And explain how the future development trend of smart medical care should be matched with the Metaverse. This in turn develops guidelines for strategies to monitor and understand the activities of the different metaverses.

Figure 1. The honeycomb of Metaversa





2 Literature Review

The framework we use is a honeycomb, seven functional building blocks including: VR/AR, Cloud Computing, Big Data, IoT, AI, 5G, Blockchain, each of which allows us to unbundle or check (1) Explain how the framework will be used to understand the functional characteristics of the different metaverses, and discuss and illustrate the fundamental impact of each module on the doctor-patient relationship as it seeks to understand its participation needs in smart healthcare (Mozumder et al., 2022) , and (2) the impact on smart medical care in telemedicine, mobile wear and simulation training. These building blocks are neither mutually exclusive nor must all be applied to all smart healthcare activities. By explaining how to use the framework to compare and contrast different functions and meanings allows us to understand how the different levels of the metaverse function and are configured.

2.1. VR/AR/MR

The concept of augmentation is derived from the reality-virtual continuum of Milgram and Kishino (1994). They see real and virtual environments as two ends of a continuum. The middle part of the system is defined as mixed reality. In Mixed Reality (MR), the end close to the virtual environment is called augmented virtual. Conversely, the end that is closer to the real environment is called augmented reality (Walker et al., 2017). Augmented reality takes the actual environment as the background, adds virtual elements in the real environment, and presents the virtual reality in 3D in a real-time interactive way (Azuma et al., 2001). Augmented reality is also considered a transformation and evolution of virtual reality. Both augmented reality and virtual reality are rich in interactive and immersive technical features. In virtual reality, a computer simulates a virtual space and provides the user's visual and other sensory stimuli. The user's senses are still based on the real world, while virtual elements are added, so that the real and virtual elements coexist in the same space (Azuma, 1997). In the digital world of the metaverse, the cost of trial and error is extremely low, and everyone can put their own wonderful ideas into practice, thereby breaking the constraints of realistic conditions. The virtual consultation room management experience can log the ward layout, equipment, patient data and other data in the real world into the system, conduct low-cost optimization tests in the virtual consultation room, and finally feed it back to the management practice of the real ward. In the metaverse era, use VR, AR, MR devices, and somatosensory devices

with touch, smell and even taste to compare the five senses to achieve a truly immersive full-body interactive experience. AR technology is also a key technology to promote change. This technology can superimpose digital information on physical objects to realize the fusion of the digital world and the real world. Surgeons spend a lot of time and energy studying various 2D images of patients before surgery to determine the best surgical plan. However, due to the limitations of 2D images, doctors may misjudge, leading to a series of problems such as temporary changes to the plan during surgery, thereby increasing the risk of surgery. EchoPixel in Silicon Valley has developed an interactive 3D surgical platform and software based on AR technology, which can provide naked-eye viewing, non-contact, interactive 3D anatomical imaging and support various structural heart surgeries. The company's True3D software enables cardiac medical teams to directly interact with 3D medical digital objects, allowing doctors to make more comprehensive and accurate judgments. The company uses computed tomography (CT), magnetic resonance (MR), echocardiography, and C-arm fluoroscopy to create holographic digital versions of life-size organs, blood vessels, and other structures, and allows physicians to associate The digital twin" interacts to determine treatment targets, surgical methods, and catheter placement, resulting in more accurate measurements, distances, and angles. These technologies greatly shorten the time for doctors to diagnose and prepare, which not only reduces the cost of hospitals, but also reduces the time and cost that patients spend on treatment, and effectively reduces risks.

Augmented reality (AR) and virtual reality (VR) are transforming healthcare practice by providing powerful and intuitive ways to explore and interact with digital medical data, as well as integrate data into the physical world to create natural and interactive virtual experiences. These immersive technologies use a lightweight stereoscopic head-mounted display to place users in a simulated and realistic 3D digital environment to gain significant advantages from the seamless integration of digital information with the healthcare practitioner and patient experience. This review article explores some current and emerging surgical techniques and applications, their benefits and challenges in terms of immersion, spatial awareness, and cognition, as well as their reported and Intended use. Enhanced access to information, knowledge and experiences through virtual and augmented reality will improve healthcare approaches and lead to better outcomes for patients and the wider community. Gamification benefits the user's emotional experience, sense of identity and social orientation, cognition, social skills, and psychomotor skills. It appears that VR with gamification (Lindner et al., 2020) maximizes the value of therapy; VR provides appropriate personalized simulation, adjustable stimulation, and repeatable multiplayer engagement, while gamification can improve motivation, Guide learning, change cognition, and provide accurate data. The widespread use of augmented reality and virtual reality in such gamification solutions will become more evident in the future; they can constitute a viable way to realize the vision of Health 4.0. Therefore, researchers can try to add more game elements such as use of points, feedback, levels, leaderboards, challenges, badges, avatars, competition and cooperation to VR therapy. to illustrate their practical effect.

2.2. Digital Diagnostics/Telemedicine

Due to physical limitations (such as geography, language, etc.), the real world cannot integrate various elements in one place to meet the needs of different groups of people. However, the Metaverse has infinite room for expansion and seamless scene changes, which effectively enables variety. There are various scenarios that can be tested in the metaverse, allowing users to virtually connect with healthcare professionals where doctors and their patients can meet in a virtual world (Xu et al., 2020). In addition, by connecting wearable or portable devices to cloud services, connecting human biological data, electronic medical records and other information, timely interception, analysis and collection of patient data. Drives telemedicine, patient monitoring, electronic medical record management systems, etc., provides preventive treatment and health care recommendations, and implements precise treatment and medication monitoring management when patients seek medical treatment, allowing the system to integrate and amplify medical care resources,

increase the operational efficiency of the medical system, and reduce cost consumption. In terms of combining the characteristics of 5G, it has high speed, low latency and wide connection, so more and more carriers and devices can be connected to 5G, such as glasses, bracelets, headbands, headphones, and stickers. device, has achieved effective, immediate, and even preventive health management.

Telemedicine refers to the use of interactive video and information and communication technology (Chunara, R., 2021) to deliver health education and medical information, or to provide medical care such as diagnosis, treatment, and consultation. Especially in today's aging society and the lack of medical staff, the market demand for telemedicine and long-distance care has greatly increased. In the past, we had to go to the hospital to measure the physiological data. Now we can know the physiological and physical data at any time by wearing the device. Health status, achieve the function of early warning, and assist doctors in making more accurate diagnosis and treatment. It is a good way to overcome the barriers of time and space, and through information and telecommunications technology to exchange clinical data and expert opinions of patients in two places. More comprehensive medical care for people in remote and outlying islands. Simply put, it is the use of information technology to eliminate geographical restrictions, so that patients can enjoy the country's medical resources and care no matter where and when they are.

Telemedicine has become an important entry point in the diagnosis, triage, and treatment process (Chunara, R., 2021), limiting patient constraints by bringing patients closer to healthcare providers and improving connections with clinicians and specialists Transfer to hospitals, allocate hospital capacity and reduce the spread of disease, and allow both patients and healthcare providers to avoid high-risk environments.

2.3. AIOT digital integration

With the advancement and rapid rise of the Internet of Things technology, a large amount of medical information has been exchanged, analyzed and used, which has become the basis of medical big data. At the same time, artificial intelligence, which has developed rapidly in recent years, has been introduced as a generalization and use of this data. After the combination of wisdom, wearable medical devices with instant mobility emerge as the times require, becoming the core concept of smart medical care. According to the advantages of flexibility, reliability, and low cost of AI cloud integration services, it can help medical and research-related applications to transform smoothly. It can be deployed flexibly according to different needs, and is compatible with different infrastructures. In addition, the medical model of different symptoms relies on AI to provide real-time auxiliary interpretation. In the entire smart healthcare ecosystem, customers will interact with the entire healthcare system all the time. Before seeing a doctor, the data on the wearable device may be used to monitor health, or the relevant center may be used to conduct regular health checks. When an alarm occurs, the patient can find relevant information through the platform or use the resources of the community. At the same time, the patient It is also possible to use AI-driven programs to make appointments to the hospital, which not only speeds up the appointment process, but the doctors who make appointments through the application through data analysis will be more in line with the needs of patients. reduce wasted resources. In addition, when seeing a doctor, the hospital can use the data provided by the patient (data from wearable devices, clinic medical records, health examination reports, etc.) to report in advance into a report so that doctors can provide more accurate diagnosis content. After obtaining the diagnosis results, doctors and patients can use telemedicine-related solutions to continuously track the condition. All of the above rely on the development of AI to enable it to have a deeper application. Apply blockchain technology, establish smart contracts, and establish a one-stop service solution for medical underwriting/claims review to improve the overall review efficiency. Current communication technologies struggle to meet the requirements of the highly dynamic and time-sensitive healthcare applications of the future. Therefore, 5G networks are being designed and developed to address various communication needs of healthcare applications in the Internet of Things (IoT) (Ahad et al., 2020). 5G-assisted smart healthcare networks are a

convergence of IoT devices that require improved network performance and enhanced cellular coverage. Current IoT connectivity solutions face challenges such as support for large numbers of devices, standardization, energy efficiency, device density, and security.

2.4. Big Data and AI

Through big data analysis. Certain developments or outcomes may be predicted and/or estimated based on large amounts of historical data (Raghupathi & Raghupathi., 2014). For example, patients at risk for medical complications can have disease detected earlier where possible and be treated more easily and effectively . Coupled with the solution of natural language dialogue, the future virtual hospital service can be more diverse, and combined with the application of big data, it is a cost-effective method for diagnosing and treating patients. Take gout as an example. In the past, when people saw a doctor, they could only passively administer medicine. However, whether they had a history of allergies could only rely on the way of consultation, and could not know in advance. However, with the development of smart medicine, some medicines are now being prescribed. It is required to carry out genetic testing on high-risk subjects to find out the most suitable treatment method. Therefore, the combination of big data and AI technology can make the use of electronic medical records more convenient. The protection of personal privacy and data rights will be the foundation of the next generation of Internet development. With the improvement of laws and regulations on personal information protection and the awakening of users' awareness of data rights, the protection of patients' privacy has become more refined. In the metaverse era, most assets are the integration of digital assets and physical assets. With the integration and development of the Internet of Things, big data, and blockchain technology, more and more resources will be realized through the chain in the future. to realize effective rights and obtain liquidity, thereby enhancing value.

2.5. Blockchain and Smart Healthcare

Since Satoshi Nakamoto wrote a paper on irreversible transactions in decentralized networks in 2008, Blockchain has grown in popularity and its use cases have been applied in various industries. A blockchain network consists of many time-stamped blocks that are linked in a linear fashion to form a chronological chain, strengthened by cryptography (ridhar, & Sanagavarapu, 2021). Different from the traditional method, without the participation of any intermediaries, the blockchain realizes the point-to-point transfer of digital assets, which is transported in a decentralized space. It consists of several core technologies such as digital signatures, Hash functions, encryption, decentralized consensus mechanisms (Monrat, Schelen, & Andersson, 2019).

A knowledge base for effective health log data management in the healthcare sector is being developed with the advent of blockchain, the next generation of information security technology. Chung, K., & Jung, H. (2019). Knowledge-based blockchain network proposed for health log data management mobile services. Because the user's log data and context information are applied to the technology that is difficult to forge and tamper in the blockchain knowledge health platform, a large number of users' log data and the use of the side chain structure, the accumulated context information is stored in a block in the knowledge base Information through configuration knowledge-based data transactions. This ensures high scalability and security.

In view of the application technology of the Metaverse, there are different needs in different doctors/hospitals and different patient combinations. In order to choose the setting application of various building block identities, it must be quite diverse and flexible. For this reason, through the selection of the metaverse technology platform and the combination of the above-mentioned 3 smart medical categories (training surgery, telemedicine, mobile wear). Of course, these choices are highly contextualized, and the ultimate goal is to hope that senior executives can use this research to understand what types of technology combinations physicians/hospitals and patients will need when they need to improve their medical care, and how these will affect their relationship with Benefit from contact with other honeycomb building blocks.

2.6 5G development

Smart healthcare is rapidly transforming from a hospital-centric style of traditional specialty and

medical care to a patient-centric, distributed approach. Several technological developments have encouraged rapid revolution in the healthcare vertical. Currently, 4G and other communications Standard healthcare for smart healthcare services and applications. These technologies are critical to the development of smart healthcare services in the future. As the healthcare industry grows, some applications are expected to generate large amounts of data in different formats and sizes. Such large and diverse data requires special handling of end-to-end latency, bandwidth, latency and other attributes. Current communication technologies struggle to meet the demands of the highly dynamic and time-sensitive healthcare applications of the future. As a result, 5G networks are being designed and developed to address the diverse needs of healthcare applications in the Internet of Things (IoT) communications. 5G-assisted smart healthcare networks are the convergence of IoT devices (Zeng et al., 2022), which require improved network performance and enhanced cellular coverage. Current IoT connectivity solutions face challenges such as supporting standardization, energy efficiency, device density, and security for a large number of devices. In this article, we provide a comprehensive review of 5G-assisted smart healthcare solutions. Internet of Things. We propose the structure of 5G smart healthcare by classifying and classifying existing ones. In 5G networks, machine-to-machine (M2M) communication and IoT are expected to be the main pillars of smart healthcare [26] In addition to network densification and support for a large number of IoT devices, 5G networks are expected to provide higher data rates. 5G networks are designed to be flexible and diverse to support new applications, which require not only high data rates but other requirements, including massive connectivity, dense deployment, reliability, low latency, high energy efficiency, and long-range communications support IoT-based smart medical applications. Healthcare Cloud provides trusted integrations that make it easier to improve the entire healthcare experience.

2.7 I-Cloud

Azure provides us with the security and reliability that our healthcare customers need, while maintaining the elasticity that allows customers to define their own personal cloud paths. The high requirements for transfer rates and processing power will accelerate the convergence of smart cloud and networking (Cai et al., 2022). Through Microsoft, access a unified programming model, identity model, security model, and management model for both on-premises and cloud implementations. Provides peace of mind for healthcare customers with protection from the edge to the cloud and access to expensive, experiential technology with healthcare-specific configuration, connectors and application technical support powered by powerful AI capabilities, including unrestricted 7/24 technical resources A rich ecosystem of healthcare partners. Improve patient engagement: Deliver a safe, personalized experience that engages patients at every point of care. Enhance healthcare team collaboration: Connect, engage, and manage your team with tools that help them deliver the best possible care. Improve the patient-provider experience: Help reduce provider burnout by automatically recording patient encounters at the point of care. Improve clinician productivity: Enable faster documentation with accurate, responsive dictation and virtual assistant capabilities. Improve Health Data Insights: Gain insights to improve patient care by connecting data and using predictive analytics to identify clinical trends. Protect Health Information: Help your organization protect and manage sensitive health data across systems, devices, applications, and cloud services.

The healthcare industry has come a long way from just hospital information systems (HIS), electronic medical records (EMR) to computer-assisted surgery and remote patient care into healthcare since the advent of information technology. With the advancement of information technology, healthcare has become increasingly digital, more collaborative, more patient-centric, and more data-driven in various markets. It is designed to access information anytime, anywhere. The traditional technological infrastructure of the health care sector will not be able to meet such a large amount of data generated and various healthcare services delivered to patients. While cloud computing is a rapidly developing trend (Bamiah, & Chuprat, 2012), it includes multiple services, all of which are provided on-demand over the Internet using a pay-as-you-go model. It promises to increase the speed of deploying applications and reduce costs. Cloud computing can manage current

digital data growth trends and availability of healthcare services anytime, anywhere. Cloud computing can also contribute significantly to controlling healthcare integration costs, optimizing resources, and enabling a new era of innovation.

3. Research methods

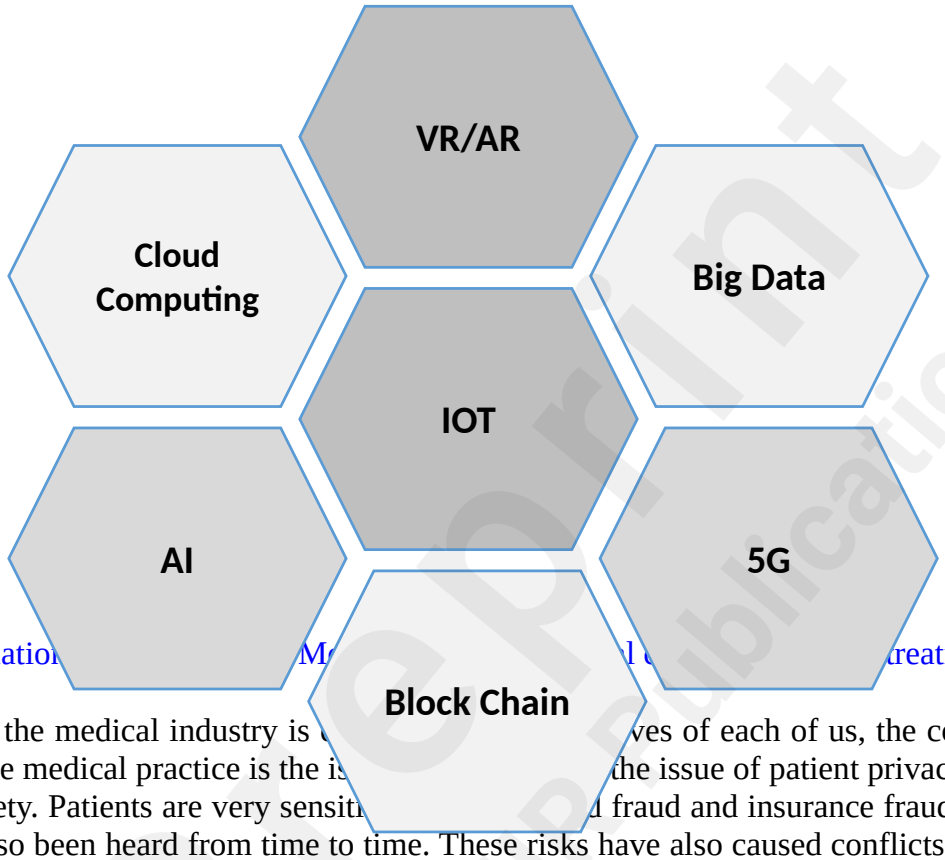
Based on the technical aspects of the metaverse described above, it is increasingly important to use the cellular framework platform to understand and develop the metaverse landscape, so we establish a research model in which patients and hospitals interact with the metaverse and patients and physicians/physicians/ The reconciliation of the doctor-patient relationship between hospitals forms an infrastructure of smart medical care. However, the scope of the medical industry is too large. Therefore, this model selects the most universal and widely applicable medical characteristics, that is, in education and training, remote medical treatment and wearable devices, to explore how to use the powerful application functions entrained by the Metaverse. , in Figure 3, according to the technology referenced by the cellular framework in Figure 1, to understand and connect the interactive platform between patients and doctors/hospitals, and connect the balance between patients and doctors/hospitals on the smart medical system, and finally establish a metaverse Cooperation model with smart healthcare. Due to the limitation of enterprise resources, the combination of smart medical treatment and metaverse technology tends to focus on three or four main honeycomb blocks. The greater the role in the medical enterprise, the senior executives of the enterprise are also facing the future development of smart medical care, monitoring, understanding and formulating strategies to respond to different smart medical activities. Therefore, this article uses the Japanese Smart Cyber Operating Theater (SCOT) as an example (Okamoto, J et al., 2018) With 5G transmission and cloud technology, are developing new applications, such as decision-making navigation or a precision guided treatment system to integrate and jointly develop and utilize IoT and AI technologies to improve the accuracy, success rate and safety of surgery. The "smart treatment room" is discussed from three aspects: medical education and training and the relationship between doctors and patients, virtual clinics and the relationship between doctors and patients, and wearable devices and medical care.

3.1 The relationship between the metaverse and clinical education and training for medical treatment

In the hospital of the future, the technological elements of the Internet of Things (AIOT), AI and VR will play an important role, especially the front-line medical staff must be constantly exposed to high risks. Therefore, the digital integration of AIOT can enable medical staff to Physiological values are monitored without patient contact. For nursing staff and physicians, the medical simulation training played by VR can be used to train medical staff to take care of patients and physicians' surgical training through VR. Therefore, AR/VR technology breaks the limitations of physical time and space, and uses augmented reality images to enable physicians to conduct distance teaching (Desselle, Brown, James, Midwinter, Powell & Woodruff, 2020). In addition, it can be used in disease health education, cognitive training, clinical skills, etc. The purpose is to make VR technology beneficial to academic, research and clinical personnel and patients. In the role of patients, VR can also assist in rehabilitation and physical therapy (Liu et al., 2022). For physicians, VR can break the learning experience that traditional human models cannot achieve in the past. In a virtual environment, physicians can analyze the human body from various angles by manipulating bones, muscles, blood vessels and organs in 3D space. From a practical point of view, VR health education clinics have been launched. Everyone enters a virtual space at the same time, and can listen to the explanation of organ structure and surgical methods, and further promote shared decision-making between doctors and patients to achieve optimal results. Therefore, in this honeycomb module, the main functional frameworks that need to be held are AI, VR/AR, and the Internet of Things. In addition to the establishment of relevant basic equipment, education, training and rehabilitation between doctors and postoperative patients are required. Courses, etc., also have leaping application growth.

At the personal level, AI technology drives digital avatars, drives personal organs, and simulates

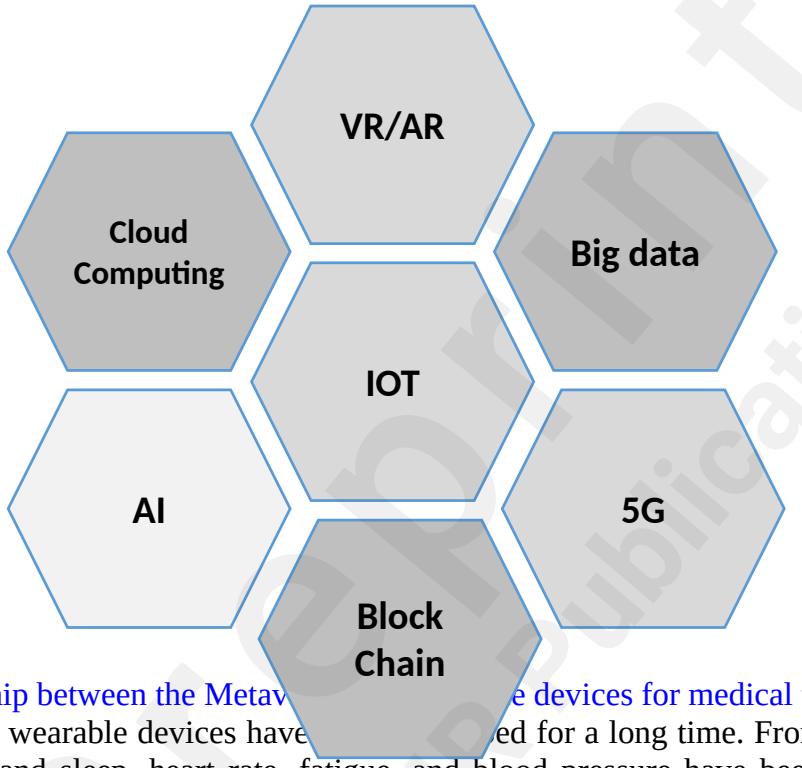
the entire human physiology. In terms of precision medicine, VR education platform, surgical anatomy training, nursing training and intraoperative navigation are used to form a real-time sharing of various physiological data. The integrated medical network system in the operating room presents all data and information through an integrated LCD panel in the operating room. Through the operation of SCOT (Nakamura, T., et al., 2020), the surgeons in the operating room can also communicate with the remote The professors of other medical departments at the end communicated synchronously, and through the training in the digital environment, found the best surgical approach and method, and reduced the incidence of medical negligence during the operation.



3.2 The relatio M l reatment

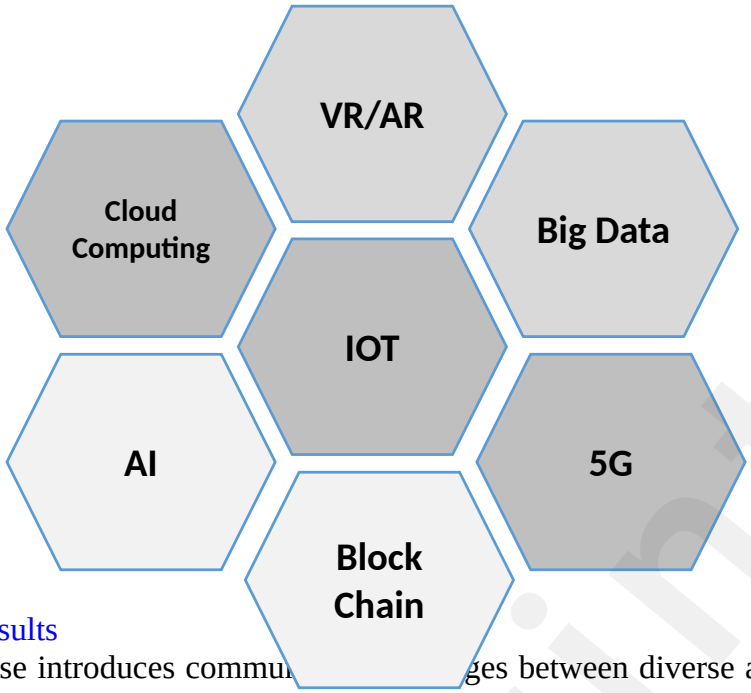
Since the medical industry is ves of each of us, the core of the dilemma of the entire medical practice is the i he issue of patient privacy and physical and mental safety. Patients are very sensiti d fraud and insurance fraud of medical record data has also been heard from time to time. These risks have also caused conflicts and contradictions between hospitals and patients due to the complexity of medical data and the exchange of benefits. Therefore, the blockchain technology of Metaverse can be used to make NFT on medical data, and carry out data classification, chaining, storage, and transmission, and combine it into a medical scene. The hospital establishes a digital twin in the virtual world to adjust and improve the hospital's data and processes. In addition, in the part of telemedicine patients and doctors, the collection and conversion of medical data will be strengthened based on high-quality telemedicine services. Therefore, Metaverse not only allows the hospital to extend its service scope, but also uses online consultation and consultation to confirm the patient's medical records and image data, so that in this structure, both the quality of the doctor's consultation and the protection of the patient's privacy are taken into account. In order to break down these barriers in the face of time and geographical constraints, it is still necessary to continue to rely on technological transformation and cooperation models, expecting to provide daily care for chronically ill patients in the comfort of their homes. It has even broken the past that online consultations were only conducted through video cameras in a strong sense of estrangement, and transformed into real-time, anywhere, and can enter the Metaverse for consultation, and at the same time reduce costs. Or leverage predictive care management tools to reduce hospital stays while addressing monitoring shortages and improving patients' overall quality of life. In the smart clinic that integrates virtual and reality, the virtual reality of VR breaks through the space limitations of the clinic, allowing patients to clearly understand the spatial structure

relationship of the surgical site, allowing patients to experience it for themselves. The simple device can be taken with you. Whether it is waiting for a doctor, when seeing a doctor, or after returning home, as long as the switch is turned on, you can enter the virtual reality clinic. Interpreting and interacting with doctors in the virtual reality clinic breaks through the limitation that doctors could only use oral descriptions and plane images to explain parts in the past. The goal is to improve the safety and efficiency of treatment by creating SCOTs that include IOT medical devices and high-power computing.



3.3 The relationship between the Metav e devices for medical treatment

Personalized wearable devices have ed for a long time. From basic functions such as step counting and sleep, heart rate, fatigue, and blood pressure have been gradually increased. Some devices cooperate with big data information to gradually improve the accuracy and stability of physiological signals. to the medical level. The operating principle of these devices is to sense PPG (Photoplethysmogram) and electrocardiogram sensing principle ECG (Electrocardiogram) through photoplethysmography to record long-term heart rate changes and electrocardiograms of autonomous event segments, heart rate variability analysis and other information to reach the body. control of the situation. In the metaverse world, both patients and doctors will be transformed into "virtual portraits" to achieve true zero-day interaction. So, to break down barriers and complexity to deliver a better system of value to patients and overall healthcare. The wearable device combines the technology of 5G transmission and serial Internet of Things, and integrates wearable devices such as head-mounted wireless smart glasses. Using the instantaneity of 5G transmission, it can provide a clear first-view image, allowing remote doctors to synchronously provide accurate guidance. , achieve multi-party real-time remote consultation, and integrate data sharing of physiological monitors, real-time data, and heart rate variability trend graphs to strengthen the rescue capabilities of emergency rescuers. For patients, it is no longer just simple data, but through system integration and analysis, information that is helpful to medical treatment is formed. Although wearables have become a trend, there are still some disadvantages, especially the more functions, the longer the learning and adaptation time may be required.



3.4 Expected results

The metaverse introduces commu ges between diverse and generic functions, which poses a new challenge to the doctor-patient relationship between doctors/hospitals and patients. In addition to these scenarios, there are many potential use cases in health and social care, including accelerated nursing certification, refresher and recertification training, and more skills-based models combining the various functions mentioned above, retaining different skill levels, derivatives a variety of innovative applications have been released to allow new users to effectively follow and choose, ensuring that opportunities are maximized and risks are minimized. Therefore, an effective educational practice will help healthcare professionals understand the relationship between theory and clinical practice, which will enable them to make better judgments in complex situations. They will also be encouraged to learn about other roles on the team and demonstrate how they can adapt and collaborate in emergencies. Finally, the problems of doctors and patients can be properly controlled and solved. For patients, doctors are expected to listen more, participate and respond appropriately. On the other hand, for doctors/hospitals, it is hoped that suitable tools can be found in the honeycomb framework. By analyzing these seven building blocks, physicians/hospitals can understand the functional differences and impacts of the Metaverse in order to develop consistent and appropriately balanced medical strategies.

4. Future contribution

The future of smart medical care is the combination of "medical care" and "technology", which makes the future of the medical industry have infinite possibilities, and the combination of the two industries is bound to bring many opportunities to the market. Nevertheless, there are still some challenges compared to traditional medical care and clinical decision-making. However, as with any new technology, there are issues and challenges that need to be addressed. Issues such as data privacy, security, and accessibility must be considered to ensure that the benefits of the Metaverse are available. In promoting the precision health strategic industry, the introduction of new technologies such as AI, IoT, 5G, and wearable devices will expand the field of smart medical care and increase the competitiveness of the medical industry. Therefore, in order to improve the entire health ecosystem and related industrial chains, the The combination of two different fields of medical and digital technology requires a lot of cross-border talents. Today, through the accelerated innovation of digital technology, as well as continuous training and exchanges, a variety of products have been developed, which will help promote the future development of the health industry, and will also bring great business opportunities to the market, injecting a steady stream into the medical industry.

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