

Applications of metaverse for improving healthcare at sea

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The provision of adequate healthcare on board ships has always represented a challenge for medicine. In general, ships are at sea for days or weeks before they can reach a port and with the only exception of some large passenger or cruise ships, they do not carry health professionals on board. The maritime healthcare sector has expanded more quickly as a result of the quickening pace of digitalisation and automation, which has led to the creation of new models and new opportunities for seafarers' treatment provision at reduced costs. By enabling both onboard patients and medical personnel to have lifelike experiences, a new digital technology known as the metaverse has relevant potential for the healthcare of seafarers.

Not only how people use technology, but also how they relate to one another and the outside world, could all be altered by the metaverse. Some people think of the metaverse as more of a merging of the physical and digital worlds, where the real world is surrounded by digital surfaces and objects. These technologies working together ensure individualised, close-knit patient care. It also provides smart adaptive solutions that lower barriers between healthcare providers and patients [1].

Around the world, major corporations including Accenture, Vantage Health, Oura Ring, Mendelian, and others have started to investigate how this period would affect the healthcare system, particularly in light of the recent pandemics that has affected much of the seafarers across world. Several new use cases [2] make it evident how healthcare could change in the future various applications includes:

- Wellness for onboard patients and healthcare professionals is possible in the metaverse, just as it is for

physicians. Doctors can explain and even demonstrate illness symptoms and treatment options using immersive environments. These settings can aid in teaching caregivers how to take care of a person in a shipping environment. Better health literacy and greater adherence to treatment plans can result in better outcomes when education is improved;

- Extended reality technologies are being used in new virtual therapies to assist patients with pain management, neurological problems, mental health, and physical wellness. Utilising an evidence-based infrastructure, the healthcare forum immerses patients in virtual settings and equips them with resources and coping mechanisms that will help them deal with stress, anxiety, and terror throughout their lives;
- Interoperability and tokenisation in context to Blockchain, Web3, autonomous driving, and artificial intelligence (AI) technologies have made it possible for users to safely own, share, and manage patient, provider, and payer data such as secure NFTs, payment rewards, the health identity and most importantly the management of complex records;
- The possible option of digital diagnosis via augmented reality is there which combines space, movement, and interactions to detect diseases. For example, by observing eye movements, medical professionals can notice neurological indicators or ocular disorders like glaucoma. These use cases show how healthcare organizations are beginning to push the boundaries of metaverse technology to provide state-of-the-art operational, clinical, and recreational experiences while transitioning from a centralized to a decentralised ecosystem.

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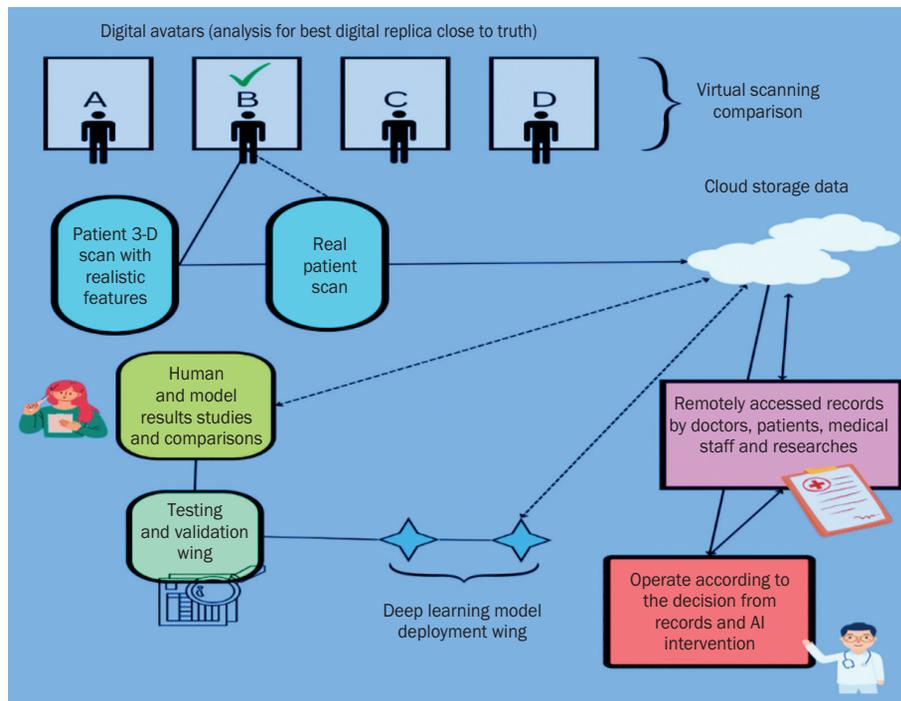


Figure 1. The working framework of intervention of metaverse in healthcare

There are many possible ways to conceptualise the workings of the metaverse in healthcare, but each model's fundamental building blocks share a common set of avatars, subsets, and connections [3]. In this, you can find the efforts that we did to illustrate how the metaverse functions when it is used as a platform for seafarers' healthcare. The identification of the eye glaucoma metaverse model has been proposed (Fig. 1). In the first phase, various avatars have been analysed to choose the one that is most realistic for a patient which is known as virtual scanning comparison [4]. The avatars, which are physical representations of individuals, replace actual patients. This information is continuously being stored in the clouds for further study. After the data is gathered, deep learning models are created and continually improved in the model deployment wing until they achieve high accuracy and minimal error. The following stage involves testing and validating the completed models. If the validation is weak, it will be sent back to the deployment wing for more model fine-tuning; if not, it will move on to the next stage for comparison for outcome analysis.

Further, this final result about the onboard patient will also be stored again on the cloud. Doctors, medical support personnel, patients, and other researchers with the proper authorisation can access the patient records that are kept on the cloud. The patient will be told about his condition and the best course of action after these records have been examined. If surgery is necessary, the patient will be instructed to arrive on the specified date. If the procedure

can be avoided based on the results thus far, the patient will just be advised to take some medication. The physical meeting between the doctor and patient is minimised in both situations. The study's findings could be expanded upon and addressed to prospective uses of the technique in the marine industry forums, such as medical marketing, telemedicine, medical education and training of seafarers, healthcare facilities, and fitness and wellbeing.

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