

THE USE OF AUGMENTED REALITY (AR) TECHNOLOGIES IN THE VISUALISATION OF ORGANS, THE TRAINING OF MEDICAL STAFF AND PATIENT REHABILITATION

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Анотація

Розглянуто застосування технологій доповненої реальності (AR) у сучасній медицині. Показано можливості AR для високоточної візуалізації органів, що сприяє кращому розумінню анатомічних структур та підвищує ефективність діагностики. Особливу увагу приділено використанню AR у навчанні медичних кадрів, де технологія забезпечує інтерактивне відтворення клінічних випадків, симуляцію операцій та поглиблене вивчення анатомії без ризику для пацієнтів. Також висвітлено роль AR у реабілітації пацієнтів, зокрема у відновленні рухових функцій після травм та інсультів, де інтерактивні вправи мотивують пацієнтів і дозволяють лікарям контролювати процес відновлення. Зроблено висновок, що інтеграція AR у медичну практику сприяє підвищенню якості лікування, оптимізації навчального процесу та індивідуалізації реабілітаційних програм.

Ключові слова: доповнена реальність, медицина, візуалізація органів, навчання медичних кадрів, реабілітація пацієнтів, симуляція, цифрові технології.

Abstract

This paper examines the application of augmented reality (AR) technologies in modern medicine. It demonstrates the potential of AR for high-precision visualisation of organs, which facilitates a better understanding of anatomical structures and improves diagnostic accuracy. Particular attention is paid to the use of AR in the training of medical staff, where the technology enables interactive reproduction of clinical cases, simulation of operations and in-depth study of anatomy without risk to patients. The role of AR in patient rehabilitation is also highlighted, particularly in the restoration of motor functions following injuries and strokes, where interactive exercises motivate patients and allow doctors to monitor the recovery process. It is concluded that the integration of AR into medical practice contributes to improving the quality of treatment, optimising the educational process, and personalising rehabilitation programmes.

Keywords: augmented reality, medicine, organ visualisation, medical staff training, patient rehabilitation, simulation, digital technologies.

Introduction

Modern medicine is actively integrating digital technologies into its practice, with augmented reality (AR) playing a particularly significant role. Its use allows the real world to be combined with virtual elements, creating new opportunities for visualising organs, training medical staff and rehabilitating patients. AR technologies provide a more accurate representation of anatomical structures, help improve the effectiveness of diagnosis and treatment, and allow medical students and doctors to practise their skills in a safe environment.

In the field of patient rehabilitation, AR opens up new possibilities: interactive exercises motivate patients, allow doctors to monitor the recovery process and tailor treatment programmes to individual needs. In this way, augmented reality is becoming a vital tool in the development of personalised medicine, improving the quality of education and optimising rehabilitation programmes.

Research results

Modern medicine is actively integrating digital technologies into its practice, with augmented reality (AR) playing a particularly significant role. Its use allows the real world to be combined with virtual elements, creating new opportunities for visualising organs, training medical staff and rehabilitating patients. AR technologies provide a more accurate representation of anatomical structures, help improve the effectiveness of diagnosis and treatment, and allow medical students and doctors to practise their skills in a safe environment [1].

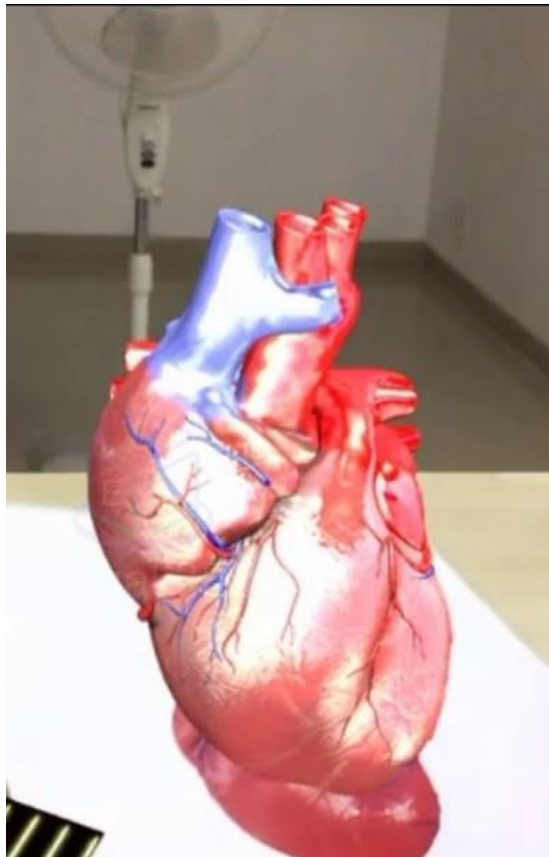


Figure 1. AR model of the heart

A particularly illustrative example is the use of AR to demonstrate the anatomy of the heart. Figure 1 shows an AR model of the heart, which allows for a detailed study of its structure, blood vessels and functional characteristics. This approach significantly facilitates the process of educating and training future doctors, and can also be used in clinical practice to explain the specifics of their condition to patients.

In the field of patient rehabilitation, AR opens up new possibilities: interactive exercises motivate patients, allow doctors to monitor the recovery process and tailor treatment programmes to individual needs. This is particularly relevant for patients who have suffered a stroke or injury. Research shows that AR programmes increase patients' motivation and adherence to treatment, whilst also providing doctors with real-time data on progress [2].

Another promising area is the visualisation of organs using AR. Superimposing digital models onto real images of patients allows doctors to plan operations more effectively, assess anatomical features and explain procedures to patients. This is particularly useful in complex operations, such as neurosurgery or cardiac interventions, where precision is crucial [3].

An important area of application for AR is medical education. Augmented reality allows students to interact with 3D models of organs and systems, simulate surgical procedures and visualise complex anatomical structures without the use of expensive physical models. Universities around the world are actively implementing XR platforms for medical training, and research shows a significant improvement in learning outcomes and student confidence when using AR/VR technologies [4], [5].

At the same time, AR technologies hold significant potential in the field of public health. Virtual and augmented reality are seen as tools for promoting public health, enabling the creation of interactive prevention and educational programmes [2].

Research in the field of medical informatics confirms that AR could become a key element of the digital transformation of medicine, ensuring integration with other information systems and improving the efficiency of data management [1].

International reviews also confirm the effectiveness of AR in medical education. Systematic studies show that the use of VR and AR in medical training facilitates better retention of material and the development of practical skills [4].

Furthermore, AR is being integrated into diagnostic imaging systems, allowing doctors to interact with 3D reconstructions in real time. This opens up new possibilities for personalised medicine and the optimisation of treatment [6].

Conclusion

Augmented reality (AR) is becoming a key tool in the digital transformation of medicine, enabling more accurate diagnoses, more effective rehabilitation and higher-quality training for future doctors. Its integration into clinical practice, educational processes and public health systems opens up new opportunities for personalised medicine, increases patient motivation and contributes to the development of a modern, innovative healthcare model.

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