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THE IMPACT OF AUGMENTED REALITY IN ARCHITECTURAL DESIGN

ALEKSANDAR KRSTEV AND ANGELA VELKOVA KRSTEV

Abstract: The health system is a complex system that includes organizations, people, institutions that want to promote, maintain, and restore physical health. In the world, and in our country, the delivery of health care is changing very fast. Although advances in medical techniques and technologies have led to a faster understanding of diseases and their treatment, the efficacy, safety, and cost-effectiveness of health care have relatively improved. Many studies develop design theories and hospital planning methods to adapt them to future changes by designing for flexibility, scalability, and scalability, as well as open-air approach to the design and design process. But only a few of these studies have applied these strategies in practice over time. Research documents the evolutionary processes of hospitals and illustrates the changes needed for the spatial environment, advances in medical technology, transformation of social health norms, and adaptive standards for health policy. Augmented reality has built a platform that allows brands to offer unique and more accessible digital experiences, providing memorable moments for consumers. One of the main reasons that retail brands invest in the development of this technology lies in the idea of enabling consumers to make better and more informative product decisions. The merging of these interoperability structures between technology on the one hand and architecture on the other hand provides a systematic pre-solution for making the right decision when designing and investing in capital and socially useful buildings.

1. Introduction

Human lives weigh on equilibrium in hospitals on a daily basis. Hospital patients and their families, and the hospital experience are often the central point in their lives - where their child was born, where they received proper care and their life was saved, where they received appropriate therapy or care to overcome a particular disease. The importance of hospital care will not diminish in future. However, changes in the social and economic environments in which hospitals operate, as well as medical and technological advances, require hospitals to be as transformative as the future develops. Continuous investment in hospital construction offers the opportunity to redesign the hospital - its design, culture, and practices, to better meet the needs of patients and families and the aspirations of those providing their care. But, if there are no principles to guide the development of the hospital for the future, hospitals can simply freeze the status quo of today. [3,4]

The long cycle of design and construction is often overtaken by the rapid cycle of innovation in medicine and technology. As a result, some buildings are partially obsolete when they open, and almost every health facility will be obsolete in some way before it reaches the end of its life. Flexibility design is a way to reduce the inconvenience and cost of these inevitable disruptions. Every design should have planned zones for future growth. When building and planning hospitals, the architectural environment that includes patients, families, and staff should support treatment in a friendly setting. However, the

majority of our current hospitals are built on a different foundation and are often seen as a direct cause of stress, anxiety, frustration, and generally longer hospitalization due to inadequate facilities and environments in today's healthcare system. In response to the current state of modern hospitals, and as a difficult tool in the discussion of our future healthcare settings, the term healing architecture is gaining ground. It is best described as a design concept that represents the vision of encouraging human well-being and healing under the influence of a well-designed architectural environment.

Hospital design and design strategy, following the open theory of building separation, needs to be analyzed and evaluated to see if the design methods and principles are sufficient to support hospital needs to make necessary changes. The research represents the importance of the separation of the system used in the design for hospital flexibility, as it allows for a significant change in all phases of the project (design, construction, and utilization) and points to the lack of a system that occurs when adopting design decisions based on which the right changes are made to the design and the design of clinical hospitals for future development. [1,2,5]

Sustainable hospital architecture aims to propose a hospital design strategy that is flexible in the systematic division of the basic structure of the basic system, the secondary system "final" and the tertiary system "FF & E" (furniture, fixtures, and equipment). This method recognizes the different range of life, investment and decision-making processes associated with each level in the system.

For a better insight and presentation of what an architect has conceived as a conceptual solution, it is best to present it with the help of computer vision, i.e., through computer visualization before it is built.

Nowadays, augmented reality has harnessed the power of the user experience, and also delights in the synergy between technology and the marketing industry. According to previous research, the global augmented reality market is projected to reach a value of 70 billion US dollars by 2023. Over the past few years, investment has continued to grow steadily, and recently technology has generated massive interest and use worldwide. But what is augmented reality?

Augmented reality is a combination of digital interactive visual elements and sensory projections translated into the real world. In this way, through the use of images, graphics, sounds and text, the digital world is combined with the reality and creates a unique user experience. This technology allows us to create content that incorporates new patterns of context, meaning, and emotion. Such experiences create a bridge to present the authenticity, innovation, and creative vision of companies. As consumers, we share different parts of life with others every day. What we choose to express can take many forms, but the basic desire to share and show how we perceive ourselves and the world around us is strong, and the augmentative reality further elevates and enriches this sharing experience.

From the prism of marketing, augmented reality has built a platform that allows brands to offer unique and more accessible digital experiences, providing memorable moments for consumers. One of the main reasons that retail brands invest in the development of this technology lies in the idea of enabling consumers to make better and more informative product decisions. The merging of these interoperability structures between technology on the one hand and architecture on the other hand provides a systematic pre-solution for making the right decision when designing and investing in capital and socially useful buildings.

2. Research methodology

This paper describes the two structures and how they can interact from both engineering sides in the development of a software product that, together with the existing hardware technology, can help in presenting a conceptual solution and how it will be justified, but also how it will have an environmental impact.

This shows all the effects from an architectural point of view in the part of structural elements, and they are placed with appropriate descriptions from a technological and economic point of view in a given database. The same base provides an opportunity in such a projection - augmented reality review to see what the advantages of the given architectural solution are and how it will affect the investor.



Figure 1. *AR concept in reality*

In essence, the architect prepares the entire project in terms of design and converts it into an appropriate 3D model that is placed on a specific location provided for the construction of that building, in this case it is the Clinical Center (Hospital), as shown in Figure 1.

3. Technology used to develop this concept model of learning and cognition

This paper uses CAD / CAM technology to develop the conceptual design, in this case AutoCAD and Google SketchUp, which is later easily converted into a suitable 3D model (.fbx, .obj) with all its development stages.



Figure 2. Architectural concept and design

In the software part, the combined development technology of C # and Unity3D was used to make a software segment-software that shows the 3D models or, in this case, a concrete projected object in a real position with appropriate coordinates in a scale of 1: 1.

C # - a programming language created by Microsoft at the initiative of Microsoft. NET and then approved as standard by Ecma (ECMA-344) and ISO (ISO / IEC 23270). C # is one of the programming languages designed for Common Language Infrastructure. C # is a simple, modern, multi-purpose programming language.

C # is a simple, modern, multi-purpose and object-oriented programming language.

- The language is intended for use in the development of software components suitable for use in distributed environments.
- The source code for portability is very important, as is the program portability, especially for developers who know the C and C ++ programming languages.
- Support for internationalization is very important.
- C # is designed to be suitable for writing applications for both home and embedded systems
- C # applications are memory and energy efficient in their processing, the language is not designed to compete in performance and size with the C programming language or assembly language.

Unity is a cross-platform game engine developed by Unity Technologies, first announced and released in June 2005 at Apple Inc.'s. The engine has since been gradually extended to support a variety of desktop, mobile, console, and virtual reality platforms. It is particularly popular for iOS and Android mobile game development and used for games.

It is cited to be easy to use for beginner developers and is popular for indie game development. The engine can be used to create three-dimensional (3D) and two-dimensional (2D) games, as well as interactive simulations and other experiences. The engine has been adopted by industries outside video gaming, such as film, automotive, architecture, engineering, construction, etc.

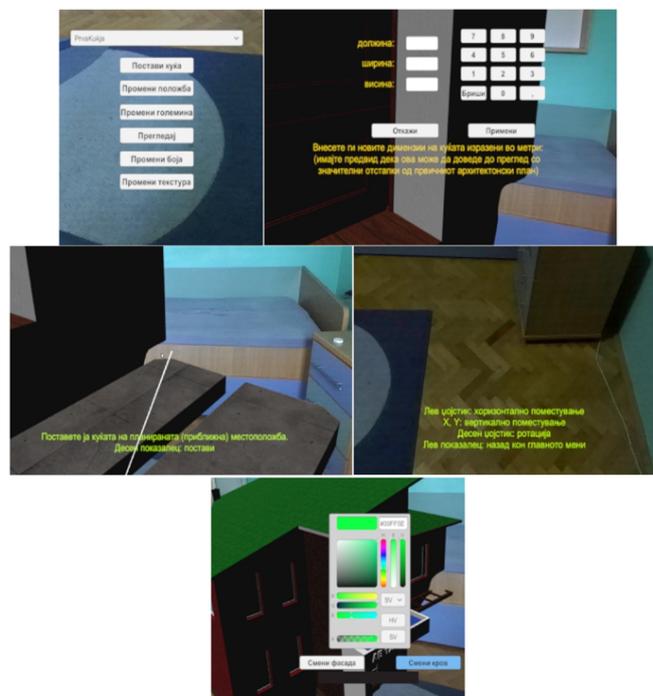


Figure 3. Developed AR application

In the hardware part, to fully experience this tool for real-time design and display of an already designed 3D object, a combination of virtual reality glasses and cameras from a suitable manufacturer that have appropriate hardware performance is used. In our case, it is a combination of Oculus Rift S and ZED mini from Stereolabs.



Figure 4. *Headset for Augmented reality*

4. Conclusion

The main goal of this paper was to understand the future of health architecture, i.e., to understand the guiding principles that contribute to the future development of hospitals and to recognize the importance of the implication of patients in the design process, i.e., to see the positive results of their interaction and support in the design, and design of clinical hospitals.

Through the phase of preliminary analysis, the needs and views of patients, the focused care and the basic human need for social assistance and support indicate a number of positive results that have an impact on the whole society and its sectors.

The paper fully strives to improve the current state of such facilities and their role in society. It is clear that this architectural design solution cannot fully determine and anticipate all the needs because the design of clinical hospitals is updated daily, but still, according to the research, we can get the picture of the main principles for future development that should be applied from the very beginning. Design has a number of positives not only to make a building look modern and beautiful, but, above all, to be fully functional and useful for those who use it; additionally, a huge positive side is that such a building will have contributions for the whole society and the environment in general. Therefore, with the help of this type of the so-called new technology that offers an alternative reality, we can see all the disadvantages and advantages of building such facilities. At the same time, the development environment itself allows a lot of possibilities that, with appropriate upgrades, would allow an architect to even design in augmented reality in real time.

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