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Effectiveness of Practicing Social Distancing in Museums and Art Galleries for Visitors Using Mobile Augmented Reality (MAR):

S.M.A.R.T. — Social Distancing Using Mobile Augmented Reality Technology

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ABSTRACT

After the tragic Coronavirus (COVID-19) pandemic was declared by the WHO (World Health Organization) in March 2020, social distancing and sanitization were recommended by top medical experts and health officials to help stop the virus spread. Research has sought to help people practice social distancing in public attractions such as museums and art galleries using touchless technologies. In the modern circle of innovation and technology, mobile augmented reality (MAR) is a touchless technology that adds layers of virtual information on top of real-world images. An individual can view 3D images and videos by pointing an AR-enabled device towards a piece of digital information. This paper describes the constructive use of the major design elements of MAR, which can directly be applied for impaired and non-impaired visitors to practice social distancing in museums and art galleries.

KEYWORDS

Augmented Reality, COVID-19 Awareness, Design Elements, Healthcare, Social Distancing, User Engagement

INTRODUCTION

Augmented reality, also called AR, is a subset of virtual reality (VR) technology. AR imposes several intrinsic layers of virtual content on the physical objects in the real environment. A brief description of the elements of augmented reality is in the chapter, "Challenges of mobile augmented reality in museums and art galleries for visitors suffering from vision, speech, and learning disabilities" in Guazzaroni and Pillai (2019). This paper is a follow-up to the above-mentioned published paper and will explain the methodology in detail. By imposing virtual content, AR provides a medium to describe the physical object on a screen of any smart mobile device by directly pointing the device towards the object. The pervasive devices possess ubiquity for the public to get accustomed to the AR applications existing in the digital market. The fundamental difference between VR and AR is that VR is all about placing the user in a virtual environment where sensations can be created

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artificially. The appeal for implementing AR in museums and art galleries is clear: The technology permits rich media such as videos and images to lay over the real environments and enhance the user experience. AR for museums takes the form of an application where the user needs to use the GPS (Global Positioning System) of the smartphone to pinpoint the user's location and view the scene on displays (Bing, 2017). This research focuses on mobile augmented reality and its challenges for the visitors suffering from vision disabilities and impaired learnings, to shed light on AR, real-time applications of AR, and AR in museums.

Augmented Reality and Its Touchless Nature

Being a platform for endless layers of information, AR tools have demonstrated the potential ability to offer the visitors extra information on their pocket-sized smartphone displays. In contrast to QR scanning applications, which make use of standard tracking features, AR tools emphasize deep learning and image recognition methods for scanning real-world objects. Museums mostly make use of location-based AR applications, which enable visitors to inspect the details of the real objects. Similar parallel research is underway to allow visitors to save the information and insights of real objects in their local phone storage for access offline. Offering more features strengthens the connections between visitors and museums. AR apps not only create a medium to present knowledge but also make one dive deeper into the details by engaging the users through a friendly GUI. Therefore, AR is also viewed as a creative tool for education. Regarding unimodal and multi-modal elements, gaze, gestures, and speech can provide individual inputs for seeking attention through the application. Unimodal inputs can be combined and provided as a multi-modal input for complementary interaction. For pointing out objects and people, gaze can be significant, and speech can specify a subject. Due to its touchless nature, mobile augmented reality can make use of unimodal and multi-modal inputs to interact spatially with the application. *Spatial* interaction means that a user is not in a static position in a 3D space but is moving around in the space and interacting with various AR stops and screens at varying distances. According to neuropsychological studies, a human brain can build up multiple spatial representations for real-world interaction. These interactions can be guided by certain eye actions, and head and arm movements. In work on 3D spatial interaction, the neuropsychological readings can be integrated in realms such as ambient extra-personal, focal extra-personal, peri-personal, and action extra-personal (Previc, 1998). Figure 1 shows the four realms of the 3D world.

Pros and Cons of Mobile Augmented Reality

Mobile augmented reality can be described as a carry-and-go augmented reality in your pocket. The user's smart device acts as hardware for the AR software application (Craig, 2013). There is significant confusion between the concepts of *portable AR* and *mobile augmented reality (AR)*. Portable AR allows the users to move the technology flask from one place to another. It is like the definition of *energy*: it can be exchanged and transferred but cannot be created or destroyed. Desktops and chargeable laptops are a few common examples of portable AR devices, whereas a mobile AR device is more compact, such as the Microsoft Holo Lens, Magic Leap, Oculus Rift, Samsung Gear VR, HTC Vive (see Figure 2).

- **Advantages of MAR:** Experiencing AR anywhere and any time, mobility, easy installation, and quick connectivity.
- **Disadvantages of MAR:** May have many difficulties regarding compatibility, including environmental constraints, technology constraints, sophisticated user understanding, and complicated system architecture. One out of ten MAR devices is non-repairable.

Despite having so many advantages in the applications of museums and art galleries, MAR has disappointed and failed in a lot of research testing it for increasing user experience and enhancing