Using augmented reality technology in distance learning

Oleksandr Makoveichuk*

Kharkiv National University of Radio Electronics, Ukraine

*Corresponding author's e-mail: oleksandr.makoveichuk@nure.ua

Abstract

Nowadays, when distance learning is transforming from a situational approach into a fully-fledged form of learning, the main task is to select methods and tools that will bring such classes closer to classes in classrooms and laboratories. Modern technologies have a variety of possibilities for visualization and virtualization of real objects used for research and educational activities. One of such technologies is augmented reality, which brings distance education closer to the traditional one, providing opportunities for laboratory and practical work anywhere and at any time.

Keywords: distance learning, augmented reality, visual information structure, AR-marker.

1 Introduction

In the terms of distance learning, the teaching of theoretical material is sufficiently well implemented by a well-known software. The problem is in the organization of practical and laboratory classes, where it is necessary to use laboratory equipment. Therefore, the main task is to replace real laboratory equipment with virtual equipment by the means of augmented reality.

Augmented reality technology introduces sensory data into the human perception field to supplement information about the environment and improve the perception of information. This technology allows to significantly expand the range of perceived data by transferring the digital information to the real world [1]-[2].

It is most appropriate in the educational process to use augmented reality based on visual markers [3]. The technology uses a camera and special passive visual markers such as QR codes. Virtual objects incorporated into the real world are extracted by detecting the markers in the video stream. The important task is to determine the position and orientation of the camera, which is carried out by the means of computer vision algorithms [4].

2 Overview

Existing augmented reality visual markers (except for QR code markers) do not contain additional informational messages and are used only to determine the spatial position of the camera, which significantly narrows their scope. Therefore, it is proposed to introduce the concept of visual information structure (VIS) of augmented reality, which generalizes the concept of augmented reality marker (AR-marker) and differs from it by the presence of an encoded message.

This paper discusses the advantages of the proposed stable mosaic stochastic AR-marker, which is a partial case of VIS and meets all the indicated requirements.

3 Decision

A stable mosaic stochastic marker was introduced in [5]. An example of the proposed AR-marker is shown in Figure 1. The marker is designed by introducing redundancy, performing stochastic permutation and mosaic containerization of data, which allows to incorporate data into the marker (Figure 2) and accurately visualize three-dimensional models (Figure 3). Note that the fact that a significant part of the marker is covered by an obstacle did not affect the decoding and visualization results.

FIGURE 1 An example of the stable mosaic stochastic AR-marker

224

The 19th INTERNATIONAL CONFERENCE
INFORMATION TECHNOLOGIES AND MANAGEMENT 2021
April 22-23, 2021, ISMA University of Applied Science, Riga, Latvia

Makoveichuk O

FIGURE 2. Playing YouTube video in the AR-marker area (the video's URL was decoded from the QR code which was incorporated into the AR-marker)

FIGURE 3 Visualizing three-dimensional model (teapot) using camera parameters obtained from the AR-marker

4 Conclusion

Augmented reality in education is becoming a popular learning tool. The use of the proposed AR-markers allows increasing the educational opportunities of augmented reality. This technology has the potential to change the location and timing of studying. It helps the students easily acquire, process, and remember information. Using augmented reality in education enhances the learning process by making students more involved.

References

[1] Godoy C 2020 *Augmented Reality for Education:* A Review
[2] Singh D, Banerjee A & Nath I 2021 *Application of Augmented Reality and Virtual Reality in Education*
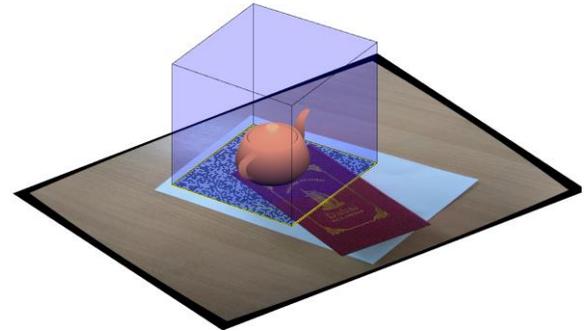[3] Siltanen S 2012 *Theory and applications of marker-based augmented reality*

[4] Ubert A 2021 *Algorithm for markers detection on fringe images*
[5] Makoveichuk O 2019 *A new type of augmented reality markers*

225