

9juli

by Agustin .

Submission date: 09-Jul-2021 03:51AM (UTC-0400)

Submission ID: 1617463198

File name: english_checked_-_V4_AR_Bacteria_ICCST_CLEAR_NO_REF.docx (685.92K)

Word count: 3332

Character count: 17983

an Augmented Reality on the Introduction of Escherichia Coli Bacteria that Cause Diarrhea using the Marker Based Tracker Method

Muhammad Bambang Firdaus¹, Dina Fadhiellah², Edy Budiman³, Andi Tejawati⁴, Lathifah⁵, M. Khairul Anam⁶, Fadli Suandi⁷

^{1,2,3,4} Informatika, Universitas Mulawarman, Samarinda, Indonesia
bambangf@fkti.unmul.ac.id, dinafadhillah.df@gmail.com, edy.budiman@gmail.com, tejawatiandi@gmail.com

⁵ Informatika, Universitas Teknokrat, Bandar Lampung, Indonesia
lathifah@teknokrat.ac.id

⁶ Teknologi Informasi, Stmik Amik Riau, Pekanbaru, Indonesia
khairulanam@sar.ac.id

⁷ Teknik Multimedia dan Jaringan, Politeknik Negeri Batam, Batam, Indonesia
fadli.suandi@polibatam.ac.id

Abstract. Indonesian current educational curriculum demands learning media for the high school degree. The use of learning tools that utilize technology nowadays is more emphasized to get better learning comprehension. Augmented Reality (AR) is a direct or indirect view of physical objects by adding information which can be displayed virtually. This study aims to apply Augmented Reality (AR) technology using the Marker Based Tracking method which is intended as a learning tool for the introduction of bacteria, especially Escherichia Coli bacteria to make it easier and also fun to understand. This study uses data collection methods that include literature study, interviews and questionnaires. Approach methods include designing, creating and testing Augmented Reality (AR). The results of this Augmented app can help both teachers and students in the teaching and learning process as well as inspire the students to learn Biology for Escherichia Coli bacteria material.

Keywords: Indonesian Education, Learning Media, Augmented Reality, Marker Based Tracking, Escherichia Coli.

1 Introduction

Augmented Reality (AR) has become an important research field. AR is the integration of 2D and 3D objects into the real world that can be touched, seen and heard, into the virtual world. Due to a real-time training discipline, AR offers great opportunities in science and engineering. By using AR technique, it allows us to get a different and unique exploration and learning experience because it involved us directly [1].

As we know that the learning system in Indonesia still uses conventional learning methods, namely teacher-centered learning with various supporting media such as

books and other educational tools [2]. For example, In the field of science learning, teachers rely on pictures in their books to teach [3], especially in recognizing bacteria. This is not fascinating for students during the course[4].

When conducting experiments in the laboratory, there are many obstacles faced by teachers and students, such as the limited resources in the laboratory, the high cost for providing the tools and materials that are needed to build real laboratory model, the time that needed to prepare tools and equipment before doing research in the lab, some students will ignore the study because it is not interesting, it is dangerous in its implementation [5]. Thus such cases occur in educational institutions today. These negative things will prevent an experiment from being held which results in students' lack of experience with experiments in certain fields [6][7].

One example of an experimental form for students is to study parts of bacteria that are only generally described in student worksheets or school books. Students cannot conduct experiments directly [8]. Therefore AR is the best solution to this problem, especially since today's smartphones are growing rapidly and can be used as a tool to develop an Augmented Reality [9][10].

In this study, users are expected to be able to visualize one of the bacteria namely Escherichia Coli in 2D and 3D within the real time. Along with the app as the results of this study later aims to be a medium or tool to provide an overview of one form of bacteria namely Escherichia Coli which is one of the bacteria close to humans that causes diarrheal disease, in 2D and 3D forms with explanations, and movements to make the teaching and learning process more attractive for both teachers and students.

2 Literature review

This research highlights the usefulness of augmented reality media in learning. It is very necessary to improve the learning process, to vary the way technology is utilized in education. Many things and objects are learned with increasing reality. As in previous studies, the case studies and their respective challenges have tried to do the same.

Augmented reality technology, even as a learning medium with different models, began to develop in different areas[11]. The researcher is exploring models of augmented reality, developed through the review of several newspapers relating to augmented reality. With keywords from the augmented reality, the researcher had gathered 100 journals from various sources. The researcher then select 41 newspapers and find 5 models of augmented reality including 3D animation, 3D video, 3D multimedia. Two types of Augmented reality, using markers and markerless, requires a signal as a trigger for the formation of increased objects within the real environment for augmented reality, whereas in augmented reality without markers, markers do not require an increase in reality into real environments [12].

In numerous areas including research, education and much more, technology has been used [13][14]. PathogenAR is a mobile educational application designed to help the education professionals, particularly teachers and students, learn a lot more fun and interactive about the dangerous viruses around us. This application can illustrate stu-

dents' actual shape and structure of viruses and can help teachers and educators to explain the sciences particularly in this area. A variety of multimedia elements are provided in this mobile application by using the AR Technology application in order to attract students to learning. Finally, this project can help students to learn more and become a part of an IT expert [15].

Augmented reality (AR) is becoming popular because AR can provide users with real-world visual guidance [16][17]. Its interactive nature makes medical fields support it since this app can lead to better diagnostic performance as well as disease detection. However, due to its challenges in mapping the virtual and real environments, it is not so easy to perform. In a medical application the proposed framework has developed an efficient RA to better detect and diagnose a disease. The work focuses mainly on mapping the 3D virtual image on the actual object without preregistration or marks in various positions [18].

2D to 3D conversion, which offers highly qualified image data without any loss, is initially performed. The conversion is then followed by segmentation in which the 3-d medical imaging region is segmented by the environmental data and the use of IMR-CNN to prevent horizontal or vertical devices. The work developed an RJ-FAST-BRISK to get rid of relevant features and accurate detection of the corner point of the image. Finally, the spatial mapping process is done using PEICP-ODCNN, based on the characteristics, which reduces the error rate due to different positions and also reduces the time required to compute. Experimental results show that the work achieves 92,24 percent mapping accuracy compared with the current state-of-the-art method [19].

The cycle of biological animal development is metamorphosis. Learning Metamorphosis is part of the student education in schools in the field of biology. Unfortunately, observation takes time, and it is limited to study a metamorphosis cycle to determine an animal specimen. This research offers an innovative solution to these challenges, which are the application of the technology of augmented reality.

In order to improve the interaction of students with learning metamorphosis during study sessions, the animal metamorphosis process is visualized into 4-sized objects. The Marker-based tracking method is utilized as a means to locate the tracking pattern of the marker as the location of the augmented reality object. Results of this study show that the students can understand better metamorphosis with a marker-based tracking method [20].

The study examined the effects of Augmented Reality (AR) technology on learning outcomes of students (measured by Bloom cognitive level) and biological attitude. The printing book has been redesigned to incorporate an AR form. The effectiveness of the developed book on learning results and biological attitude was tested through quasi-experimental pre-testing and posttest concepts. The students also collected views on AR technology and the redesigned book.

A total of 68 students of the 9th grade took part in the study. They were divided into the experimental band, which used the printing book and the AR technology as a learning supplement. The results showed that AR technology could improve learning results for students and their learning attitudes towards biology at the analysis level. Students pointed out that AR can improve their biological education [21].

An experiment was conducted with increased learning reality to investigate the child's performance of learning, including the number of errors they had made, the ability to keep in mind the content they had read, and the three types of teaching materials they had been satisfied with including a picture book, physical information and an AR graphics book [22][23]. In order to demarcate respectively the characters of six bacteria with 2D graphics, 3D physical items and 3D virtual objects, these three teaching materials were intended.

Seventy-two children of the fifth grade were randomly selected for studying and divided into three groups, each using the teaching material assigned in intervals 1, 2 and 3 min, to learn the names of the six different bacteria. Results showed that the AR graphics book provides children with a practical and convenient way of exploring and learning bacteria. Follow-up interviews indicated that the AR graphic book was very much appreciated by the children and preferred to other materials [24].

3 Research Method

3.1 Data Collection

The initial stage in the analysis is data collection, the collection of data used in research. The methods used in collecting data and information are:

Literature Review. At this stage the researcher collects and studies all kinds of information related to the application of Augmented Reality and its programming model [25][26], through papers, journals, books and the internet.

Interview. The researcher also conducted interviews with teachers of SMAN 2 Samarinda regarding the syllabus for learning the structure of Escherichia Coli bacteria, learning methods for students, problems that often occur in learning the structure of bacteria, and others.

Questionnaire. After testing the AR app that has been create, the researcher also distributed questionnaires in the form of several questions regarding the results of the app trial to several respondents [27][28], namely class X students of SMAN 2 Samarinda, general public at all levels of education, and biological students of Faculty of Teacher Training and Education at Mulawarman University. With a list of questions as follows;

- (a) Does 3D animation interesting and easy to understand?
- (b) Does the application easy to operate?
- (c) Does the interface design of the Application attractive?
- (d) Does the information in the information section easy to understand?
- (e) Does the learning by using leaflets able to increase the interest of application users for studying?
- (f) Can the application increase interest in learning?
- (g) Can the learning using marker methods improve user understanding of the application?

3.2 System Design

The researcher develops an Augmented Reality (AR) application based on android mobile with the aim as a medium of learning about the structure of plant roots. The researcher uses the Research and Development (RAD) method to meet quality standards with application development [29][30].

The stages of the development procedure carried out by the researcher as follows:

Requirements Planning. In this section, the researcher identifies the purpose of making the plant structure AR application for the biology teacher at SMAN 2 Samarinda, then identifies the information requirements of the goals discussed and agreed.

RAD Design Workshop. Entering the design and application development stage, the researcher creates and shows a visual design and work pattern for the Escherichia Coli Bacteria structure AR application that has been built for the biology teacher at SMAN 2 Samarinda. The researcher then examines each module which is made based on the teacher's response.

Implementation. After the researcher and biology teachers of SMAN 2 Samarinda agreed on all aspects and work patterns on the AR application of Escherichia Coli Bacteria structure built by the researcher, a trial and introduction of the AR application was carried out to the students of SMAN 2 Samarinda with the aim for being an Escherichia Coli Bacteria learning medium.

Augmented Reality Application Flowchart. The system design flowchart shows research and Augmented Reality application flowcharts. It described in Figure 1.

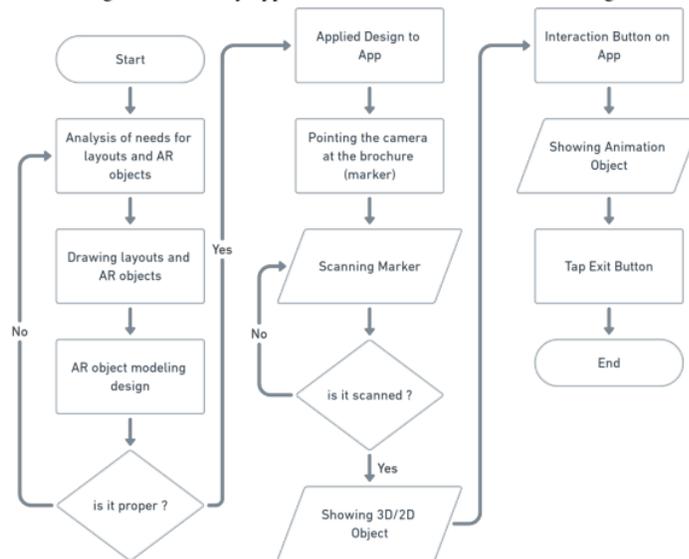


Fig. 1. Augmented Reality Application Flowchart

- 1) The first stage, the researcher analyzes what object that needed for the application.
- 2) The second stage is to do a general description of the layout and AR objects manually using paper, scribbles or using a design application on a Personal Computer.
- 3) The third stage, modeling the objects and layouts that have been designed and manually drawn earlier in 3D within the 3D blender application.
- 4) The fourth stage, if it is appropriate then the 3D and 2D designs apply to the app (Unity). At this stage the reseacher applies and installs the design that has been made earlier into 3D form on a predetermined marker.
- 5) Fifth stage, testing the app by pointing the camera towards the marker to read the marker.
- 6) Sixth stage. If the marker is detected, a 3D object that has been previously designed will appear.

4 Results and Discussion

4.1 Research Results

User. Users of this Augmented Reality (AR) app are practitioners and participants in teaching and learning activities (teachers, students and students) or the general public who want to learn biology, especially for Escherichia Coli bacteria [10].

2D Markers. The 2-dimensional (2D) marker which is used for this AR application is a representation of the interview results, that is the structural model and micro shape of the Escherichia Coli bacteria, and the marker is designed in the form of a brochure as shown below;



Fig. 2. Escherechia Coli Brochure

4.3 Device Test

Layout. In the process of developing Augmented Reality app for Escherichia Coli bacteria, the recommendation of aspect ratio size is 16:10 (Landscape).

After finished building the app then it tested on several smartphones to check compatibility with the layout of the android version and certain screen aspect ratio [31], the Application is installed and running smoothly. Device testing was carried out directly on 36 Smartphones belonging to several students at SMA N 2 Samarinda and students of Informatics. The following is a list of 10 Smartphones that have been tested based on smartphone brands and different android versions:

Table 1. App Layout Test

Device Name	Android Version	Screen Resolution	Layout Compatibility	Smoothness
Samsung Galaxy Ace 3	4.0	1280 x 720 (16:9)	Unable to install	Unable to install
Oppo A37	5.1	1280 x 720 (16:9)	Compatible	Smooth
Oppo A39	5.1	1280 x 720 (16:9)	Compatible	Smooth
Galaxy J5	6.0	1280 x 720 (16:9)	Compatible	Smooth
Xiaomi Redmi 4	7.1	1280 x 720 (16:9)	Compatible	Smooth
Redmi 5A	7.1	1280 x 720 (19:9)	Compatible	Smooth
Vivo Y71	8.1	1440 x 720 (18:9)	Compatible	Smooth
Xiaomi Note 3	9.0	1920 x 1080 (16:9)	Compatible	Smooth
Redmi note 7	9.0	2380 x 1080 (19:9)	Compatible	Smooth
Asus Max Zenpro M1	9.0	2160 x 1080 (18:9)	Compatible	Smooth

10 smartphones with different Android versions and screen resolutions have been produced from a series of tests, resulting in a layout compatibility that is in accordance with the system design carried out on the Unity 3D app.

Memory Capacity. After testing the device, it shows that app transfer from the flashdisk takes a long time. From the 33 participants in the trial, all of them took a

considerable amount of time, affected by the insufficient memory capacity of the participant's device to accommodate the application size of 50 Mb.

Minimum Operating System. The participants of the application device test were 33 students, and there were 5 students who were unable to transfer the soft-file application and could not install the application. Therefore, this application can only be used and runs smoothly on android devices at least Lollipop to Pie versions. Meanwhile, the devices of the 5 students mentioned, 4 (four) of them have devices with the IOS operating system and the rest are Android devices with version 4.0.

Maximum camera distance. The test aimed at students of class X MIPA1 at SMA Negeri 2 Samarinda, including a scan application test, this test resulted in several conclusions, those are the camera used also affected this test. From the tests that have been carried out, the maximum distance from the brochure media with the camera is 1 meter in order to maximize the reading of the marker.

4.4 Questionnaire Test

Questionnaire testing results a high category for the feasibility of the question using the SPSS application for the Validity Test with the results of the Pearson Correlation reaching more than 0.7 which means the questionnaire used is valid.

Then, a Reliability Test was also carried out to test the questions used whether they can be reliable with applications made using the same application, namely SPSS. It shows that the results of Cronbach's Alpha on Reliability Statistics which means it reaches the high Reliability category.

In addition to the two tests that have been mentioned, the results of the questionnaires that have been distributed are positive and quite qualified to be distributed to SMA Negeri 2 so that they can be used as teaching media in the following year's learning. This can be seen from the graph where the percentage of answers strongly agree and agree from the respondents range from 88.2% to 94.1% with each percentage of Strongly Agree and Agree which can be seen below;

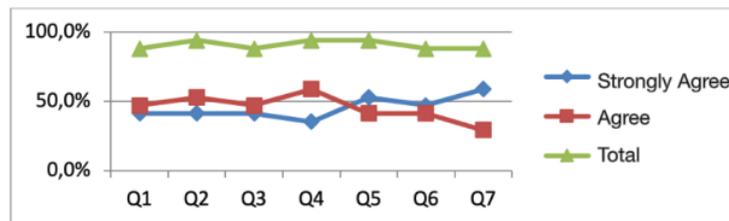


Fig. 8. Respondents Positive Percentage

5 Conclusion

Based on the results and discussions that have been made, it can be concluded that several things that affect whether smoothness or not a marker scan are: the level of

accuracy of markers on vuforia, the soft and hard file brochure's , the smartphone camera and the lighting when scanning. The results of the application test based on the distributed questionnaire showed that each question from the questionnaire obtained results indicating a positive response from application users based on the percentage range of answers "yes", "agree" and "strongly agree" including the Direct Test Questionnaire for high school students ranging from 41.2% to 100%, Questionnaires for FKIP Biology Mulawarman University Students' which ranged from 58.4% to 91.7%, Questionnaires for the General Public, High Schools to Students which ranged from 76.7% to 97.7%. The results of the device usability testing show that the application has been able to be distributed to high schools, because it has met the specified criteria, specifically the number of trial participants who run smoothly until the last stage must exceed half the value of the number of trial present participants.

6 Suggestion

Based on the findings of the assessment for the Escherichia Coli Bacteria AR app, several suggestions for further app development should be implemented not only on the android platform. The need to further increase the role of education in mobile app as an enhanced reality as an educational media, so that this country has an identity and does not always follow other countries. In this app, the role of education is only an overview of biology material, especially bacteria. Furthermore, it can be improved by increasing the role of education in other fields of study, such as chemistry learning media and so on.

References

ORIGINALITY REPORT

3%

SIMILARITY INDEX

1%

INTERNET SOURCES

2%

PUBLICATIONS

0%

STUDENT PAPERS

PRIMARY SOURCES

- 1** B Afandi, I Kustiawan, N D Herman. "Exploration of the augmented reality model in learning", Journal of Physics: Conference Series, 2019 1%
Publication
- 2** Aditya Wahana, Hasti Hasanati Marfuah. "The Use of Augmented Reality to Build Occupational Health and Safety (OHS) Learning Media", Journal of Physics: Conference Series, 2021 1%
Publication
- 3** journal.portalgaruda.org 1%
Internet Source
- 4** Didi Istardi, Irwanto Zarma Putra. "The Weakest Cell Identification in Li-Ion battery packs using Discharging Technique Performance", 2018 International Conference on Applied Engineering (ICAE), 2018 <1%
Publication
- 5** mafiadoc.com <1%
Internet Source

Exclude quotes Off

Exclude matches Off

Exclude bibliography Off