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# Mobile application for advertising faculty educational services

*Galyna V.* Marchuk[1], *Vitalii L.* Levkivskyi[1], *Maryna S.* Graf[1], *Yelyzaveta A.* Dombrovska[1] and *Iryna V.* Panarina[1]

[1]*Zhytomyr Polytechnic State University, 103 Chudnivska Str., Zhytomyr, 10005, Ukraine*

**Abstract.** The article shows the use of augmented reality technology and the creation of a mobile application for advertising educational services of the Faculty of Information and Computer Technologies of the Zhytomyr Polytechnic State University, Ukraine. The research method is the use of augmented reality technology to create mobile applications using the Vuforia platform. The developed application is intended for use on devices running on the Android operating system. As a result of this work, a mobile software application was designed and created to promote educational services of the Faculty. Animated 3D models created using the Blender package, cards with information on each specialty and animated videos were created. There is a possibility of direct transition from the mobile application to external information resources. The proposed development can be used to promote the educational opportunities of the educational institution, increase the information value of advertising paper advertising and greater interest of entrants. Mobile application prototype tested in production environment and can be used by multiple faculties. For use by other faculties, information about the relevant specialties must be added to the program. As a result of using the developed mobile application, the number of applications from entrants to the faculty has increased by 40 percent over the past three years.

**Keywords:** augmented reality, Vuforia, 3D models, mobile application, advertising

## 1. Introduction

Human-computer interaction is a dynamically developing area of science. The constant improvement of technology leads to the possibility of innovative user interface paradigms [5]. The globalization of virtual reality has led to the introduction of a new term "augmented reality" into scientific circulation. If current user interface technologies focus mainly on human-computer interaction, then augmented reality with the help of computer technology offers an improvement in the interaction between humans and the real world.

At the moment, augmented reality is one of the most relevant objects for research. Augmented reality (AR) is a concept that describes the process of augmenting existing reality with virtual objects.

Smartphones and tablets are becoming more powerful as the share of web browsing using desktop PCs is reduced to 48.7 % [9]. Currently, the number of people using a mobile device exceeds the population of China, India and Europe combined. The balance between mobile

pzs_mgv@ztu.edu.ua (G. V. Marchuk); levkivskyy@ztu.edu.ua (V. L. Levkivskyi); graf.maryna@gmail.com (M. S. Graf); lizadom.com@gmail.com (Y. A. Dombrovska); kkn_piv@ztu.edu.ua (I. V. Panarina)
0000-0003-2954-1057 (G. V. Marchuk); 0000-0002-1643-0895 (V. L. Levkivskyi); 0000-0003-4873-548X (M. S. Graf); 0000-0002-5095-4385 (Y. A. Dombrovska); 0000-0003-4783-2587 (I. V. Panarina)

and desktop traffic will never be restored. Therefore, the combination of mobile devices and augmented reality technologies will give even more advantages in the advertising purposes of educational services.

The aim of the study is to use augmented reality technology in the design and development of a mobile application for advertising educational services of the Faculty of Information and Computer Technologies of the Zhytomyr Polytechnic State University, Ukraine. In order to obtain information about the educational services provided by an educational institution, it is often necessary to visit it. We don't always have time for this. Browsing information from websites is a common, banal phenomenon. Therefore, there is a problem of finding new means of advertising educational services. This problem can be solved using a combination of mobile devices and augmented reality technology. The rise in popularity of augmented reality technology during the pandemic is boosting global investment in the field.

To promote the educational process and advertising of the educational institution, it is advisable to use augmented reality technology. This will undoubtedly increase the interest of applicants, as well as increase the level of perception of information about the specialties of the faculty. This is achieved through diversity, interactivity and visual presentation of information.

The application provides visualization of the university building, as well as the environment in the form of 3D models and animation of some objects. Cards with brief information about each specialty of the faculty will also be created. The application will be able to add useful links to social networks. The application is aimed at a wide audience of people who are interested in finding educational services.

## 2. Literature review

AR is a phenomenon of the space-time continuum that combines objective and virtual reality and has a number of specific qualities and properties that are not available in objective and virtual reality separately. Speaking about the definition of augmented reality, it is also impossible not to refer to the generally recognized work of Azuma [1], in which he formulated the basic principles characteristic of an augmented reality system:

- combining the real and the virtual;
- interaction in real time;
- work with three-dimensional space.

In a narrower sense, augmented reality can be defined as a technology for integrating virtual objects into the real world.

The concept of AR includes several aspects: visualization, context operations (triggers), visual instructions (assistance). Visualization by means of AR can be used when making decisions during development, design, when making a purchase. Successful use in educational and other fields is also possible.

Augmented reality is used in various fields and is now increasingly used in educational activities. There is still little research on the use of this technology in education, but the potential and effectiveness of the use of augmented reality is described in the literature. Wyss et al. [11] shows that students have a very positive attitude towards augmented reality technologies

and are interested in working with this technology. The same trend is supported by He et al. [2], Hordiienko et al. [3], Vakaliuk et al. [10]:

- the software application described by [3] demonstrates in detail the behavior of objects in the solar system on a real scale using AR technology;
- He et al. [2] describes a study of demonstrating the best results in learning English using AR technology;
- Vakaliuk et al. [10] demonstrates the possibilities of using AR technology to create a software application in the field of local lore "“Monuments of the city of Zhytomyr”. The application was tested during city tours with the participation of elementary school students. As a result of this approach, the interest of schoolchildren in studying the history of the native city has increased [10].

Augmented reality is an innovative technology in marketing communication, it focuses on the fact that the virtual interaction of the product with advertising provides additional interest for consumers. The technology allows consumers to get information about the product through virtual reality before the purchase. Mauroner, Le and Best [6] describe an experimental study of the application of augmented reality in advertising and brand communication. The study proved the effectiveness of advertising using AR.

AR-based advertising helps to fight the competition and create a better picture of the offered product in the minds of buyers. Sinha and Modak [8] prove that respondents are more interested in products that use the concept of AR advertising, while consumers' inclination towards traditional advertising was low. Irshad and Rambli [4] demonstrated that advertising using AR has a positive impact on users.

Some well-known companies, such as McDonald's, Coca-Cola, Nike, use AR technology as a marketing and advertising tool. Thus, de Ruyter et al. [7] proposes the concept of using advertising content using AR technology.

The research of the Zulkifli, Ahmed Alnagrat and Che Mat [13] deserves special attention. The authors present the results of the development and evaluation of the Mobile Augmented Reality interactive brochure application. The purpose of the application is to provide interactive information in addition to a typical brochure in the promotion of higher education institutions among foreign students.

Based on the analysis of the latest publications and the experience of using augmented reality technologies, it is possible to conclude that it is appropriate to use this technology for advertising purposes. In our research, we apply AR technology to advertise educational services.

## 3. Mobile application development

### 3.1. 3D objects design

Several graphic objects have been developed to create a mobile AR application that serves to promote the faculty's educational services. All 3D models were developed in Blender.

The main model created is the university building. The initial appearance of such a model is shown in figure 1. The result of adding textures is shown in figure 2.


**Figure 1:** The initial model of the university (created in Blender 2.8).

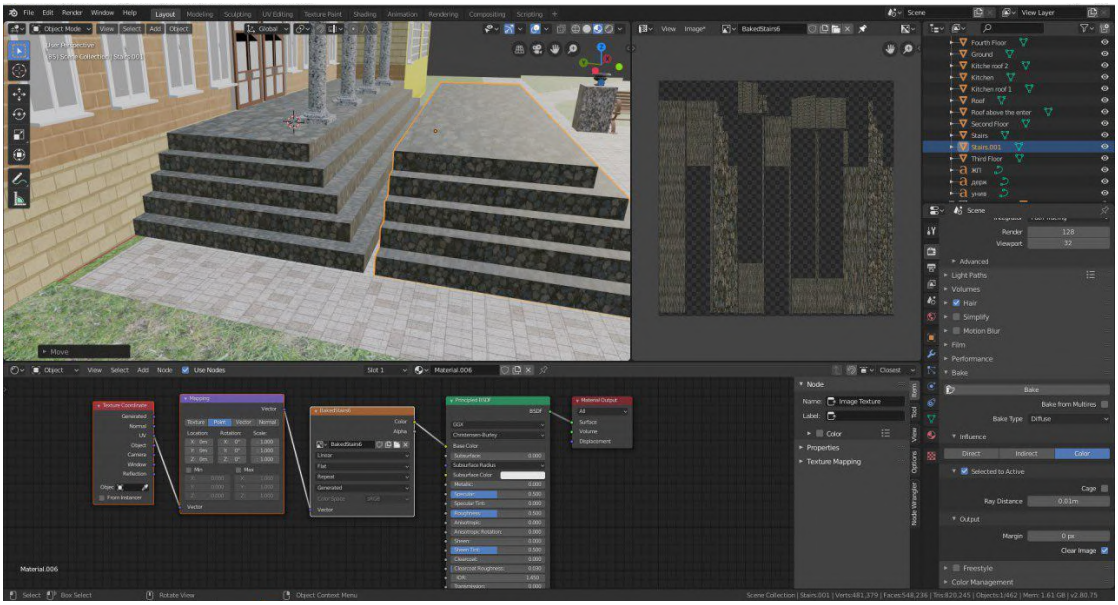

**Figure 2:** View of the model with textures.

Thus, the main model of appearance of the Zhytomyr Polytechnic State University was obtained, which is the basis of the mobile application (figure 3).

In addition to the main facility, a number of others have been created: models of trees whose leaves should have animation – movement in the wind, and models of people, which can be seen in figure 4. Each human object has an animation of walking on its own trajectory.

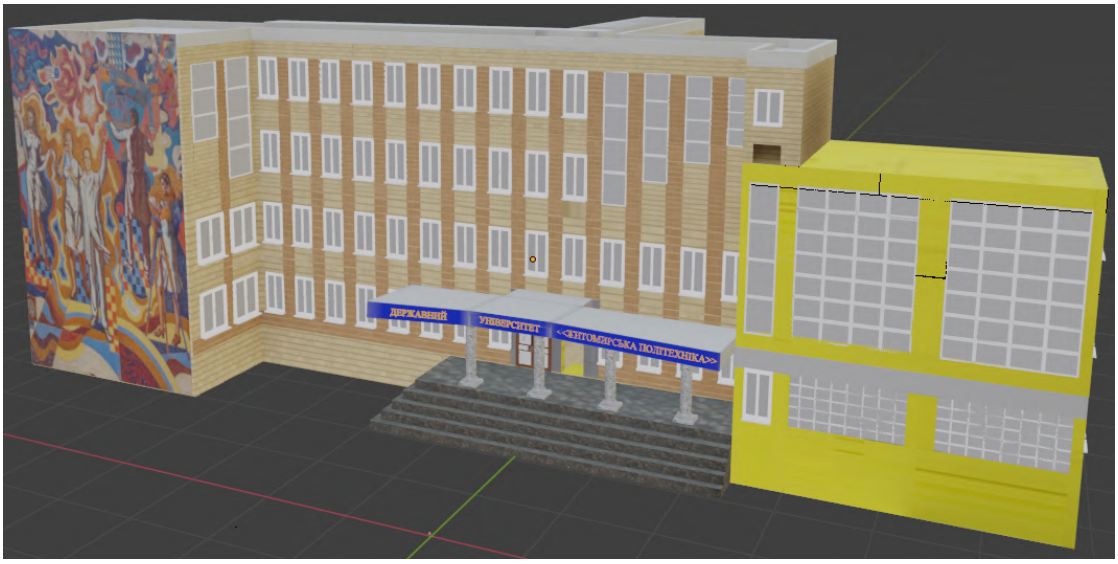


**Figure 3:** Object "Zhytomyr Polytechnic State University, Ukraine".

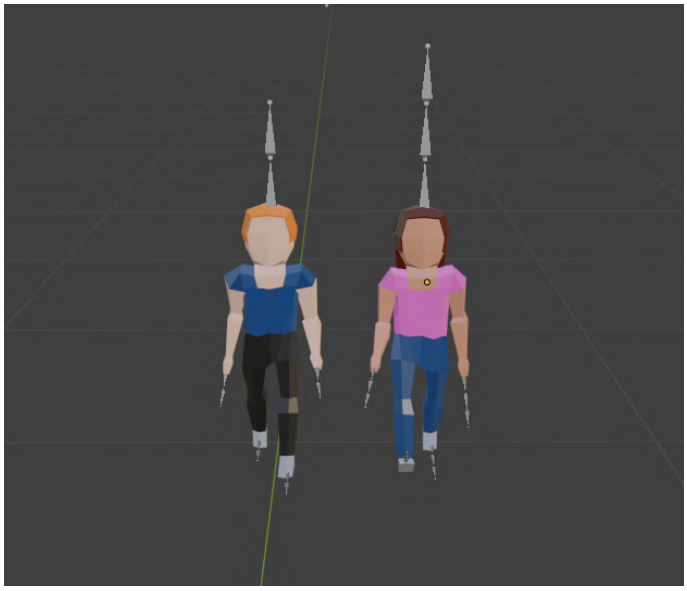

**Figure 4:** Models of humans.

Models of benches, lanterns and a model of a fountain near the university were also created. At the top of the university, the user can see the inscription "We are waiting for you!".

A number of buttons have been added to the mobile application, which will allow the user to select certain actions (figure 5).

The orange plus button expands a kind of menu with different buttons, where each has its own function. The green button with the letter "*i*" is responsible for displaying information

**Figure 5:** Menu with icons.

cards for each specialty of the Faculty of Information and Computer Technology (FICT). The button, with the image of the social network Facebook, will take the user to the main page of FICT in this network. The button showing the point on the map is responsible for the location of the university on Google Maps. The button of the social network Instagram is responsible for going to the main page of the faculty in this social network. The button with the symbol of the university is responsible for the user's transition to the official website of the educational institution.

## 3.2. Design and implementation of individual system modules

The main advantage of the Unity engine is the use of component-oriented object management system. All interactivity and gameplay in Unity are based on three fundamental blocks: GameObject objects, components and variables. Any object in the game is a GameObject, be it characters, light sources, special effects, scenery and everything else. Components determine the behavior of game objects to which they are attached and control them. Figure 6 shows the main game objects and their components.

A state diagram is used to describe the behavior of the application. Figure 7 shows a diagram of the transitions between the states of the mobile application.

After launching the mobile application, as soon as the user hovers over the image of the paper advertising, the "Start" button will appear and the melody will start playing. After that, the user can press a button, and then the animation of the appearance of the university as if from the floor and scrolling the building 360 degrees will begin. Other objects located on the ground will also appear. Gait animation is applied to objects in the form of people, the movement of leaves on trees under the influence of wind is realized.

By clicking on the third button "*i*", the user will open animated seven cards with useful information about specific specialties at the faculty. Each card is accompanied by a special "View animation" button, which allows you to look at the sprite animation, selected for each specialty separately. When the user removes the paper advertising from the camera's view, the music stops, objects and buttons disappear.

Many animations have been created in the mobile application. Animation of the university building (it can be viewed from all sides, rotate 360 degrees), Animation of all the characters on stage. Animation Controller is required to apply animations to GameObject. The animator controller is created by Unity and allows you to manage a set of animations for GameObject and switch between them when you need to meet certain conditions.

Figure 8 shows an animation diagram of the university. It depicts three blocks – Entry, Any State, UniversityAppearance. The Entry block marks the beginning of the animation, that is, when you turn on the scene with this animation, the animation starts, and you go to the

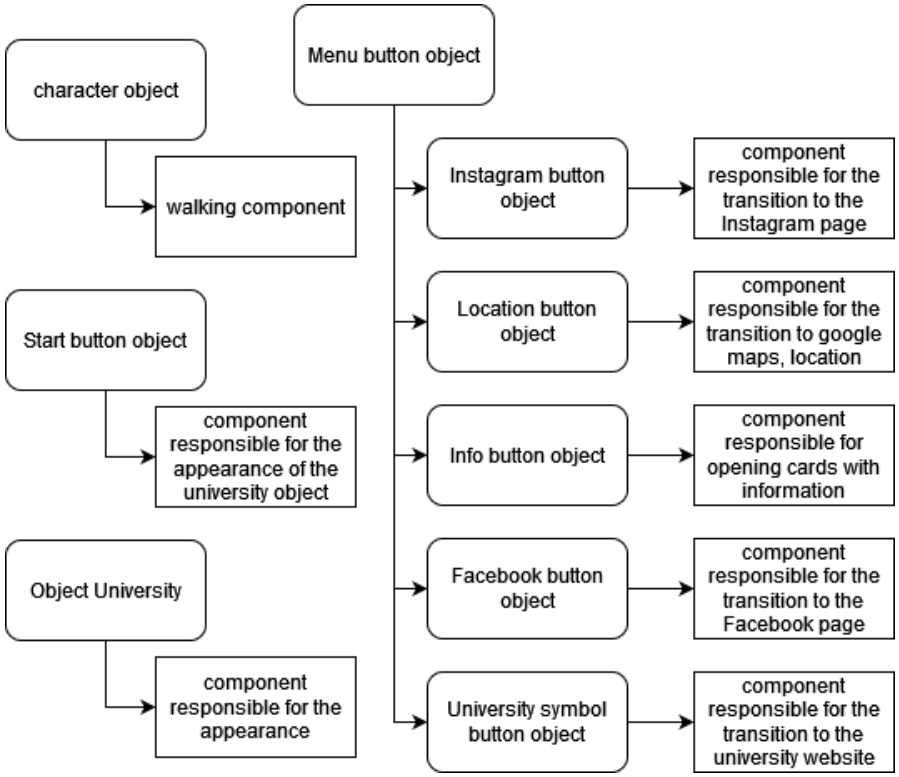


**Figure 6:** Game objects and their components.

UniversityAppearance animation, which is an animation of the university emerging from the ground and scrolling 360 degrees.

The application also has animations: “Start” button, animation of people; animation of cards with information about the specialties of the faculty. On the card animation diagram (figure 9) you can see four blocks – Entry, Any State, CardAppearance, GIF Appearance. The Entry block marks the beginning of the animation, that is, when you turn on the scene with this animation, the animation begins its action, and there is a transition to the CardAppearance animation, which is an animation of the appearance of cards on the screen. There is also a GIF Appearance block that corresponds to the sprite animation when you click the “View Animation” button.

Unity supports C# scripts based on one of two main approaches: the traditional and widely used object-oriented approach and the information-oriented approach.

## 3.3. Description of work with the mobile application

The software application called UniAD is implemented on the Unity engine using augmented reality technology. The application can be used on devices with Android operating system version 10 and higher and requires 210 MB of free memory, you also need to have a promotional flyer for the faculty. Other requirements and competencies are not required. The interface of the application is quite simple. Management is carried out using the camera of the smartphone

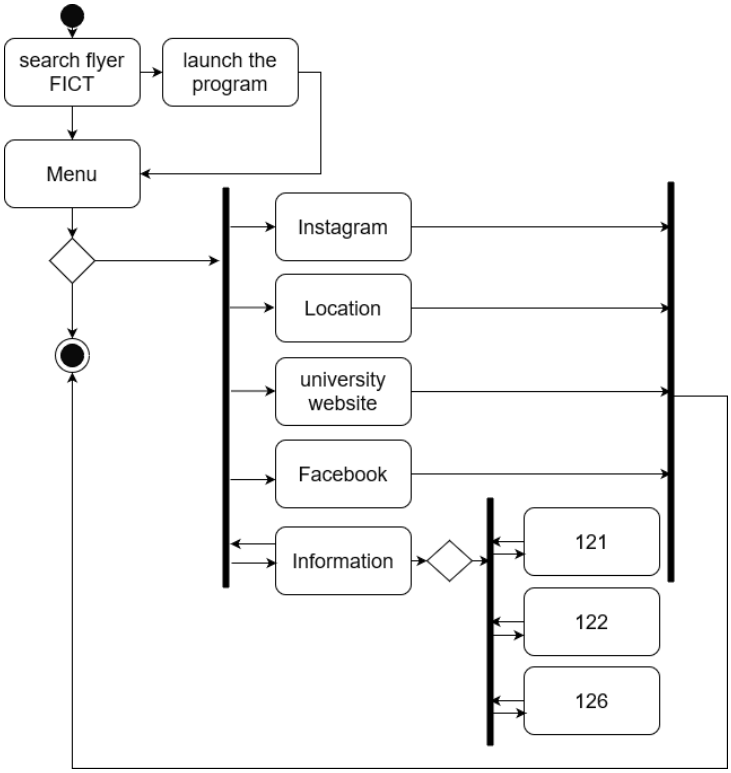


**Figure 7:** Diagram of transitions between states in the mobile application.

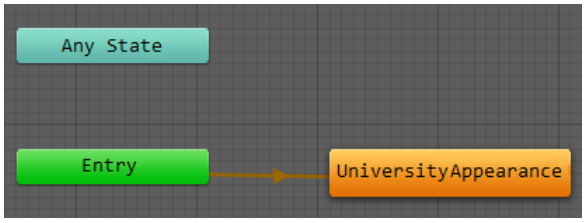


**Figure 8:** University model animation diagram.

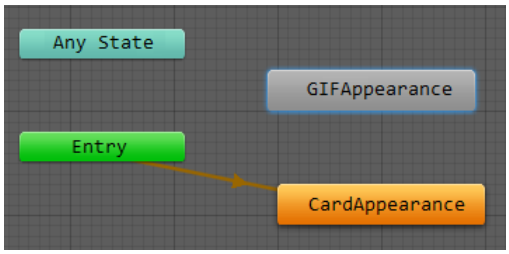


**Figure 9:** Information card animation diagram.

on which the application is installed, and pictures of triggers (advertising paper advertising of the faculty) on which the user must point the camera.

After launching the mobile application and pressing the "Start" button, calm music starts playing and the animation of the university appearance will start. Near the university there are people who have an animation of walking, trees whose leaves have an animation of rustling, as well as benches, lanterns, a fountain, an inscription above his head. Another "Menu" button appears on the screen. An image of the program after clicking the "Start" button can be seen in figure 10.

Currently, you can view the model of the university by turning around a paper advertising with advertising, it is also possible to enlarge or reduce the image of the institution.

The user has the opportunity to open a drop-down menu, where you can go to additional resources of the university: the main site of the university, Instagram, Facebook. It is also possible to open the Google Maps service, which will indicate the location of the Zhytomyr Polytechnic State University, Ukraine (figure 11).

By pressing the "*i*" button, the user will open seven cards. All cards have the same design (figure 12) – they are depicted in the form of a rectangle with round edges, but each of them is a representation of a separate specialty at the faculty. At the top of the card you can see the name and number of the specialty. Below is a list of preferences, subjects or interests about each specialty. At the bottom of the card, the user sees a button labeled "View animation", when pressed, instead of the card appears sprite animation related to the main activity (figure 12), which is studied in this or that specialty. By flipping the screen to the left, the user can see all the animations and all the cards. To close the card view, the user must click on the "*i*" icon again.

When the user loses sight of the camera paper advertising with advertising, all objects, music and sounds will be lost. To view the program again, you need to point the camera at the paper advertising again.

## 4. Results and discussion

As a result of the study of the use of augmented reality technology for advertising the educational services of the faculty, a mobile application was created. The application is able to provide:

- information about the specialties of the Faculty of Information and Computer Technologies (text and video version);
- the possibility of switching to additional resources of the university: the main website of the university, Instagram, Facebook;
- the ability to open the Google Maps service with the location of Zhytomyr Polytechnic State University;
- obtaining contact data of faculty representatives.

During the performance test, the application was able to recognize all the markers on the advertising flare and displayed the corresponding virtual content in a fairly short time.

From the point of view of users, it is important to conduct an evaluation to get an opinion on the usability of the program. Initially, the mobile application was tested on the immediate

**Figure 10:** General view of the program after pressing the “Start” button.

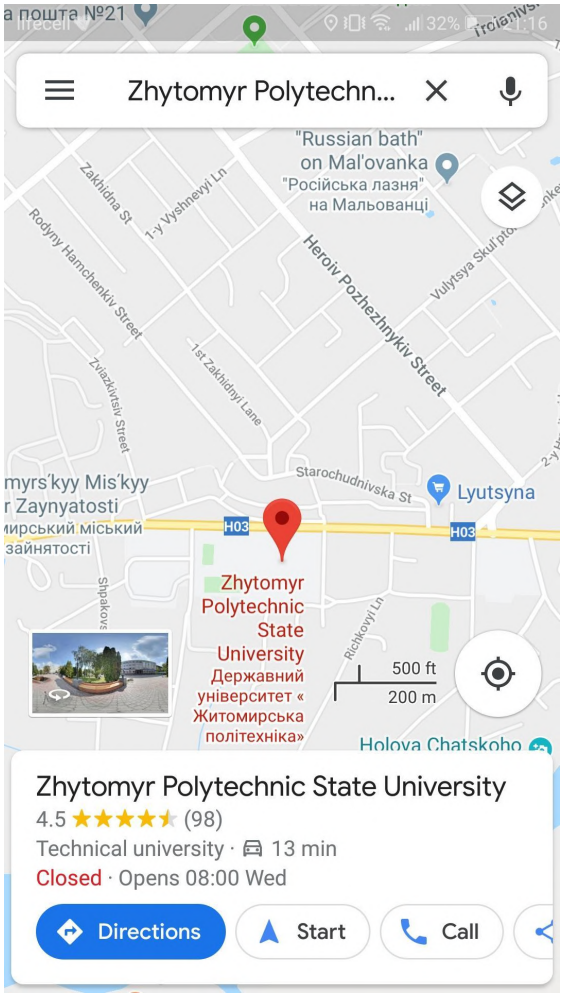


**Figure 11:** The result of pressing a map button.

environment of users. All feedback and recommendations of users were taken into account and changes were made to the program. Next, the software application was tested in the work of the admissions committee of the Faculty of Information and Computer Technologies of the Zhytomyr Polytechnic State University. Summarized feedback from applicants is given in table 1.

For the past 3 years, this mobile application has been actively used during career guidance work. It became a marketing tool of the faculty. As a result, we can observe a 40% increase in the number of entrants in the faculties of “Software Engineering”, “Computer Science”, “Information Systems and Technologies” [12].

The use of AR technology in advertising is effective. Such applications attract applicants, as information about specialties is presented in an interesting way. The text is not always perceived qualitatively and in its entirety. The information presented in an animated clip briefly presents the essence of the specialty, which improves perception.

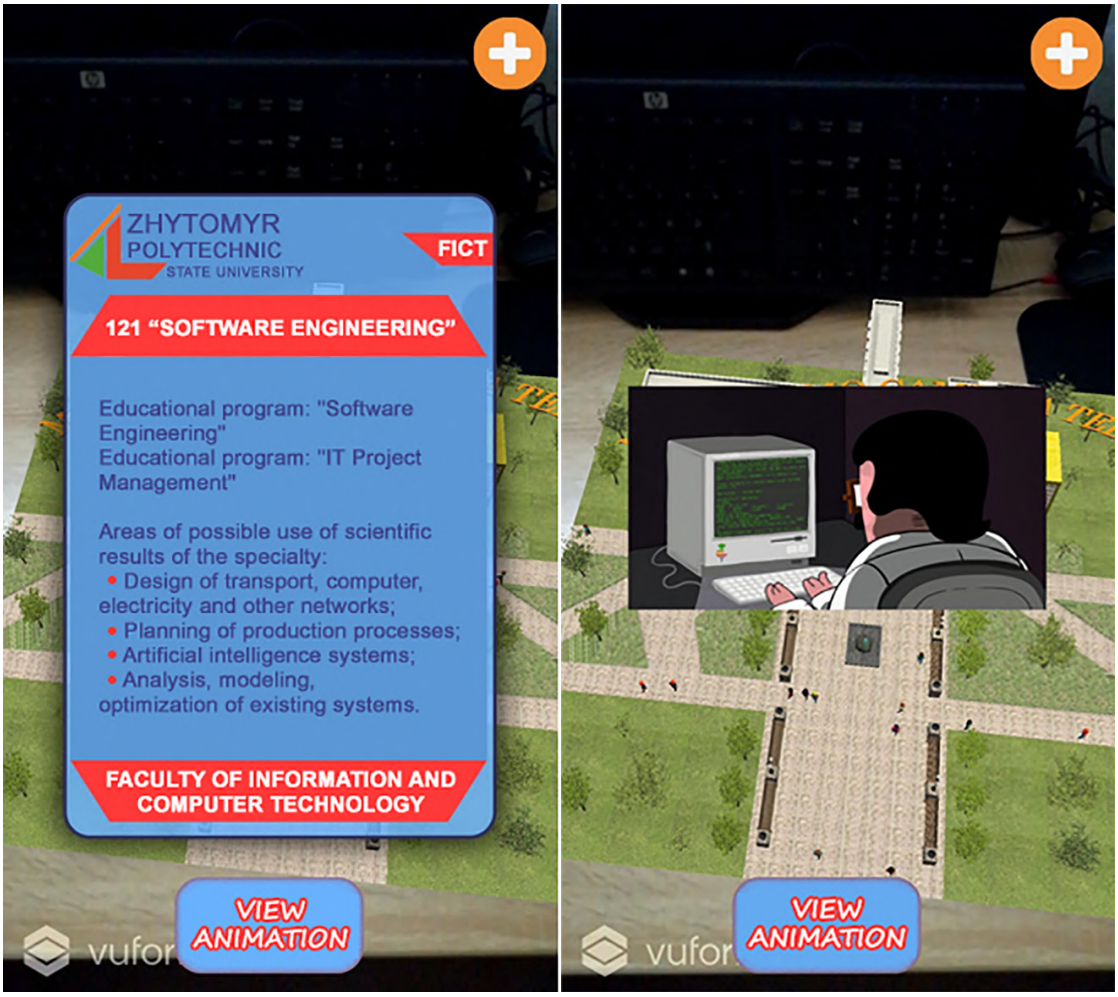


**Figure 12:** The result of pressing the "*i*" button and card animation view.

**Table 1**
Results of assessment by applicants.

| Task | Rating |
|---|---|
| Easy of use | ***** |
| There are practically no errors | ***** |
| Ability to use on different platforms | ** |
| It works without fail for the required period of time | ***** |
| It has a well-organized program structure | ***** |
| Satisfies the needs of users | **** |
| Provides an opportunity to have information | ***** |

As the study showed, modern advertising goes beyond the usual framework. But the use of AR technology in the advertising of educational services is new. The effectiveness is confirmed by the number of entrants and achieved due to the novelty of use.

Currently, the application is available for download from cloud hosting, subject to the faculty's promotional flyer. In the future, it is planned to expand it for the possibility of use by various faculties and educational institutions and make it public in the play market. In general, users agreed on the usefulness, informativeness, functionality and ease of use of the mobile application.

## 5. Conclusions

Advertising goes beyond gadgets, postcards and other familiar frames. Thanks to the proposed software product you can learn about the educational proposals of the Faculty of Information and Computer Technology of the Zhytomyr Polytechnic State University, Ukraine. Key features of the mobile application:

- provides information about the educational services of the faculty;
- works on the basis of the advertising flyer of the faculty;
- has developed 3D models, the main of which is the university model, which is made in a close to real style;
- contains animated videos, with which it arouses more interest in specialties;
- interacts in real time with external information resources (university website, Instagram, Facebook, Google Maps service).

The paper presents modern possibilities of using elements of augmented reality to increase the information value of printed publications for advertising purposes. As a result of using the developed mobile application, the number of applications from entrants to the faculty was increased.

The study was limited to the Faculty of Information and Computer Technologies of the Zhytomyr Polytechnic State University. Interest in a mobile application can be demonstrated precisely by the fact that applicants are focused on the IT field.

In the future it is planned to expand the mobile application, the possible use of other extended reality technologies, adding disciplines and competencies, a list of proposals for specialties in the labor market, application at other faculties of the university. To do this, you need to add data to the application by entering information about new specialties.

## References

[1] Azuma, R.T., 1997. A Survey of Augmented Reality. *Presence: Teleoperators and Virtual Environments*, 6(4), pp.335–385. Available from: https://doi.org/10.1162/pres.1997.6.4.355.

[2] He, J., Ren, J., Zhu, G., Cai, S. and Chen, G., 2014. Mobile-Based AR Application Helps to Promote EFL Children's Vocabulary Study. *2014 IEEE 14th International Conference on Advanced Learning Technologies*. pp.431–433. Available from: https://doi.org/10.1109/ICALT.2014.129.

[3] Hordiienko, V.V., Marchuk, G.V., Vakaliuk, T.A. and Pikilnyak, A.V., 2020. Development of a model of the solar system in AR and 3d. In: O.Y. Burov and A.E. Kiv, eds. *Proceedings of the 3rd International Workshop on Augmented Reality in Education, Kryvyi Rih, Ukraine, May 13, 2020*. CEUR-WS.org, *CEUR Workshop Proceedings*, vol. 2731, pp.217–238. Available from: http://ceur-ws.org/Vol-2731/paper12.pdf.

[4] Irshad, S. and Rambli, D.R.A., 2015. User Experience Satisfaction of Mobile-Based AR Advertising Applications. In: H. Badioze Zaman, P. Robinson, A.F. Smeaton, T.K. Shih, S. Velastin, A. Jaafar and N. Mohamad Ali, eds. *Advances in Visual Informatics*. Cham: Springer International Publishing, *Lecture Notes in Computer Science*, vol. 9429, pp.432–442. Available from: https://doi.org/10.1007/978-3-319-25939-0_38.

[5] Leshko, K.V. and Rykova, L.L., 2017. Augmented reality as a tool in creative development of future education professionals. Available from: https://doi.org/10.55056/cte.329.

[6] Mauroner, O., Le, L. and Best, S., 2016. Augmented Reality in Advertising and Brand Communication: An Experimental Study. *International Journal of Information and Communication Engineering*, 10(2), pp.422–425. Available from: https://publications.waset.org/10003504/augmented-reality-in-advertising-and-brand-communication-an-experimental-study.

[7] Ruyter, K. de, Heller, J., Hilken, T., Chylinski, M., Keeling, D.I. and Mahr, D., 2020. Seeing with the Customer's Eye: Exploring the Challenges and Opportunities of AR Advertising. *Journal of Advertising*, 49(2), pp.109–124. Available from: https://doi.org/10.1080/00913367.2020.1740123.

[8] Sinha, K. and Modak, K.C., 2019. A Study on Customer Awareness and Perception for Mobile based Augmented Reality (AR) Advertising. *UNNAYAN : International Bulletin of Management and Economics*, X, pp.78–91. Available from: https://www.researchgate.net/publication/330764043.

[9] Tepes, Y., 2019. Maizhe 23 mln ukraintsiv rehuliarno korystuiutsia Internetom – doslidzhennia [Almost 23 million Ukrainians regularly use the Internet - research]. Available from: http://mind.ua/news/20204323-majzhe-23-mln-ukrayinciv-regulyarno-koristuyutsya-internetom-doslidzhennya.

[10] Vakaliuk, T.A., Marchuk, G.V., Levkivskyi, V.L., Morgun, A.M. and Kuznietsov, D.V., 2021. Development of AR Application to Promote the Historical Past of the Native Land. *DHW 2021: Digital Humanities Workshop, Kyiv, Ukraine, 23 December 2021*. ACM, pp.125–131. Available from: https://doi.org/10.1145/3526242.3526244.

[11] Wyss, C., Degonda, A., Bührer, W. and Furrer, F., 2022. The Impact of Student Characteristics for Working with AR Technologies in Higher Education–Findings from an Exploratory Study with Microsoft HoloLens. *Information*, 13(3), p.112. Available from: https://doi.org/10.3390/info13030112.

[12] Zhytomyrska politekhnika — IS «Vstup.OSVITA.UA», 2022. Available from: https://vstup.osvita.ua/r7/208/.

[13] Zulkifli, A.N., Ahmed Alnagrat, A.J. and Che Mat, R., 2016. Development and Evaluation of i-Brochure: A Mobile Augmented Reality Application. *Journal of Telecommunication, Electronic and Computer Engineering (JTEC)*, 8(10), p.145–150. Available from: https://jtec.utem.edu.my/jtec/article/view/1386.