Mobile Application for Advertising Educational Services and Research the Efficiency of Its Use

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Keywords: Augmented Reality, Vuforia, Intelligence Analysis, Descriptive Statistics, Processing of Data Processing of Data, Advertising.

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 Zhytomyr Polytechnic State University, Ukraine. Today, augmented reality technologies are one of the most relevant for application in the field of advertising. However, little research has been conducted to determine the effectiveness of its use. The purpose of the study is to create and determine the effectiveness of using a mobile application for advertising educational services. The object of the study is the technology of creating mobile applications using augmented reality technology and analyzing the feasibility of its use in advertising. The application was created using the Vuforia Software Development Kit in Unity and compiled for various platforms. It can be used on iOS and Android mobile devices, creating a wide range of uses. To determine the effectiveness of the proposed mobile application, statistical and visual analysis methods were used, namely descriptive statistics and exploratory analysis. Based on the results of the analysis, the effectiveness of using a mobile application in career guidance has been proven. It is proved that the interest of applicants who have used the created application in the proposed specialties has increased. The proposed mobile application can be used to get acquainted with the list of specialties in an educational institution, increase the information content of advertising flyers and increase the interest of applicants. In the future, it is planned to expand this mobile application for use in all faculties of the university.

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. The globalization of virtual reality has led to the introduction of a new related terms like augmented reality into scientific circulation. If current user interface technologies focus mainly on human-computer interaction, then augmented reality (AR) 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 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% (Wha, 2022). Currently, the number of people using a mobile device exceeds the population of China, India and Europe combined. The balance between mobile and desktop traffic will never be restored.

Currently, the vast majority of educational institutions teach on a state and commercial basis. In addition, the constant increase in the number of private educational institutions leads to the fact that universities are forced to "fight" for each entrant. Having the same areas of training and educational programs contributes to the deterioration of perception and memory of the educational institution by potential entrants and their parents. To attract customers, strengthen their position in the market of educational services and increase competitiveness, universities should use rele-

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Marchuk, G., Levkivskyi, V., Graf, M., Marchuk, D. and Panarina, I.
Mobile Application for Advertising Educational Services and Research the Efficiency of Its Use.
DOI: 10.5220/0012066100003431
In *Proceedings of the 2nd Myroslav I. Zhaldak Symposium on Advances in Educational Technology (AET 2021)*, pages 564-577
ISBN: 978-989-758-662-0

vant marketing tools and instruments.

Therefore, the combination of mobile devices and augmented reality technologies will give even more advantages in the advertising purposes of educational services.

Advantages of using AR for advertising purposes:

- informing entrants and their parents;
- creating a positive impression;
- increasing the level of recognition of the university;
- increasing the efficiency of career guidance activities.

On the basis of the Department of Computer Science of Zhytomyr Polytechnic State University, Ukraine, specialists in the field of game development and augmented reality created the software product UniAd. The development was presented in detail on May 20, 2022 at The 5th International Workshop on Augmented Reality in Education at Kryvyi Rih National University.

The purpose of this study is to determine the effectiveness of a mobile application UniAd for advertising educational services of the Faculty of Information and Computer Technology (FICT), Zhytomyr Polytechnic State University, Ukraine using augmented reality technology. It is planned to conduct the study:

- use the data collected during career guidance work;
- make a sample of the required data;
- to conduct intelligence analysis;
- to conduct statistical analysis in terms of various indicators;
- draw conclusions based on the analysis.

2 LITERATURE REVIEW

At the AREdu 2020 (Augmented Reality in Education 2020) conference, AR technologies were considered as part of their use in science education (Burov et al., 2020).

Particular attention should be paid to the development of AR applications as a promising area of research for students (Bilous et al., 2020). The article outlines the essence of AR, directions and advantages of using AR technology in the educational process. It has been proven that AR is a unique tool that allows educators to start a new digital generation in a readable, understandable form and is the basis for developing interest in learning to share work.

The current state and relevance of the use of augmented reality are discussed in many articles. The described developed software application demonstrates the behavior of solar system objects in detail with augmented reality technology (Hordiienko et al., 2020). The described application has its own features, because to implement the distance to the planets uses dimensions in scale that correspond to the real.

The development of technology and the increasing use of mobile devices affects the educational process. He et al. (He et al., 2014) describes a study demonstrating the best results in learning English using AR technology. Using the mobile camera, a bright picture appears to represent the English word on the card. This approach improves children's interest in learning. Vakaliuk et al. (Vakaliuk et al., 2021) 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. Zhou et al. (Zhou et al., 2020) presents a mobile application, the purpose of which is to popularize the lifestyle in augmented reality, allowing users to enjoy it. The initial goal of the project is to give children the opportunity to combine practical skills and visuals in order to better realize multidimensional intelligence development.

Nechypurenko et al. (Nechypurenko et al., 2023) explains the current state of augmented reality (AR) technology use in contemporary chemical education and the potential for using augmented reality technology to enhance students' chemistry research projects. The article describes the development of augmented reality software to support the research activities of 11th grade chemistry students in the form of an AR-based virtual chemical laboratory, as well as its implementation in the teaching and learning process. The article (Krainyk et al., 2019) considers the development of a historical guide based on augmented reality technology. Hruntova et al. (Hruntova et al., 2018) theoretically substantiate the application of augmented reality technology and its features in higher technical educational institutions. Bilyk et al. (Bilyk et al., 2022) shows the feasibility of using augmented reality in the case of STEM education in Ukraine. The expediency of using augmented reality in the case of using STEM education in Ukraine is shown.

All considered articles are aimed at achieving the effectiveness of the educational process. In addition to the educational process, augmented reality tech-

nologies are used in various spheres of human life.

The application described in (Jung et al., 2020) is intended for virtual tours of Jeju Island. Sometimes it is difficult to find time to travel, but such software applications allow you to get acquainted with the cultural heritage of even remote regions. Wang et al. (Wang et al., 2021) examines the popularity of augmented reality mobile applications in 4 categories: augmented reality mobile games, advertising, videos and augmented reality shopping for mobile devices. As a result of the research, the author's team came to the conclusion that augmented reality mobile games are most often used.

The role of virtual and augmented reality for accessibility and marketing in tourism is studied in (Ozdemir, 2021). AR has both strengths, such as enriching knowledge, expanding experience, and weaknesses, such as high cost, insecurity. The high cost of both technologies limits availability and marketing.

Wang et al. (Wang et al., 2020) analyzing the status of the application of AR technology in domestic logistics and the benefits of using technology. This article summarizes 36 applications of augmented reality technology in domestic logistics. In addition, the prospects for the application of augmented reality technology in logistics are summarized and analyzed.

Osadchyi et al. (Osadchyi et al., 2021) analyzes the possibilities of using innovative AR technologies in the process of forming the viability of the future specialist based on the implementation of competence and subject-personal approach to the introduction of AR technologies in the educational process. Research by (Hu et al., 2021) aims to study the attributes of theatrical performances using augmented reality in theme parks that affect the emotional experience of visitors. The results showed that the use of AR technology had a positive effect on nostalgia and emotional arousal of visitors, which caused a sense of belonging to the theme park.

Carmigniani et al. (Carmigniani et al., 2011) considers the current state of augmented reality technologies, systems and applications. The problems of augmented reality mobile systems and the requirements for successful mobile systems are considered.

Young and Koo (Young and Koo, 2020) discusses the development of library services of the university with the use of technology and content of virtual and augmented reality (VR/AR). Based on the results of the research, questions were suggested that should be taken into account when using VR/AR technologies and content to provide university library services.

AR is used in various fields and is increasingly used in the educational process. Although research on the use of this technology in education is still scarce, the research literature points to its potential and effectiveness. The research results by Wyss et al. (Wyss et al., 2022) show that students have a very positive attitude towards augmented reality technologies and are very interested in working with this technology. With the advent of information technology, AR has made a significant contribution to industrial applications, namely: medicine, aviation, manufacturing, etc.

Park (Park, 2021) introduces ARLooper, an iOS augmented reality application for multiplayer audio and performance. The aim is to explore the possibility of using mobile augmented reality technology to create new music interfaces and collaborative audio-visual experiences.

Based on the analysis of recent publications and the experience of using augmented reality technologies, it can be concluded that this technology can also be used in education for advertising purposes.

3 THEORETICAL BACKGROUND AND SYSTEM DESIGN

3.1 Augmented Reality Technology

Augmented reality is a concept that describes the process of complementing existing reality with virtual objects. AR is evolving rapidly and is ready to take off and will be as important a technological advancement as the Internet or mobile devices. AR is the most important tool for brands, which attracts consumers, improves communication with people and strengthens consumer confidence. The camera transforms AR from gaming technology into a complete experience that makes people's lives exciting and rewarding. Augmented reality is already here, widely recognized as both interesting and useful, and also promotes rapid implementation and growth. There is an untapped demand to increase the number of applications in AR. Consumer demand for AR needs to be met, and now is the time to act for brands, platforms and developers.

The introduction of augmented reality is associated with a boom in the use of mobile devices – by 2025 almost 75% of the world's population and almost all smartphones users will be frequent users of AR. Deloitte Digital and Snap Inc. conducted a survey of 15 thousand people and published global "Consumer Augmented Reality" report, according to which (Deloitte Digital, 2021):

- 73% of people successfully identify augmented reality when they see it, but when they talk about it, it's hard for them to tell if a description of what it is.

- 65% of augmented reality consumers worldwide use AR to have fun; most discover AR through social/communication programs.
- Augmented reality is usually considered a “toy”, but 76% of people expect it and want to use AR as a practical “tool” in everyday life.
- The use of augmented reality technology in advertising leads to a 94% increase in conversion rate compared to companies that do not use AR in advertising. Consumers are 41% more likely to prefer a product that uses AR technology to promote.

AR can be implemented using applications for ordinary smartphones and tablets, augmented reality glasses, stationary screens, projection devices and more. The essence of augmented reality technology is to combine the real image with its complement and the output of the final image on the visualization device.

The basis of augmented reality technology is an optical tracking system. There are several options for using AR technology: marker-based, markerless.

Marker-based technology is easier to use. It is easier to recognize by the camera and gives a tighter binding to the location for the virtual model. This technology works almost smoothly. A sheet of paper with some special image often acts as a marker. The type of image can vary greatly and depends on image recognition algorithms. You can use pictures, photos, booklets, but of good quality. The advertising booklet of the Faculty of Information and Computer Technologies of Zhytomyr Polytechnic State University, Ukraine is used in the work. Before using the booklet, to activate the application, you need to mark it with Vuforia. The booklet image must be less than 2 megabytes in size, with a clear picture or photo. You need to upload it to the Vuforia website and get a rating. It is better not to use a 1-2 star rating, because the speed and quality of recognition will be very low and incorrect program reviews are possible. The booklet to be used has a rating of 4-5 stars. This means that the recognition in the software application does not take much time and will be displayed reproduced information about the specialty.

Marker technology using Vuforia creates static markers and uses them to enable an object to be activated (figure 1).

The left part of figure 1 shows an advertising flyer of the Faculty of Information and Computer Technologies of the Zhytomyr Polytechnic State University, Ukraine. On the right in the same figure is a flyer with markers on it with Vuforia.

3.2 Create 3D Objects

A number of graphics have been developed to create the UniAd mobile AR application. All 3D models are developed in Blender.

Figure 2 shows the main 3D models that were created. The main, but the most time-consuming model is the university building. 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. Models of people can also be seen in figure 2. Each human object has an animation of walking on its own trajectory. Models of benches, lanterns and a model of a fountain located at the main entrance to the university were also created.

In addition to 3D models, the mobile application has added a number of 2D models that act as buttons. With the help of buttons the user has the opportunity to select certain actions (figure 3).

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 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.

3.3 Design and Implementation of Individual System Modules

The Unity engine is used to create the program. Its main advantage is the use of a component-oriented system of working with objects. All interactivity and gameplay in Unity are based on three fundamental blocks: GameObject objects, components and variables (Scr, 2022). Any object in the application 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 4 shows a precedent diagram. This diagram demonstrates possible user actions when using a mobile application. The precedent corresponds to a separate service of the system, determines one of the options for its use and determines the typical way of user interaction with the system. Usage parame-

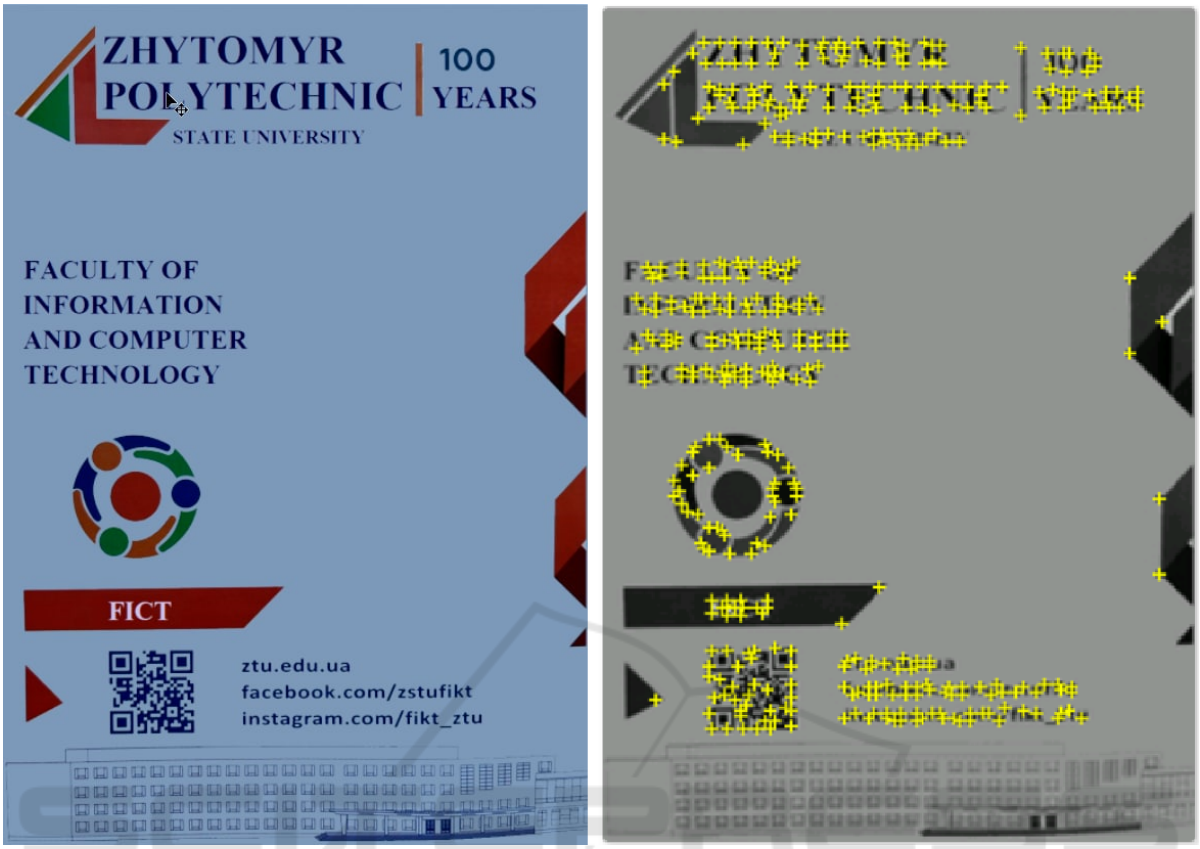

Figure 1: Creating targets on the booklet for the UniAD application.

ters are commonly used to determine system requirements.

The Activity diagram was used to describe the behavior of the mobile application (figure 5). The diagram reflects the dynamic aspects of system behavior. In essence, this diagram is a flowchart that illustrates how the control flow moves from one activity to another.

3D application simulation was created using the Blender development environment. The main model created is the university building. Auxiliary objects on the stage have also been created – bushes, benches, trees, and a fountain, which are partially animated. Many animations have been created in the mobile application. Animation of the university building – it can be viewed from all sides, rotating 360 degrees. Implemented bone animation of 3D characters of students moving near the university. 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.

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. 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.

The scheme presented in figure 6 shows the general algorithm of the system. With the help of an AR camera, the focus is on the booklet of the Faculty of Information and Computer Technology. If the appropriate markers are found in the image, the "Start" button is displayed.

Let's take a closer look at some of the Vuforia methods that were used to create the software application. This piece of code helps to determine how you can "catch" the marker.

```
public enum TrackingStatusFilter {
  Tracked,
  Tracked_ExtendedTracked,
```

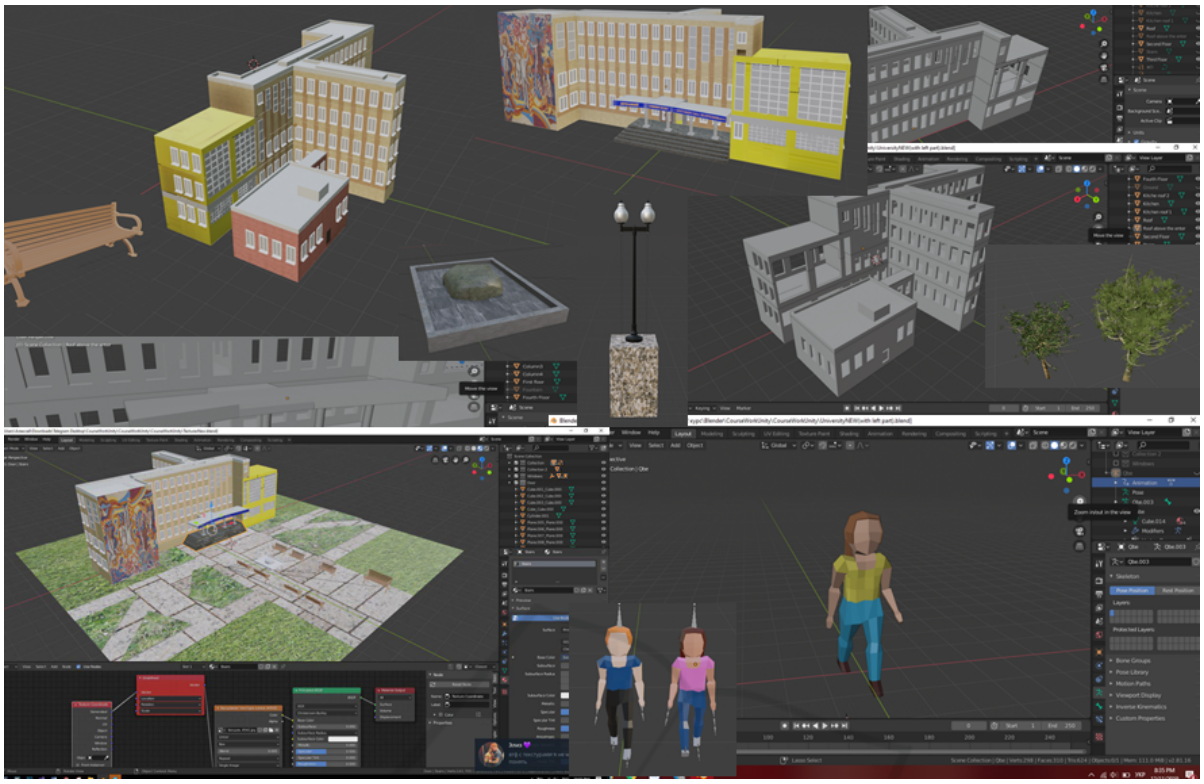

Figure 2: 3D models developed in Blender.

Figure 3: Buttons.

```
  Tracked_ExtendedTracked_Limited
}
```

The part of the code that is responsible for pressing the “Start” button and launching the animation on the stage of the software application.

```
public class GIFShow : MonoBehaviour{
  public GameObject gif;
  public GameObject hide;

  public void ShowGif() {
    if (gif != null) {
      bool isActive = gif.activeSelf;
      if (!isActive)
        gif.SetActive(true);
      else
        if (isActive)
          gif.SetActive(false);
    }
    if(hide != null) {
      bool isActiveHide = hide.activeSelf;
      if(!isActiveHide)
        hide.SetActive(true);
    }
    else
      if(isActiveHide)
        hide.SetActive(false);
}
```

After pressing the “Start” button, the main scene of the program starts. 3D models and textual information appear on the stage. A piece of code that is responsible for tracking the camera’s position and rotates the text toward the camera so that it can be read.

```
public class TextCenter : MonoBehaviour{
  public GameObject target;

  void Start() {}

  void Update() {
    Vector3 targetPosition =
        new Vector3(
          target.transform.position.x,
          target.transform.position.y,
          target.transform.position.z);
    transform.LookAt(targetPosition);
  }
}
```

A sprite animation has been created for each spe-

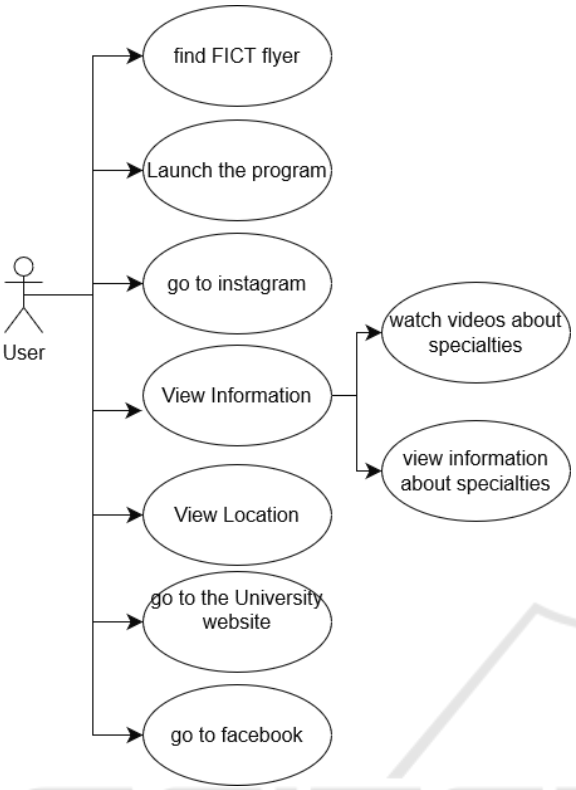

Figure 4: Use Case diagram of a mobile application.

cialty available in the application, which reflects the specifics of the specialty. An array of graphic images is used to play the animation. The part of the code that is responsible for converting an array of images into a sprite animation.

```
public class AnimationGIF : MonoBehaviour
{
  public Sprite[] animatedImages;
  public Image animateImageObject;

  void Start() {}
  void Update() {
     animateImageObject.sprite =
        animatedImages[(int)(Time.time*10)
        % animatedImages.Length];
  }
}
```

The code snippet that is responsible for defining items in the Dropdown menu. Each list item has its own method.

```
public class DropdownAction: MonoBehaviour
{
  public GameObject Image;
  private Animator animator;

  void Start() {
    GetComponent().value  = 5;
  }
  void Update() {}
  public void ShowImage() {
    if(Image != null) {
      bool isActive = Image.activeSelf;
      if(isActive == false)
        Image.SetActive(true);
      else
        if(isActive == true)
          Image.SetActive(false);
    }
  }
  public void ValueChanged() {
    Debug.Log("Choosen element:  " +
      GetComponent().value);
    if(GetComponent().value == 0) {
      Application.OpenURL(
"https://www.instagram.com/fikt_ztu/");
      GetComponent().value = 5;
    }
    if(GetComponent().value == 1) {
      Application.OpenURL(
"https://goo.gl/maps/Me2vbsnkUzmLfxrN6");
      GetComponent().value = 5;
    }
    if(GetComponent().value == 3) {
      Application.OpenURL(
"https://www.facebook.com/zstufikt");
      GetComponent().value = 5;
    }
    if(GetComponent().value == 4) {
      Application.OpenURL(
"https://ztu.edu.ua/");
      GetComponent().value = 5;
    }
    if(GetComponent().value == 2) {
      ShowImage();
      GetComponent().value = 5;
    }
  }
}
```

Unity supports C# scripting that follows one of two main approaches: the traditional and widely used object-oriented approach and the information-oriented approach.

3.4 Mobile Application Interface

The application is implemented using Unity and Vuforia. Vuforia Engine is a software development kit (SDK) for creating Augmented Reality apps. Management is carried out with the help of the camera of the smartphone on which the application is installed,

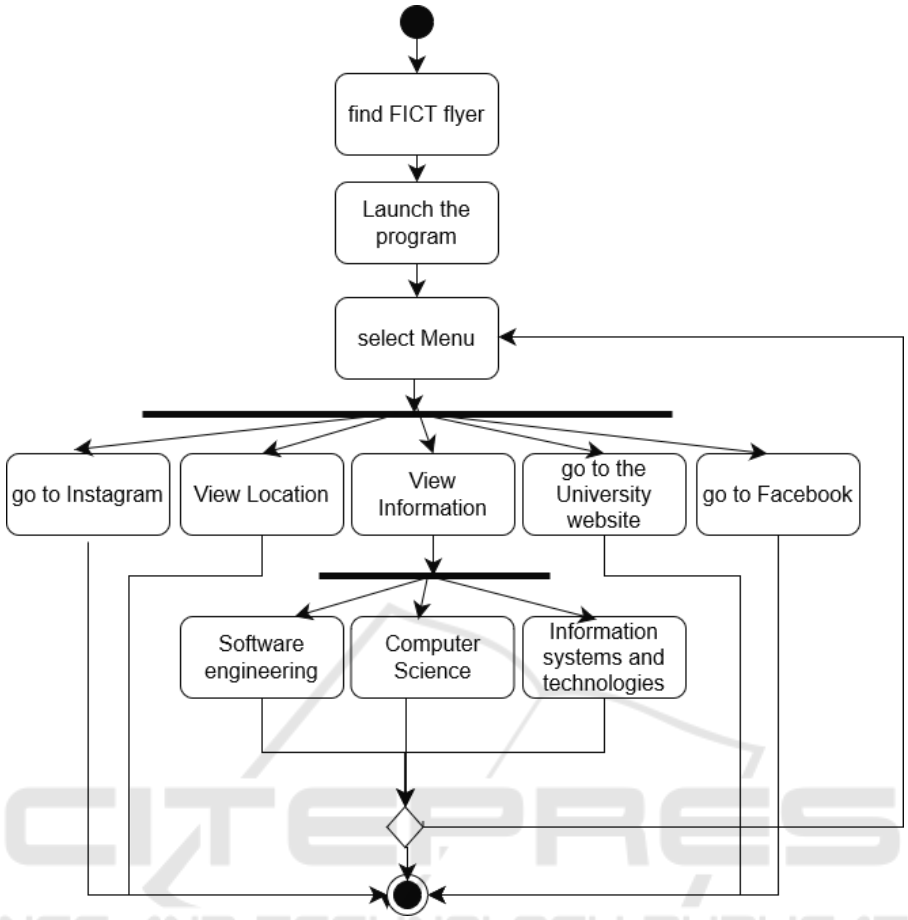

Figure 5: Activity diagram.

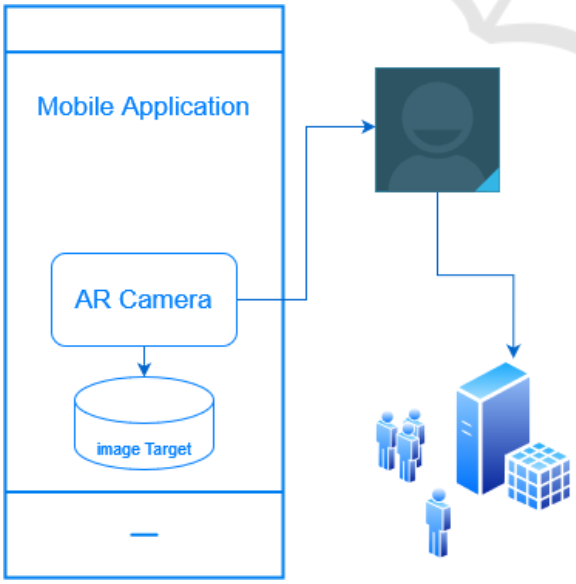

Figure 6: Scheme of project elements and its works.

and the booklet of the faculty on which the user has to point the camera.

The application can be used on devices with Android operating system version 10 and higher and requires 210 MB of free memory. The interface of the application is quite simple. Management is carried out using the camera of the smartphone 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 7.

Currently, you can view the model of the university by turning around a paper advertisement with ad-

Figure 7: General view of the program after pressing the Start button.

vertising, 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.

By pressing the "I" button, the user will open seven cards. All cards have the same design (figure 8 – 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, which is studied in a particular specialty. Figure 8 shows an animation showing an IT professional creating software. This animation reflects the essence of the specialty 121 "Software Engineering". 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 THE RESULTS OF THE STUDY

The application was intensively used during the career guidance work of the Faculty of Information and Computer Technology in 2021. In the process, a set of data was accumulated, on the basis of which the analysis was conducted. A data set in CSV format was used for analysis. The file contains 1086 records. The data set is represented by the following fields: submitted documents, saw AR advertising, entered the university, competitive score. Among them, 3 fields are categorical data (0 or 1, saw advertising -1 did not see -0) (figure 9).

It is better to use descriptive statistics in the initial stages of the analysis of the created dataset. Measures of the central tendency were considered, where the following indicators were revealed: the minimum value on the competitive score is 125 points, the maximum – 200 points.

The scope is 27 points. The arithmetic mean is one of the most common measures of the central trend. The average value indicates that the "typical" score in the dataset is approximately 160.76. Accordingly, most entrants have a fairly high competitive score. Estimation of tightness established by Spearman's rank correlation established a connection between two parameters – competitive score and admission. There is still a small relationship between parameters such as admission and ad viewing. The distribution of observations showed the following data: the first quarter is 152, the second quarter – 162, the third quarter – 166. The standard deviation of the competition score is 13.32.

After profiling the file, it was determined that out of all applicants who submitted documents, 630 saw advertising, which is 58% of all submitted documents.

Of all entrants who submitted documents, 60% (652) of applications were submitted for specialty 121 "Software Engineering", 23.8% (259) for spe-

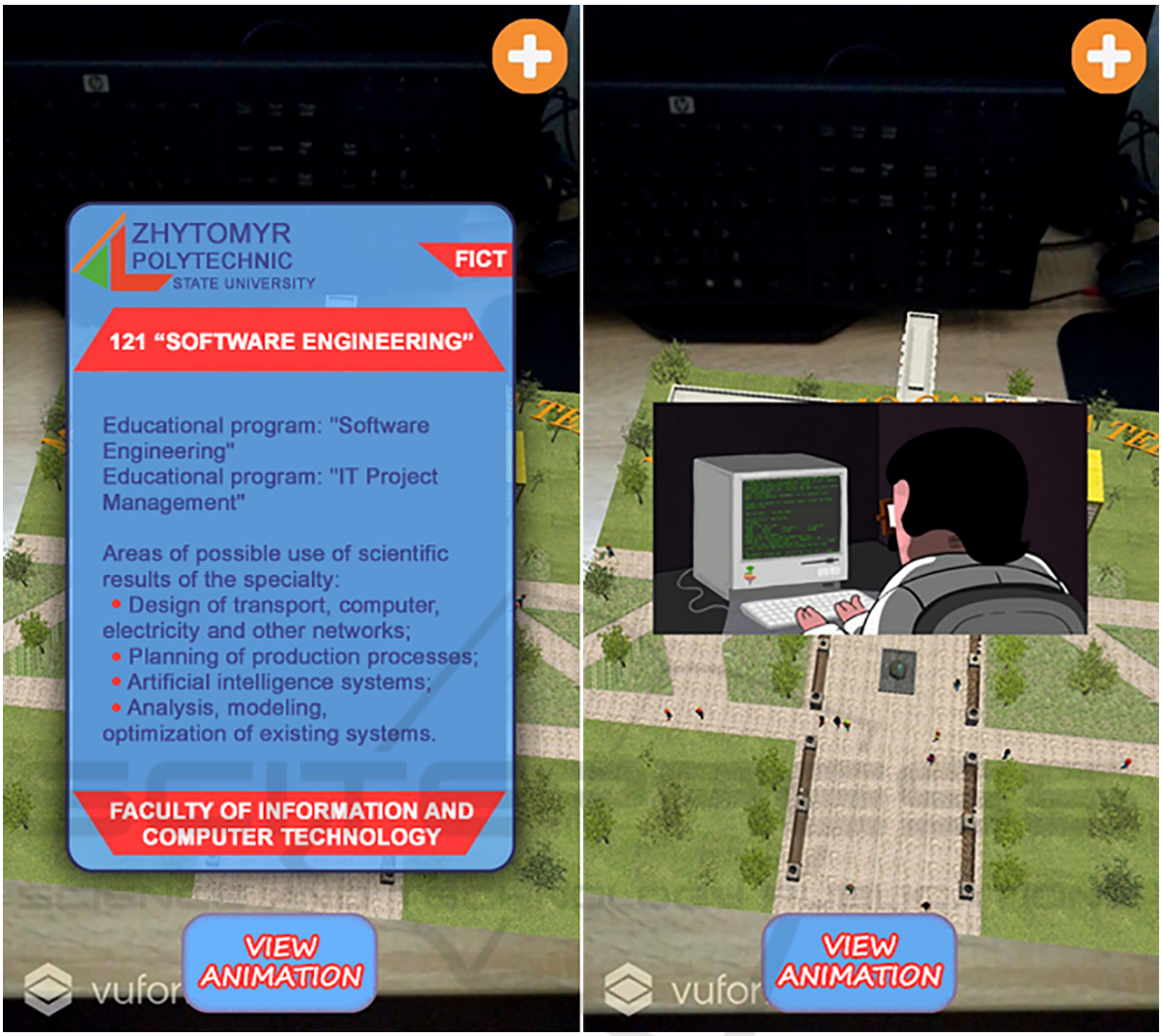

Figure 8: The result of pressing the "I" button

	video_pres	sex	entered	competitive_ball	speciality
0	1	1	1	175	125
1	1	1	1	172	125
2	1	1	1	175	125
3	1	1	1	162	122
4	1	1	1	165	125
5	1	1	1	183	125
6	0	1	0	145	122
7	0	1	0	149	125
8	0	1	0	144	126
9	1	1	1	142	121
10	0	1	0	182	121

Figure 9: Fragment of a data set.

cialty 122 "Computer Science", 6.9% (75) for specialty 125 Cybersecurity, 5.5% (60) for specialty 123 "Computer Engineering", 3.7% (40) for specialty 126 "Information Systems and Technologies".

Of all the applicants who applied, 374 became students of the Faculty of Information and Computer Technology of Zhytomyr Polytechnic State University, Ukraine.

Figure 10 shows the general schedule of all applicants and those who enrolled and those who saw the advertisement. The results show that not everyone who used the mobile application enrolled at the Faculty of Information and Computer Technology of the Zhytomyr Polytechnic State University.

Figure 11 shows the data for the target variable entered. Elements of the sample according to the value of the target variable entered are divided into

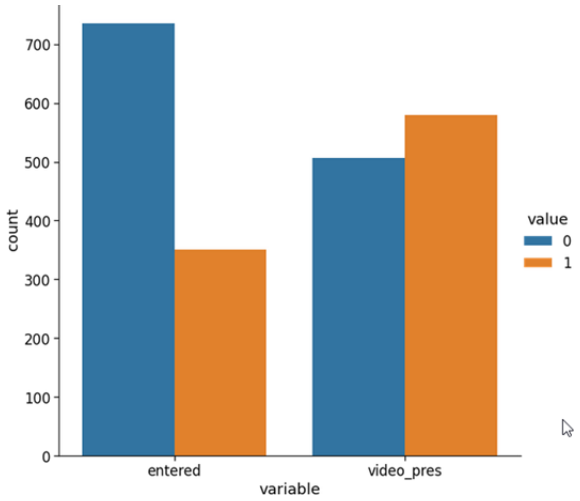

Figure 10: The general schedule of all applicants and those who enrolled and those who saw the advertisement.

two graphs, which show a separate number of applicants who did not enroll in FICT, but saw advertising and those who saw advertising and enrolled in FICT. From the received schedule it is possible to draw conclusions that on two values, the number of entrants who saw advertising is more. This demonstrates the search conducted before admission and increased interest in specialties at the university.

Figure 12 shows a histogram showing the data on the viewing of advertising using the application and the number of students enrolled in terms of specialties FICT. The histogram is an estimate of the central trend for a numerical variable and gives an idea of the uncertainty of this estimate using the error bar. It is interesting to note that in the specialty 122 "Computer Science" the number of entrants who viewed the ad is less than the number of entrants. Although specialty 122 is given special attention to the study of augmented reality technology, on the basis of which the created and researched mobile application UniAd is built. Analyzing in more detail the data of entrants to the specialty 122, it was found that a significant number of students came from other regions of Ukraine than Zhytomyr region (Lviv, Luhansk, Kyiv, Khmelnytsky, Rivne regions) and did not have the opportunity to use applications and are not reflected in the collected statistics. The coverage of a larger number of geographical regions of Ukraine has a great influence.

The results show a significant number of entrants who saw the ad, but did not enroll. This is due to various factors. One of them is the low competitive score of entrants (figure 13). The next factor – the fact that the passing score for admission was quite high (different in each specialty) – this created a significant competition. The graph in figure 13 establishes the relationship between categorical and continuous variables. Vertical segments indicate part of the data of a particular category.

Another factor influencing admission is the lack of budget places (for new specialties), due to which entrants are looking for other specialties or universities.

Considering the data in the context of gender, shown in figure 14, we can observe a much smaller number of female entrants to technical specialties. In contrast, the girls' competitive score varies between 154-176, which is above the mean, and the standard deviation is less than the total. It should also be noted that girls are more interested in specialties 121 "Software Engineering" and 122 "Computer Science".

Based on the analysis of the data set, it can be concluded that advertising services using a mobile application based on AR technology are effective. Such applications attract entrants, as information about the specialty is provided in an interesting way. Not always textual information is perceived qualitatively and in full. The information presented in the animated video briefly represents the essence of the specialty that improves perception.

Methods of descriptive statistics and exploratory analysis were used for the analysis. This is implemented using the Python programming language, namely the libraries numpy, pandas, seaborn, matplotlib.

5 CONCLUSIONS

In the process of studying the effectiveness of the use of a mobile application for advertising educational services of the Faculty of Information and Computer Technologies of the Zhytomyr Polytechnic State University was an analysis of data collected during career guidance work. The metrics for the analysis were: the number of entrants who submitted applications, taking into account the specialty, the number of entrants who used the mobile application, the competition score and the number of entrants.

According to the results of the study, we can conclude that it is appropriate to use the developed mobile application. This is proved by the fact that the enrollment of first-year students in 2021 has increased for all specialties of the faculty. The number of submitted applications exceeded the number of licensed volumes by specialties (Marchuk et al., 2023).

Therefore, we believe that the use of augmented reality technology is appropriate to promote the educational process and advertising of the educational in-

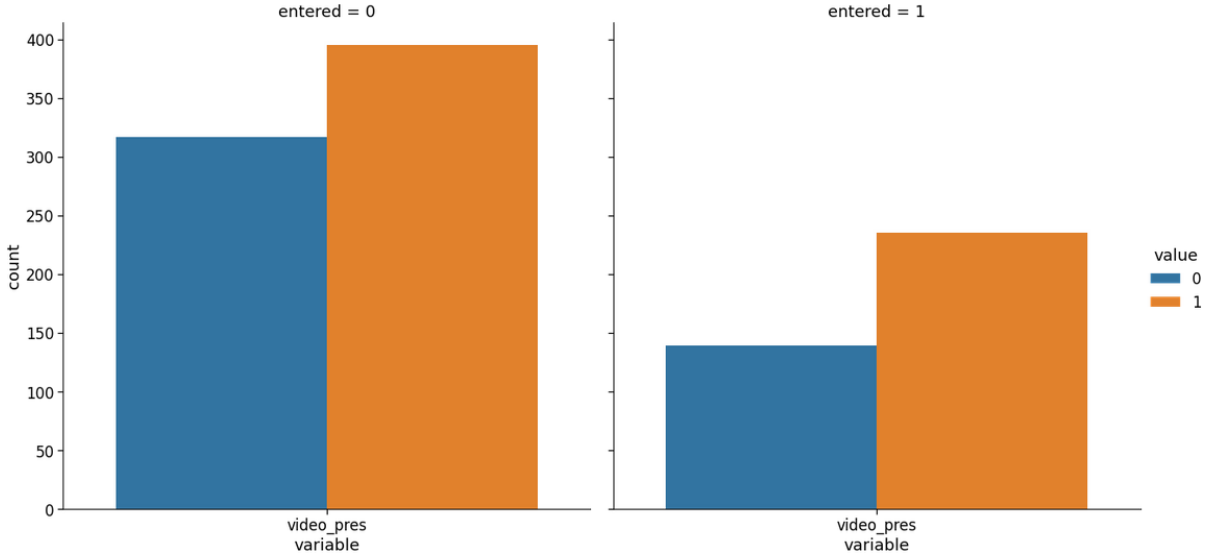

Figure 11: Data on the target variable entered.

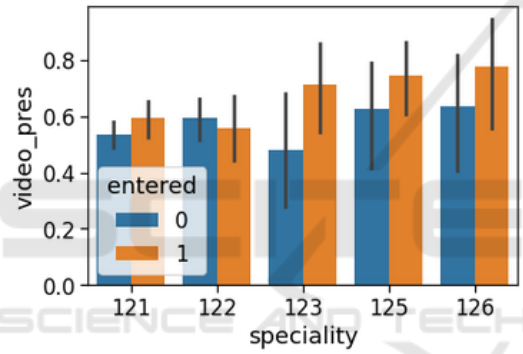

Figure 12: Histogram of views of advertising and specialties entered.

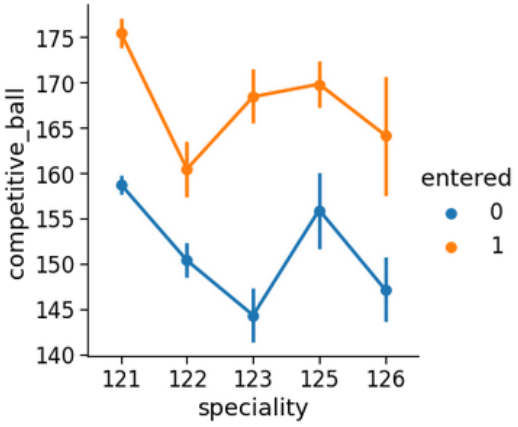

Figure 13: Data on the competitive score of entrants by specialties.

stitution. 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.

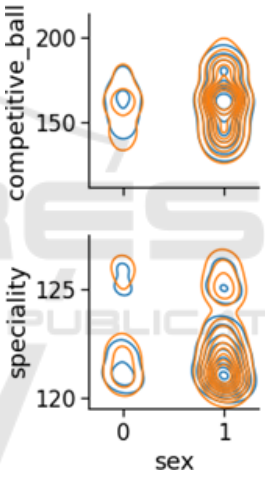

Figure 14: Diagram of advertising views by gender.

The mobile application was tested on the basis of the Faculty of Information and Computer Technologies of the Zhytomyr Polytechnic State University, Ukraine. In the future, it is planned to expand it so that it can be used by various faculties and published in the Play Market.

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