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Landmark and Tourist Spots Using Augmented Reality

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ABSTRACT

It takes seriously a lot of time to build a system design like this, but why not use the rising technology to build an Augmented Reality design? Using the appropriate technology can help minimize the time needed in building one, plus it can show other people that society is catching up in terms of the new applications and technologies. For one, Augmented Reality (AR) is a technology that overlays digital information on a live view of the physical world to create a blended experience. Augmented Reality has now progressed to the point where real-time applications are considered and needed. Consequently, in this study, Augmented Reality is used to show the 3D model of the selected Landmark and the whole Municipality of Dumangas, Iloilo by just pointing the Android mobile device to the provided Landmark marker. However, it is important that synthetic elements are rendered and aligned in the scene in an accurate and visually acceptable way. In order to address these issues real-time, robust, and efficient model-based tracking was proposed for a mobile camera - a virtual map for the Municipality of Dumangas, Iloilo. This would help not only the Municipality of Dumangas to promote their tourist attraction but also the people who want to locate different tourist spots in Dumangas, Iloilo. This application would also provide the user with information about the specified Landmarks. The Landmark Tourist Spots Using Augmented Reality would test the user to know the Landmark in Dumangas, Iloilo.

INTRODUCTION

One of the economic areas with the strongest growth rates worldwide is tourism. There is undoubtedly a certain allure with travel. People's expectations for the caliber of games have been rising at the same time. It has been observed that many Filipinos do not have enough knowledge about their history and other facts about the country such as heroes, national symbols, heritage sites, and how the Philippines gained freedom from the colonizers. As a Filipino, the developer incorporated information about Philippine history specifically on Panay Island in designing the game.

In connection with this, a study, entitled "Landmark and Tourist Spots using Augmented Reality" was developed. This study has aimed to develop a game that will be able to help ease the difficulty of navigating a location specifically Dumangas while at the same time incorporating enjoyment and at the same time developing one's strategic capabilities. Landmark and Tourist Spots using Augmented Reality is a 3D platform game that was developed with the use of Game Maker Studio as the main engine. This is aimed to create a difference from one another through the integration of Augmented Reality. There is a level progression in the game where the difficulty increases in parallel to its level.

The game was developed to serve as an aid in learning Philippine history primarily Dumangas, Iloilo on the island of Panay. This system would be able to help the users understand and gain more knowledge about different tourist spots and landmarks in Municipality of Dumangas, Iloilo. The contents of the game would be based on the different histories of the municipality of

Dumangas in Iloilo. For the municipality of Dumangas, the game would be based on <http://dumangas.gov.ph/about-us/history-of-dumangas/>. It is the Dumangas Municipality's local blog about the rich history of Dumangas. For Iloilo City, the game would be based on <http://www.iloilo.gov.ph/history> it is the City's local blog about its history. And in other municipalities, it will be based on their own history blog. And the result of the evaluation of IT Experts using McCall's Software Evaluation Criteria for Software Quality Model and the result of the evaluation of the respondents using the ISO/IEC 9126-1:25010 Software Quality Model Characteristics. The term "augmented reality" refers to a live or direct view of an actual, physical environment whose elements have computer-generated sensory input, such as sound, video, graphics, or GPS data, added to or enhanced them. It is connected to a broader idea known as "Mediated Reality," in which a computer or other device alters one's perception of reality. Therefore, the technology works by improving how one now perceives reality. Contrarily, virtual reality simulates the real environment in place of it. Traditionally, augmentation is done in real-time, inside a semantic framework, and with ambient components like sports scores on TV while a game is in progress. The information about the user's immediate environment in the actual world becomes interactive and digitally manipulable with the aid of cutting-edge AR technology.

A software development kit (SDK) for augmented reality applications called Vuforia is available for mobile devices. It employs computer vision technologies to instantly identify and follow simple 3D objects, such as boxes, as

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well as planar images. When real-world photographs are viewed through the camera of a mobile device, this image registration functionality allows developers to position and orient virtual items, such as 3D models and other media, in relation to those real-world images.

LITERATURE REVIEW

One of the biggest technological breakthroughs in recent years has been the creation of augmented reality, which has improved accessibility, education, and entertainment inside the confines of a smartphone. Since its first release, numerous studies and applications have been produced using this as a starting point.

The main goal of augmented reality was to provide a platform that would enable users to gain a deeper understanding of a specific place or activity by displaying the intended environment inside of a virtual 3D representation. However, innovators have made augmented reality more advantageous to a world that is gradually beginning to rely entirely on its necessary technology. When someone mentions the term “AR” nowadays, the vast majority of people will immediately look to their smartphone or mobile device. For AR to work properly, it must have access to a suitably powerful processor, a feasible display or monitor, several different types of sensors, and input options.

“Typically a smartphone contains a processor, a display, accelerometers, GPS (global positioning system), camera, microphone, etc., and contains all the hardware required to be in an AR device,” the Interaction Design Foundation says in “Augmented Reality – The Past, The Present, And The Future” on its organizational blog.

A few forward-thinking marketing departments have already begun to adapt AR technology to campaigns aimed at tech-savvy consumers. Comic book films have paved the way for their upcoming theatrical releases with AR Snapchat filters, the Lego app shows an AR version of a complete Lego set when people look at the box through their smartphone camera, and manufacturers of accessories such as watches or glasses use AR to allow customers to “try on” different styles to see how the product looks. AR is also being used in several revolutionary mobile apps and games to inspire effect. Android platform authority Joe Hindy covers AR apps in his “10 Best Augmented Reality Apps And AR Apps For Android” on AndroidAuthority.com.

According to Hindy, Google Translate now utilizes AR to translate languages on the fly, simply by pointing a smartphone camera at a sign, page, or screen written in a foreign alphabet. Quiver takes the recent coloring book craze to new heights by transforming colored images into three-dimensional characters through AR. And AR can also be found in QR code scanners, star maps, instant messaging apps, games, and online directories (Maryville, 2022). Why enter the market now with the idea of AR/VR technologies? The idea of VR technologies is not new. At the beginning of the 1990s, virtual reality was already a big topic. Nintendo announced the first home

VR system named virtual boy. Since they only had a few games available, lack of color (only red and black), and the uncomfortable device, the consoles didn't sell well. A few years passed without big news. Then in 2014 Oculus Rift put the topic of virtual reality back on the table, and companies around the world began to build their own VR headsets. Since spring 2016 several interesting products have been released and have now started to be produced in mass circulation (Brown, 2017).

There is even more good news. The World Tourism Organization UNWTO stated that tourism has shown extraordinary strength and resilience in the past few years and continues to grow strongly. So now, tourism is now one of the fastest-growing economic sectors in the world. According to the latest UNWTO World Tourism Barometer, the international tourist arrival reached a total of 1'235 million, which was a growth of 3.9% or some 46 million more tourists (overnight visitors) compared to 2015 (Sobrinho, 2017; UNWTO, n.d.).

The first way to augment reality is with a video system - a video feed of reality with AR overlaid upon the digitized images. This includes removing or replacing the marker with virtual objects. Another way is to have an optical vision system whose real-world perception is real, with AR displays using transparent mirrors and lenses. It can be applied to head-mounted displays, handheld displays, and projectors. Aside from not changing the resolution of the real world, they also have the advantage of being parallax free. These techniques are safer because they can be used without the use of electricity, making them an ideal technique for military and medical purposes. Other input devices, such as a camera, are required for interaction and registration. The third approach is to project the AR onto the objects themselves, resulting in projective systems. The advantage of these screens is that they cover large areas for a wide field of view. However, other input devices are required for the interaction. Also, projectors should be calibrated each time the environment or distance to the projection surface changes (ICC, 2021). Smart glasses have been in circulation for the best part of a decade but so far they have failed to become widely adopted by consumers. With several new products expected to be released this year, 2021 is looking to be a promising year for AR smart glasses to become more accessible (Zuckerberg, 2021). However, despite its many benefits to the community, Augmented reality (AR) has the potential to revolutionize the training industry completely. From corporate training in areas like soft skills to hands-on learning in sectors like manufacturing and healthcare, there are countless use cases for the application of this technology. 2019's Training Industry Sector Report by the VR/AR Association lists 100+ companies eager to help organizations transform their training capabilities with AR. But despite this level of interest, the adoption of AR in training is still at a nascent stage. While there are several disruptive startups and promising investments, the use of this technology training is yet to go mainstream (Mallick, 2020).

It's 2022 and it seems like before anyone realized it, the future arrived. Technologies that people once only dreamed about are now accessible to everyone at their fingertips. Artificial intelligence, machine learning, blockchain, autonomous vehicles, CRISPR — the list of unprecedented technologies goes on and on. One of the most game-changing technologies for retail in 2022 is augmented reality. AR empowers customers with the ability to visualize and customize products in 3D when shopping.

Engaging customers through the shopping process is becoming increasingly competitive. With augmented reality, retailers can establish a new way to compete with an entirely new customer experience that leads to higher sales and increased customer satisfaction (Threekit, 2021). “Augmented vs virtual reality have one big thing in common. They both have the remarkable ability to alter our perception of the world. Where they differ, is the perception of our presence (Ronzio, n.d.).

Table 1: aims to describe the differences between AR and VR and depicts the differences between physical, augmented, and virtual reality.

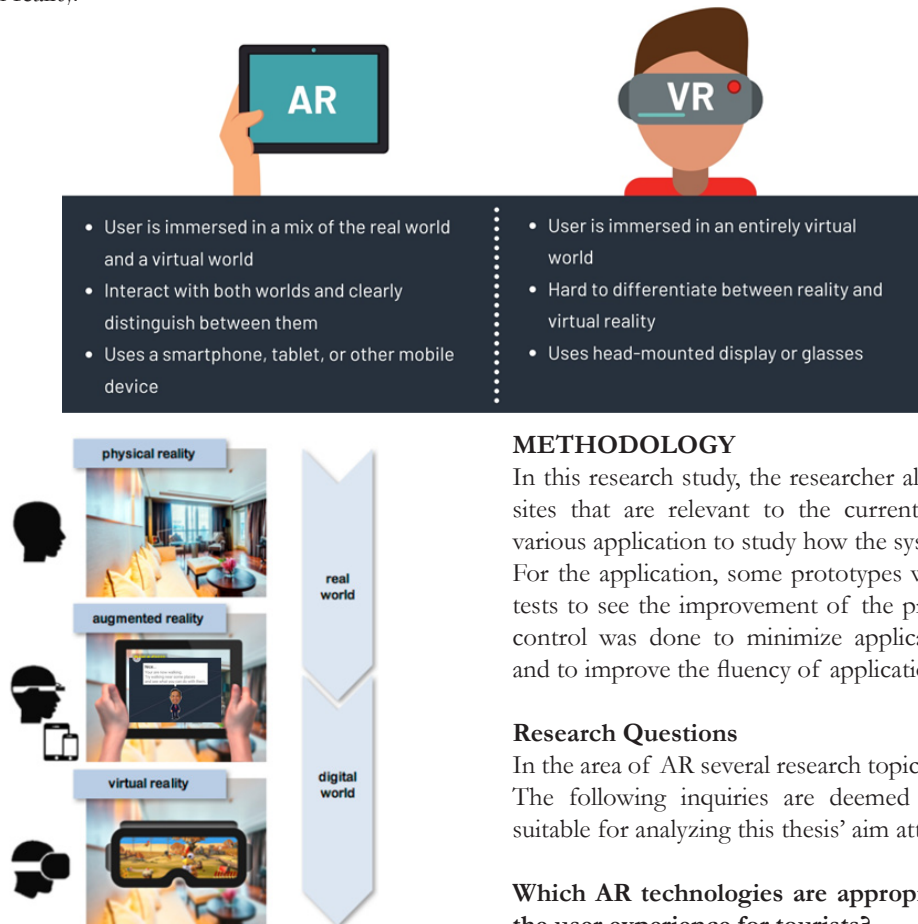


Figure 1: Depiction physical/augmented/virtual reality (Elias, 2017).

Dynamics and interactivity are crucial needs for augmented reality application entertainment ability, and the power relationship between the user's context and the content that is delivered (delivered content should be current, real-time, local, and generally context-sensible), as well as a user interface that is clear and functional avoiding cognitive fatigue, easy application navigation for efficient usage of the application. The majority of the functionalities are added and extrapolated from plus additional ones that the analytic procedure uncovered to generate tours automatically for those who are investigating areas of interest. Communication enables direct channels to service providers, agents, and/or other users, etc.

METHODOLOGY

In this research study, the researcher also visited various sites that are relevant to the current study and used various application to study how the system works. For the application, some prototypes were made to run tests to see the improvement of the project. Versioning control was done to minimize application redundancy and to improve the fluency of application development.

Research Questions

In the area of AR several research topics might be posed. The following inquiries are deemed to be the most suitable for analyzing this thesis' aim attainment.

Which AR technologies are appropriate to improve the user experience for tourists?

1. Where do the AR technologies have gaps? (Correlation of sound and image, interactivity, area of vision, resolution.)
2. Security considerations (using the AR device while strolling around, theft prevention)
3. Comfort features (fitting of the devices, weight, easy handling)

Which case study should be used to improve tourism through AR/?

1. Which issues need to be addressed?
2. Which product is it?
3. The mission and vision statements.
4. What marketing opportunities are there?

Which business model fits this case study the best?

1. Who are the clients?

2. Software Design and Development Component

Rationale

This is a research without own development or experiments. There are several reasons for this decision:

Scope: Before developing a service or product on the



Figure 2: Software Design and Development Component.

wrong technologies, ascertain the need and appropriate technology.

Time: Time constraints for conducting the research

Costs: The cost of the powerful PC/Laptop and mobile phone needed to power the devices is PHP 80,000.00.

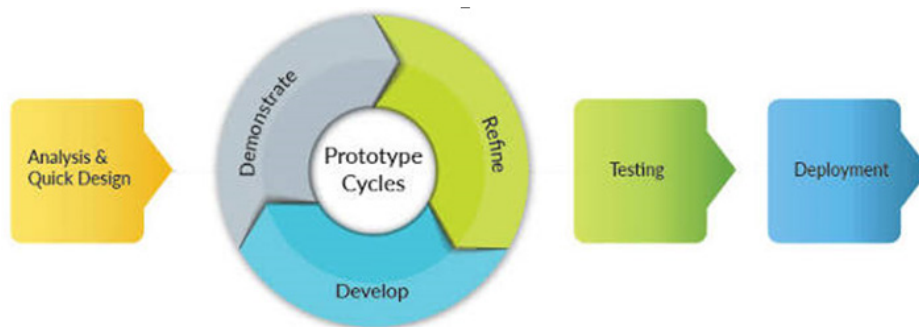


Figure 3: Rapid Application Development Methodologies.

are used to validate requirements and design elements.

The following phases were observed in the production of the software: Analysis & Quick Design, Prototype Cycles, Testing, and Deployment

Analysis & Quick Design. This phase serves to analyze the aspects that were considered before coming up with the concept of the study. Landmark Tourist Spots Using Augmented Reality is one of the easiest applications to make but the Unity 3D application made it easier with the use of Cordova Android which is made especially for Augmented Reality. Prototypes are much easier compared to other tasks. In this kind of application, the researchers make the design simple yet it still aims to impress users as to what the application could do. Minimal buttons were placed to avoid making the screen messy or cluttered.

Troubleshooting was done every time after errors were fixed and maintenance was done. Assembling of the document followed and every progress was recorded for observation and recording. Deployment of the application

Project Development

The major improvements in software development environments that enable quick production and changing of screens and other user interface elements made the RAD technique practicable. The end user is permitted to interact with the screens online, just as they would in a production setting. This allows minimal room for interpretation, and a large proportion of mistakes are discovered using this method. The drawback of RAD is the end user's propensity to make the development effort include scope creep. It must be simple to add a widget or two because the developer made the basic screen seem so simple to create. The end users and developers were caught in an endless cycle of improvements in the majority of RAD lifecycle failures, with users and developers attempting to satisfy their requests for more and more features.

Due to this, the software development team combines limited prototyping with requirements and design development throughout a traditional waterfall lifecycle rather than using a full RAD method. The produced prototypes lack an integrated interface and are narrowly focused on a portion of the application. The use of additional requirements or the addition of user interface options not readily supported by the development environment is actively discouraged because prototypes

included a medium amount of coding since it focused more on its design. The application makes some of the codes function automatically. It runs mainly HTML and Javascript program files or hybrid applications

The System

The technique converts the 3D model of Landmark tourist Spots in the municipality of Dumangas and popular tourist attractions into virtual augmented reality. Its features include using a 3D model projected in augmented reality to create a user-friendly educational application. Additionally, the system has markers that help it locate the image target. The 3D model is automatically displayed as soon as the input location is selected. As soon as the user chooses to enter the mastery game or the virtual map, the system begins. When one of the available alternatives is selected, the camera application instantly launches and scans the marker.

Technical Specifications

Software Specifications

The software is developed for the android operating system version starting from Android Nougat and up.

Hardware Specifications

The application requires an android device that has a 1 GB or higher Random Access Memory (RAM) 1.0 GHz or higher processor. The higher the RAM and Processor, the faster and better the result is obtained. A minimum of 300MHz stock or custom GPU (Graphic Processing Unit).

User Specifications

The application is accessible to android smartphone users, especially to people who want to travel to and know more about Dumangas or who those want to install the application.

Systems Implementation

Implementing the system involved testing some prototypes of the application, starting with the Dumangas' Town Plaza. The researcher assessed and evaluated applications for any Landmarks or Tourist Spots for the improvement of the system in terms of rendering display of the Landmarks or Tourist Spots and developing accuracy of marker identification to avoid lags and post errors and to perfectly provide the 3D model of the Landmarks and Tourist Spots in Dumangas using Augmented Reality.

Systems Inputs and Outputs

The system application is conceivably an optical input application. It uses the camera to input identified markers and objects relating to the system input. Input markers are logos. The output is the 3D model of the landmark, rendered on the display, which is a visual output that serves information to the user.

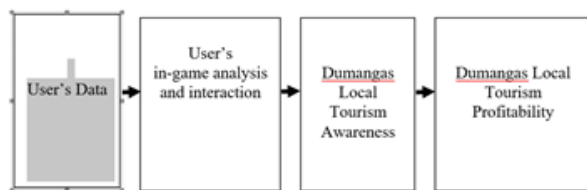


Figure 4: Diagram of Systems Input and Output.

RESULTS

The Landmark tourist spots using Augmented Reality computer programs were made utilizing Solidarity and Vuforia after considering a few improvement approaches. Both marker-based and marker-less AR capabilities, as well as client interaction and data assets, were included. In spite of the required ease of use and usefulness, this fashion of improvement permitted the application to be made in a moderately brief sum of time.

The study was planned to supply information for investigation by highlighting and to be assisted broken down by age gather to decide which include they favored. ISO/

IEC 9126-1:25010 Software Quality Model Characteristics were utilized, with reactions being perused as 1-2 rating being treated as unfavorable ; 3 being impassive, and 4-5 being treated as favorable. This can be supportive for comparing the comes about in table 2 - The moment address within the study inquired respondents on the off chance that they thought the application would include esteem to their visit. As can be seen from the ISO/IEC 9126-1:25010 Software Quality Model Characteristics, all the scores for all bunches are between 4 and 5, appearing that most individuals who accepted the app would include esteem to their visit. This may show the legitimacy of improvement.

Landmark tourist spots using Augmented Reality might apply anywhere in the country, which is not a fair location. So distant, analysts have centered on mixing genuine and virtual pictures and design. In any case, AR may be amplified to incorporate sound.

Table 2: Evaluation of the Respondents of the Landmark and Landmark Tourist Spots Using Augmented Reality.

Areas	Mean	Verbal Interpretation
Functionality	4.330	Very High
Efficiency	4.337	Very High
Compatibility	4.335	Very High
Usability	4.615	Very High
Reliability	4.339	Very High
Security	4.678	Very High
Maintainability	4.968	Very High
Portability	4.930	Very High
GRAND MEAN	4.5665	Very High

Table 2 shows the result of the evaluation of the respondents using the ISO/IEC 9126-1:25010 Software Quality Model Characteristics

Table 1: Evaluation of the Respondents of the Landmark and Landmark Tourist Spots Using Augmented Reality
 The Landmark and Tourist Spots Using Augmented Reality has an area mean of 4.330 for functionality, 4.337 for efficiency, 4.335 for compatibility, 4.615 for usability, 4.339 for reliability, 4.678 for security, 4.968 for maintainability, and 4.930 for portability, with the grand mean of 4.5665. This was because the system was suitable for providing appropriate functions to the needs in enhancing the tourism of the Municipality of Dumangas. Furthermore, the system provides accuracy on the agreed results in functionality stability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. As a whole, the result was very high which revealed that the system was stable, efficient,

compatible, usable, reliable, secured, maintainable, and portable to be used. There are some functional factors that the panels suggested for improvement. First, adding the audio function to serve as background music for that the game so the game can also target auditory factors that will lessen instances of developing boredom during the game. They have also suggested that the history will automatically appear as soon as the location or GPS of the phone detects the user being within the range of a specific marker. Lastly, they have given suggestions on the appropriate range and location of the markers in order to ensure the correctness of the user's location.

Table 3: Evaluation of IT Experts of the Extension and Community

Criteria	Mean	Verbal Interpretation
Audibility	4.3	Very High
Accuracy	4.8	Very High
Completeness	4.6	Very High
Communication Commonality	4.6	Very High
Conciseness	4.7	Very High
Consistency	4.4	Very High
Observability	4.3	Very High
Operability	4.4	Very High
Security	4.4	Very High
Self-Documentation	4.8	Very High
Simplicity	4.4	Very High
Software System Independence	4.6	Very High
Traceability	4.5	Very High
Training	4.4	Very High
Controllability	4.7	Very High
Data Commonality	4.4	Very High
Decomposability	4.8	Very High
Error Tolerance	4.3	Very High
Execution Efficiency	4.6	Very High
Expandability	4.7	Very High
Generality	4.8	Very High
Hardware Independence	4.7	Very High
Instrumentation	4.5	Very High
Modularity	4.8	Very High
GRAND MEAN	4.5625	Very High

Table 3 shows the result of the evaluation of IT Experts using McCall's Software Evaluation Criteria for Software Quality Model.

The Application Landmark and Tourist Spots Using Augmented Reality has a mean of 4.3 for audibility, 4.8 for accuracy, 4.6 for completeness, 4.6 for communication

Commonality, 4.7 for conciseness, 4.4 for consistency, 4.3 for observability, 4.4 for Operability, 4.4 for security, 4.8 for Self-documentation, 4.4 for simplicity, 4.6 for Software System Independence, 4.5 for traceability, 4.4 for training, 4.7 for controllability, 4.4 for Data commonality, 4.8 for decomposability, 4.3 for error tolerance, 4.6 for execution efficiency. 4.7

For expendability. 4.8 for generality, 4.7 for hardware independence, 4.5 for instrumentation, 4.8 for modularity with the grand mean of 4.5625. The evaluation proved to have high results which proved that the application had met its operational standards and is now prepared to be launched for its targeted users. The IT experts also suggested several tips for the improvement of the game such as regulating the difficulty of the application so that the users will not find the game too easy or too difficult for the users/ they have also suggested adding a reward system that would motivate the users to reach a higher level as the game progresses.

Services Data Management System with App Support

It shows that the generality of the Landmark and Tourist Spots Using Augmented Reality was rated Very High. It is because of the user-friendly design of the system, the ease of its performance, the provided information about the location's history, the accuracy of the location for the user, the game entertainment, and the fast run time of the game. Generally, the IT experts concluded in their evaluation that the system was easy to use and can manage running on or outside field use, and can provide both interaction and information to the users.

ANALYSIS AND DISCUSSION

This research study was developed for the purpose of promoting local tourism in the Municipality of Dumangas Iloilo. The development method of research was application development which functions to provide information to its users. This research project was made possible using rising technology specifically augmented reality. The application was first coded and then launched. Several troubleshooting of the application was done in order to fix inconsistencies and a survey was given to respondents to measure the quality of the application. The application resulted to a grand mean of 4.5665 (Very high) based on the user's evaluation of the application which proved that the application had given satisfactory results in all eight aspects namely: functionality, efficiency, compatibility, usability, reliability, security, maintainability and portability.

This application has also been evaluated by several I.T. experts using McCall's Software Evaluation Criteria for Software Quality Model and has resulted in a grand mean of 4.5625 (Very High) which proves that the application runs smoothly and passes the quality standards needed for this type of application namely audibility, accuracy, completeness, communication commonality, conciseness, consistency, observability, operability, security, self-

documentation, simplicity, software system independence, traceability, training, controllability, data commonality, decomposability, error tolerance, execution efficiency, expandability, generality, hardware independence, instrumentation, and Modularity. The results have shown that the application has shown consistency in its operational factors and has proved to offer user satisfaction to those who have been the pioneer batch of users for the application.

CONCLUSION

The researcher has established an Augmented Reality application that can provide information about the landmarks in Dumangas, Iloilo. After an evaluation, it has been proven that the researcher has successfully developed a proficient Augmented Reality system that could be used by the users who want to install the application. This system can contribute to assessing the user's knowledge about the local Municipality of Dumangas, Iloilo as well as give them valuable information about the area.

Furthermore, one of the most important contributions of the system is in providing information to users with the power of their mobile devices in the most portable convenient way, whereby they can interact with models and other contents of the application.

The program was referred to as an integrated travel application. There are various concepts that could be implemented into the service to produce even more value. Currently, 3D objects are offered. Augmented reality could be integrated with a mobile phone, and scenarios like the largest Catholic Church in all of Panay, half of the Siete Pecados, or reconstruction of the former Rotanda and the Monument of Col. Quintin D. Salas of Dumangas were generated. A wise decision guide could also be beneficial for the clients. The intention is to work together with the clients so they can offer their ideas and feel involved. So, this application allows users to view the spots or any landmarks of the municipality of Dumangas or as they will be when upcoming modifications are made. Due to changes throughout time, visitors to historical sites such as the oldest and biggest Catholic Church in the whole Panay. It can be challenging for a modern visitor to envision how these sites actually know the history of the spots of Dumangas. An artificially created version of Living History could be viewed by a visitor with an outdoor AR system. Modern structures and monuments in the distance might be hidden by the HMD head-mounted display and shown, directly on a place in the municipality of Dumangas, Iloilo.

But nowadays AR frameworks are fundamentally found in scholarly and mechanical inquiries about research facilities. There are a number of intriguing products on the market, but the technology still has to advance. One issue is that equipment is used in the market penetration process. Since augmented reality is still a relatively new concept, it is particularly crucial to develop applications to provide clients with genuine value and introduce it as soon as you can to the market to get a jump start

on outperforming rivals and so gain market share. since many individuals already own advanced smartphones, it makes sense to use cheaper means such as cardboards or comparable tools to reach as many clients as possible. The most crucial factor in developing applications or services is that they will deliver genuine value to the clients or risk losing their interest fast.

RECOMMENDATION

Based on the findings and conclusions derived from the study, the following recommendations were the following: The developed program may be considered to enhance the profitability of the Local Tourism of Dumangas, Iloilo. It can help to boost the economic status of the municipality of Dumangas, Iloilo which serves as a great entryway of opportunities for local businesses, job openings, investors, etc.

The program can also be used in schools to help enrich the knowledge of the students about the history of the local tourist spots in Dumangas. It is very appropriate in today's generation since most of the students are not very familiar with the history of Dumangas.

Future researchers may improve the requirements in functional aspects such as the input and the output of the system and enhance the graphic user interface and detailed 3D models with a compressed size to prevent application lag and maximize user experience. Highlighting possible paths when selecting a target is also recommended to add information about the target. Rigid and smooth animation in camera and character movements will greatly improve the impact of the application on the user.

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