

Real State Web Application With Android Augmented Reality House Catalogue

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Abstract. One of the effects of a pandemic is facing the new normal approach that provides us the improvement of human interaction in virtual environments such as on education, businesses, science, health, geographic locations, and others. The physical appearance is minimized and mostly prefer to conduct business transactions online. This study started and focused on creating web applications for everyday business transactions of a real-estate company and developing modern Android application using augmented reality. This technology can satisfy both buyers and agents in presenting model houses even without visiting the actual place. The website can provide convenience by allowing customers to view their payment summaries online. The application can give advantages to the agent and real-estate owners by eliminating the construction of the tangible miniature models, which can be costly and time consuming on its assembly.

Keywords: augmented reality, web application, real state, house catalogue

I. INTRODUCTION

For a long time, augmented reality and the internet went from science fiction movies and imaginations to actual reality. Papagiannis (2015), describes the augmented reality (AR) as a gateway to a new dimension without the need to leave the physical world behind and still see the real world around us. By inspiring design for the best of humanity and the best of technology, augmented reality is for anyone who desires a peek at virtual future. With augmented reality application, the business can bring static print ads to life, watch a movie trailer by pointing your smartphone camera at a poster, or discover nearby establishments and landmarks with your mobile device. Langlotz et al (2013) stated that the first instance of Mobile AR can certainly be associated with the development of wearable AR, in a sense of experiencing AR during locomotion. Mobile Augmented Reality has largely evolved over the last decade, as well as the interpretation itself of what is Mobile Augmented Reality. Patkar, et al (2013), created an android mobile based application with idea to allow the user to view the virtual object in the real world using a marker-based AR system. The user could provide images of the object which would be the front, back, top, bottom, left and right-side pictures of the object. They will be placed onto a 3D cube which will make up the complete virtual object. K. Khairnar et al (2015), used augmented reality that lets user to try on virtual furniture to real home structure before buying. On this application users can try out multiple combinations of furniture objects virtually without physical movements of furniture items. The system was developed to increase and improve the accessibility of furniture to try on with the use of furniture layout augmented reality. The system uses web cam and marker to capture and detect the furniture that the user wants to try and it will then be projected of the user's computer screen as a 3D furniture object. J. Wen et al (2013), used augmented reality on smart phones to overlay virtual tags in the real world to show points of interest that people may want to visit. They created a simulated environment that provided perfect tracking for AR and conducted experiments based on real world navigation studies. They measured time-on-task performance for guided traversals on both desktop and head-mounted display systems and found that accurate tracking did validate the superior performance of AR-based navigation tools. Mai Le et al (2012), explore also the augmented reality and a marker-based method for placement of 3D objects in an indoor scene for the purpose of previewing décor changes. Objects are placed in the scene using OpenGL using a

MATLAB vanishing point calculation algorithm. This technique allows users to specify orientation and placement of the object via placement of a physical marker and allows for color balance correction on the 3-D object. They also conducted preliminary exploration into wall detection and coloring techniques. In 2015, Microsoft introduced HoloLens, their AR headset lead by Kinect inventor Alex Kipman. HoloLens's inventor Kipman hints at VRD with his description of how HoloLens works by tricking the human brain into seeing light as matter. "Ultimately, you know, you perceive the world because of light," Kipman explains. In relation to that, the unique way of promoting products is essential to the success of every business. Thus, researchers aimed to create software that will present high-tech business performance and used the AR technology. This study will focus on developing a real estate website for Island Front Residences with an image-based augmented reality mobile application. The website and application must provide a new and unique way of product endorsement and demonstration to improve communication between the buyers and agents. The application was created to reduce the expenditure on expensive miniature architectural models used as a traditional way of display. The application is an augmented reality-based application that allows the buyers to see the virtual house before going to the location. It will also provide convenience for better presentation both on the side of the buyers and agents. The website provides a list of house models that will benefit the perspective view of the customers. When the transactions are done, the buyers can view their payment summary online, a very convenient way of knowing the payment they have made. This study creates a new way of product presentation for the prospective buyers to capture their attention, keep the home owners informed about their transactions, and make an easy and quick way to update information about the house models rather than print materials. The website together with the mobile application can help generate more customers not just outside the city but worldwide as well.

II. RESEARCH ELLABORATION

A. Conceptual Framework

The Rapid Application Development model (RAD) is the software model used in the study. RAD approaches emphasize a flexible process that can adapt as the project evolves rather than rigorously defining specifications and plans correctly from the start. The conceptual framework of

the study discusses about the processes and for the summary of the functions and flow of the android application shown in the conceptual paradigm below:

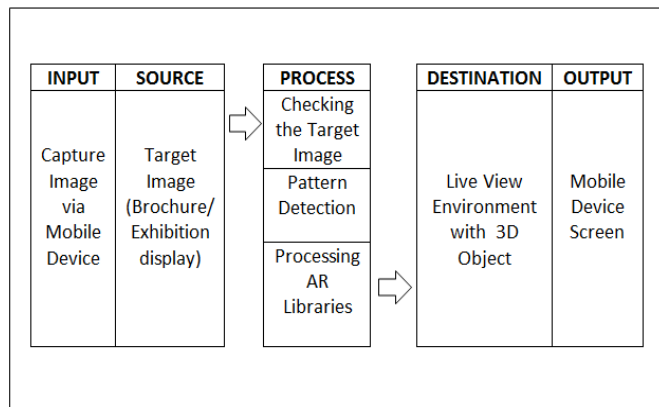


Figure 1. Conceptual Paradigm of the AARHC

For the summary of the functions and flow of the website, please refer to the conceptual paradigm.

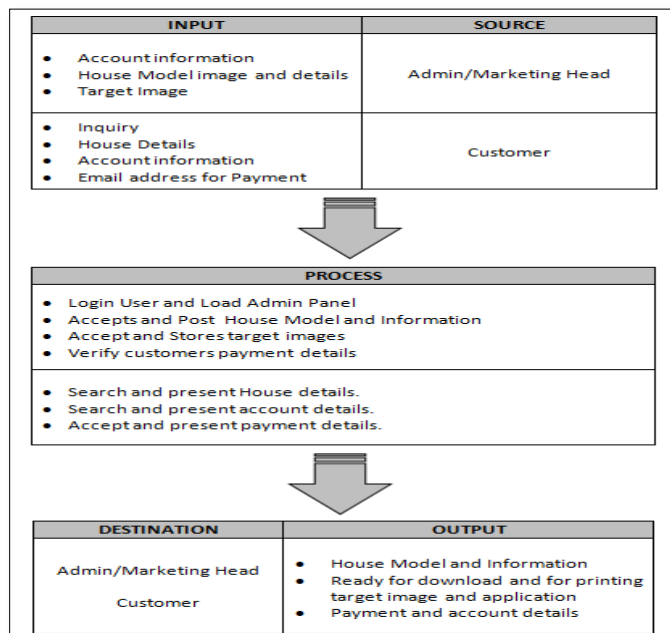


Figure 2. Conceptual Paradigm of the REWA

The study was conducted at Island Front Residences which is a real-estate /subdivision. Island Front Residences offers customized homes and located at Magsaysay, Alaminos City Pangasinan (1.5 km away from Hundred Islands).

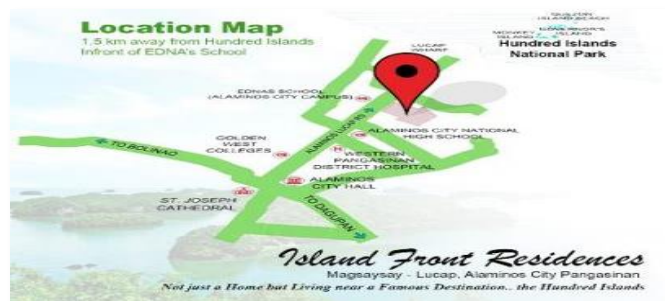


Figure 3. Location Map of Island Front Residences Respondents of the study

The respondents of the study were the selected from different real-estate agents from different real-estate company, employees from the Island Front Residences, and possible clients or end users. They were chosen to be able to determine the effectivity and advantage of the modern application and website on their daily presentations and transactions. The distributions of the respondents are Real-estate Agents (5), Real-estate Employees (5), Clients (10), and IT Experts (10).

Instruments

The result of the questionnaires was reviewed and evaluated to draw a foundation in the creation of the proposed website and android application. A survey form with 10 items was used in evaluating the development of AARHC, based on the four characteristics of mobile application, specifically: Graphical User Interface, Ease of Use, Fun and Engaging, and Reachability. And also, a survey form with 12 items was used in evaluating the development of the website based on the ISO 9126-1 software quality model, 6 main quality characteristics, namely: Functionality, Reliability, Usability, Efficiency, Maintainability and Portability. Weighted mean was used in determining the functionality, reliability, usability, efficiency, maintainability and portability of the Real Estate Web Application (REWA). The weighted mean also used to check if the four characteristics of mobile application, specifically: Graphical User Interface, Ease of Use, Fun and Engaging, and Reachability where met by the Android Augmented Reality House Catalogue (AARHC).

III. RESULTS AND DISCUSSION

This study is composed of four phases for development since it uses a RAD model for its Software Development Life Cycle.

Phase 1 - Requirements planning. This phase combines the elements of system planning and systems analysis phases of the Systems Development Life Cycle (SDLC). The researchers carefully analyze the flow of the system and constructed the Context Diagram in order to visualize scope and limitation of the mobile application. Choosing the third-party software like SDK was carefully studied.

Phase 2 - Design phase. During this phase, the researchers created the diagram; develop models and prototypes that represent all system processes, inputs, and outputs. Designing is a continuous interactive process that allows the developer to understand, modify, and provide a working model of the system that meets the client needs. Use-Case diagram below shows the relationship between the users and different task in which the user is involved.

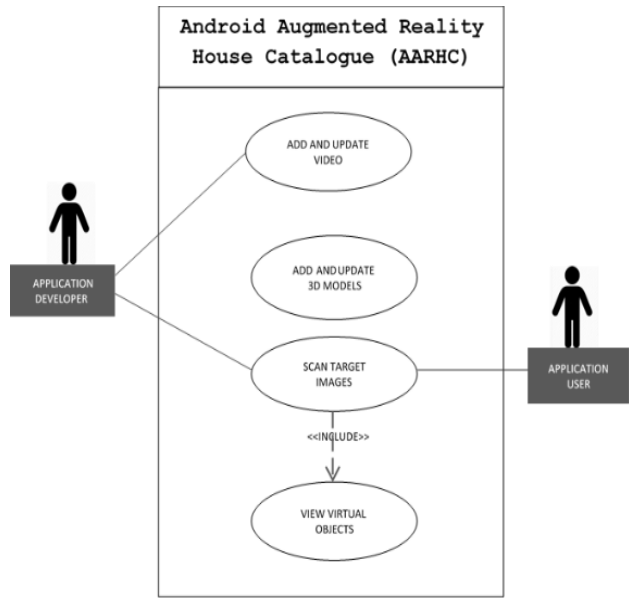


Figure 4. AARHC Use – Case Diagram

AARHC Access Equipment. The image below shows a material and device needed for the mobile application. All you need is the image marker (e.g. catalogue), a smart device (e.g. Android), and application



Figure 6. AARHC Access Concept

A data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system, modelling its process aspects. A DFD is often used as a preliminary step to create an overview of the system.

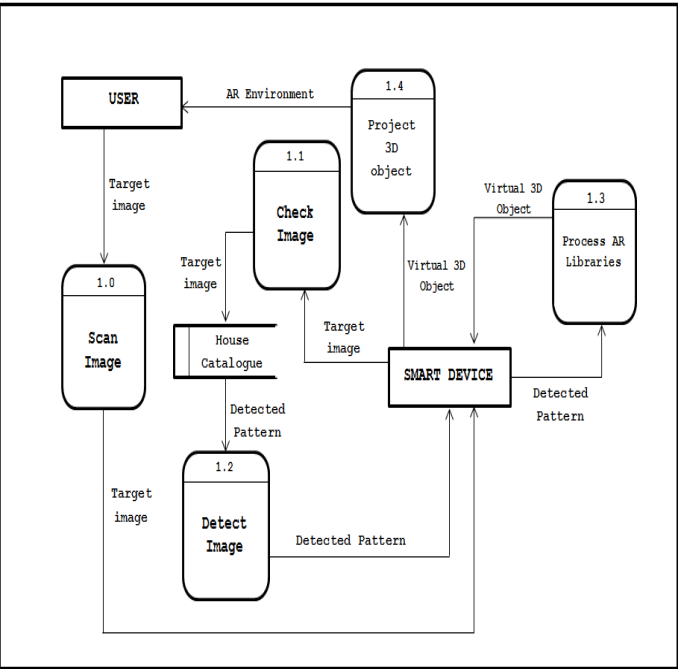


Figure 5. Data Flow Diagram

REWA Access Equipment. The image below shows the devices needed for the proposed website.

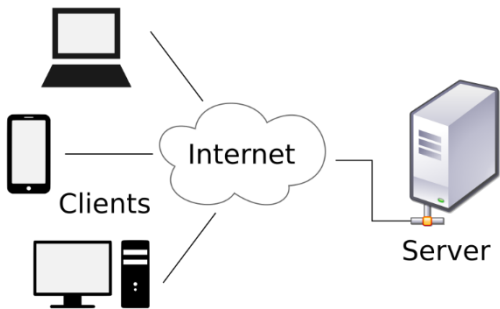


Figure 7. REWA Access Concept

Phase 3 - Construction phase. This phase focuses on program and application development. The tasks during this process are programming and application development, coding, device-integration and system testing. The SDK like Vuforia has been used in the construction phase of the application together with the game engine unity 3D and MonoDevelop for an open source editor. Another text editor that was used in the creation of the website is Adobe Dreamweaver CS6.

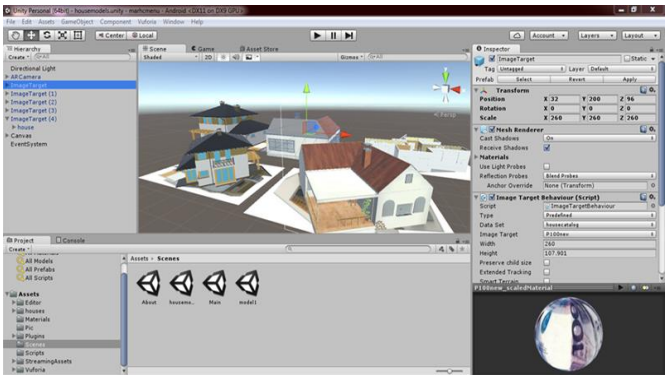


Figure 8. Unity Development Environment

Phase 4 - Cutover phase. It includes data conversion, testing of the new application software, and user training. The system was first tested in one client, and all the functions were checked if working well, additional functionality were suggested by the client during the first test. After the test, the system underwent modification for additional functionality. It was tested again by the client and real estate companies. The system goes through evaluation with IT experts and Island Front Residences if it fits the criteria for replacing the old system, and for additional improvement that was found necessary. Assessment of the technical quality of the REWA based on ISO 9126. The assessment of the technical quality of the website and application was based on the ISO 9126 six characteristics of software development namely: Functionality, Reliability, Usability, Efficiency, Maintainability, and Portability.

Table 1.
The assessment of the technical quality of the website and application

Criteria	Clients	Real Estate Employees and Agents	IT	MP	Verbal Interpretation
Functionality	4.75	4.5	4.95	4.75	Excellent
Reliability	4.8	4.5	4.76	4.68	Excellent
Usability	4.6	4.5	4.9	4.66	Excellent
Efficiency	4.85	4.4	4.95	4.7	
Maintainability	4.95	4.55	4.85	4.78	
Portability	4.9	4.5	5.0	4.8	

For the functionality the Real-estate employees and agents gave a mean score of 4.5. The clients gave 4.75 and the IT experts gave 4.95 evaluation score for the website. The total evaluation grade for Functionality is 4.75 which is equivalent to Excellent. For the reliability the clients gave a mean score of 4.8, and for the real estate agents and employees a rating of 4.5 for the application was given, and a score of 4.76 from the IT experts. Table 1 displays the evaluation rating from the evaluators. The total evaluation score is 4.68 which is equivalent to the rating of Excellent. For the usability measures of the website, the clients gave a mean score of 4.6. The IT experts rating for the website is 4.9, and a score of 4.5 was given from the Real Estate agents and employees. For the efficiency requirement the Real-estate agents and employees gave a rating of 4.4, and for the clients a score of 4.85 were given and 4.95 from the IT experts. Table 4 indicates the assessments rating received from the evaluators. The total evaluation score is 4.7 which is equivalent to Excellent. For the maintainability the Real-estate agents and employees gave a mean score of 4.55. The clients gave 4.95 and the IT experts gave 4.85 evaluation score. Table 5 shows the evaluation ratings received from the evaluators. The total evaluation grade is 4.78 which is equivalent to Excellent. For the portability the clients gave a mean score of 4.9, and for the real estate agents and employees a rating of 4.5 for the application was given, and a score of 5.0 from the IT experts. displays the evaluation rating from the evaluators. The total evaluation score is 4.8 which is equivalent to the rating of Excellent.

Evaluation of Clients, Real-estate agents and employees, and IT experts on AARHC prototype

How would the system be beneficial in terms of User Interface, platform appropriate, ease of use, engaging and software reachability?

Table 2. Evaluation of Clients, Real-estate agents and employees, and IT experts on AARHC prototype

Criteria	Clients	Real Estate Employees and Agents	IT Experts	MP
User Interface	4.6	4.1	4.8	4.5
Ease of Use	4.6	4.4	4.9	4.6
Fun and Engaging	4.9	4.7	4.9	4.8
Reachability	4.8	4.3	4.9	4.6

For the user interface design the Real-estate agents and employees gave a mean score of 4.1. The clients gave 4.6 and the IT experts gave 4.8 evaluation score for the app. The total evaluation grade is 4.5 which is equivalent to Excellent.

For the simplicity of use the clients gave a mean score of 4.6, and for the real estate agents and employees a rating of 4.4 for the application was given, and a score of 4.9 from the IT experts.

Table 2 displays the evaluation rating from the evaluators. The total evaluation score is 4.6 which is equivalent to the rating of Excellent.

For the fun and engaging measures of the app, the clients gave a mean score of 4.9. The IT experts rating for the mobile app is also 4.9, and a score of 4.7 was given from the Real Estate agents and employees.

Table 2 shows the assessments scores from the evaluators. The overall evaluation grade is 4.8 which correspond to the rating of Excellent.

For the reachability requirement the Real-estate agents and employees gave a rating of 4.3, and for the clients a score of 4.8 were given for the application and 4.9 from the IT experts. Table 10 indicates the assessments rating received from the evaluators. The total evaluation score is 4.6 which is equivalent to Excellent.

Features of the Proposed Prototype Application

The proposed application allows the users and agents to view the available house designs in 2D images and 3D models. The models are rotatable 360 degrees depending on the user perspective.

Graphical User Interface of AARHC Splash Screen

This screen appears while the program is launching. A splash screen is a graphical control element consisting of window containing an image, the logo of unity appeared on the application splash screen since it was developed using this game engine.



Figure 9. Splash Screen

Loading Screen

A loading screen is the picture shown by the AARHC application, while the program is loading or initializing.

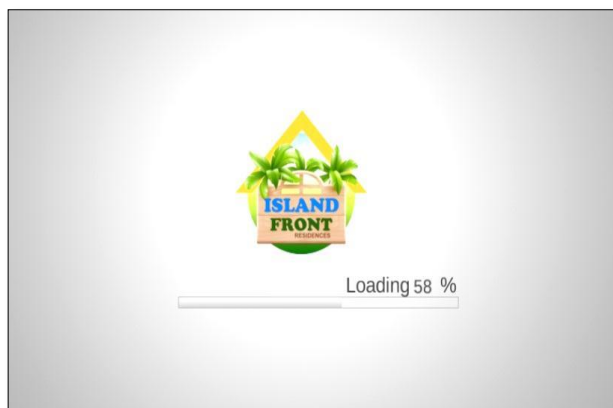


Figure 10. Loading Screen

Main Menu Screen

The Main Menu screen is the first window that opens after the loading screen when the application was started. The Main Menu screen displays all buttons of AARHC app.



Figure 11. Main Menu Screen

Instructions Screen

This screen will tell the user the instruction on how to use the app.

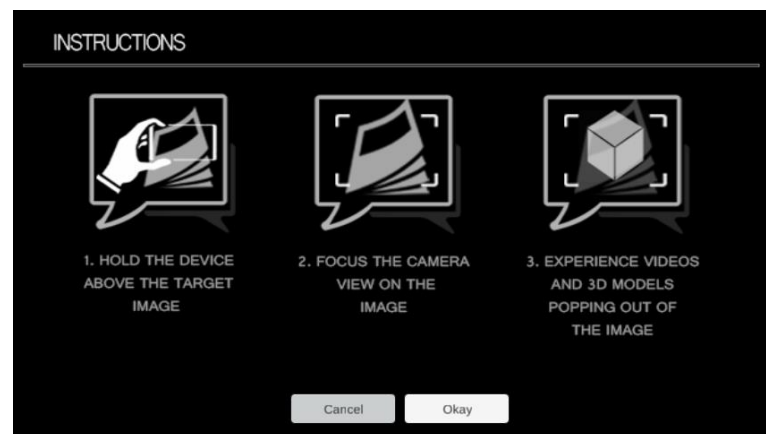


Figure 12. Instructions Screen

3D Models Screen

This screen will allow the end user to view the virtual house models when they scan the image marker provided that it is on the application database.



Figure 13. 3D Models Screen

Video Tour Screen

This screen will allow the user to watch the video tour of each house model when they scan the target image.



Figure 14. Video Tour Screen

- [6] Mai Le, Aaron Zarraga, Kangrong Zhu, An Augmented Reality Application for Previewing 3D Décor Changes, 2012.
- [7] Dr. Helen Papagiannis, (2015, January 21). Reality Has Changed. Microsoft's HoloLens and what you need to know about the next wave of Augmented Reality. Retrieved from <https://augmentedstories.com/2015/01/21/hololens/>

CONCLUSION

The researchers concluded that the development of Real Estate Web Application (REWA) with Android Augmented Reality House Catalogue (AARHC) will help the real estate company in better and modern way of promotional advertisement because it received an Excellent rating from the evaluators based on the characteristic of mobile application and those criteria are from User Interface, Ease of Use, Fun and Engaging, and Reachability. The REWA also received an Excellent Rating from the evaluators based on the ISO 9126-1 software quality model 6 main characteristic, namely: Functionality, Reliability, Usability, Efficiency, Maintainability and Portability. And based on the outcome of the evaluation, the researchers are confident to recommend the use of the mobile application for business presentations.

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REFERENCES

- [1] Dr. Helen Papagiannis, (2015, January 21). Reality Has Changed. Microsoft's HoloLens and what you need to know about the next wave of Augmented Reality. Retrieved from <https://augmentedstories.com/2015/01/21/hololens/>
- [2] Tobias Langlotz, Daniel Wagner, Raphael Grasset, Alessandro Mulloni, Lukas Gruber, History of Mobile Augmented Reality, <http://www.icg.tugraz.at/Members/langlotz/history-of-mobile-ar>, 2013
- [3] Raviraj Patkar, Pratap Singh, Swati Birje, Marker Based Augmented Reality Using Android OS, IJARCSSE, Vol. 3, Issue. 5(May 2013), pp. 64-69.
- [4] Khushal Khairnar, Kamleshwar Khairnar, Sanketkumar Mane, Rahul Chaudhari. (2015). Furniture Layout Application Based on Marker Detection and Using Augmented Reality. International Research Journal of Engineering and Technology (IRJET), 02 (07), 540 – 544, <https://www.irjet.net/archives/V2/i7/IRJET-V2i780.pdf>
- [5] Wen, J., Helton, W. & Billinghamurst, M (2013). If Reality Bites, Bite Back Virtually: Simulating Perfection in Augmented Reality Tracking, <http://www.hitlabnz.org/index.php/research/augmented-reality#sthash.PCvEtOVb.dpuf>