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Augmented Realty Learning Prototype for Primary School (AR-LPS)

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2017

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

- (١) أَقْرَأُ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ
- (٢) خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ
- (٣) أَقْرَأُ وَرَبُّكَ الْأَكْرَمُ
- (٤) الَّذِي عَلَّمَ بِالْقَلَمِ
- (٥) عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ

صدق الله العظيم

العلق (١-٥)

DEDICATION

To our parents, may Allah bless both of you,
for giving us all love and have always done
your utmost to support and help us in every
way.

To our brothers and sisters deserves
heartfelt thanks for their support and
encouragements.

To our doctors, teachers and friends, and to
our lovely people that we know that

We would like to take this opportunity

To dedicate this A Graduation Project

For all of you.

ACKNOWLEDGMENT

We would like to express our gratitude to everyone who supported us through our work on this project, both directly and indirectly. First, thanks to Allah for giving us the morale and power to accomplish this project. We would like to thank our supervisor, Dr. Naji Shukri Al-Zaza, for his optimistic and openminded research spirit and methods and for her constant guidance, inspiration, generous help, support and patience throughout the development of this project. We have encountered many difficulties during the work on the project, Dr. Naji Al-Zaza had the wisdom to point us in the right direction, yet allow us to find our own answers. We would like also to thank our friends in the university and outside it for making the best of the worst times during our study. And most importantly, none of this would have been possible without the love and patience of our families, our fathers, mothers, brothers and sisters.

Our teachers and lecturers: Eng. Eman Al-Ajramy, Eng. Ahmed Abu Msameh, Eng. Mohammed Abu Lamdi, Eng. Suheir ALmurshidi, Eng. Asaad Al-Tayan, Eng. abed El-Wahab Mohanna.

Without their unconditional love, faith and unimaginable patience, this project would never have been done.

Thank You All

ABSTRACT

Augmented Reality which known as (AR) represents one of the most important new technologies that the users like, because of the ability to the augmentation of the actual reality through adding new features that makes it more and more interactive, fun, and useful. So that you can add interactive contents such as video or interactive image to a printed book. So, the reader can use his/her phone to listen to the introduction of the magazine as a video, also the student can see interactive images for the pictures and maps and explanations that the book present, which absolutely add unlimited fun and benefits. One of the studies indicates that most of boring times that students spends in their lives exists in some of their school classes which its content and the way of teaching the subject bring the boring for the students which leads to some students' tendency to create problems in his class, so they turn to sleep as a way to escape from boring that they feel. This study aims to improve the application of augmented reality and make the leaning much more easy and funny for the children, and the XP methodology has been implemented in the project life cycle, where an experiment was conducted on a number of students in Al-Zahra Private School for the third grade's Islamic subject, and the experiment has been evaluated upon them, where the results was highly positive. The requirements were elicited using the data of the similar projects. The Graphical User Interface (GUI) was designed using unity program. The AR-LPS application was tested and evaluated by different evaluators and according to the questionnaires it was accepted by 73% percent. Finally, the AP-LPS application is the first version and in the future it will be evolved and new features can be added.

Key Words: Augmented Reality, Virtual Reality, Mobile Learning and Virtual Learning

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LIST OF ABBREVIATIONS

Term	Description
AR	Augmented Reality.
AR-LPS	Augmented Reality learning prototype for primary schools.
APP	Application.
ET	Educational Technology.
GPS	Global position System.
GUI	Graphical user interface.
JVM	Java virtual machine.
MEL	Maya Embedded Language.
CRC	Class-Responsibility Collaboration.
PC	Personal computer.
SRS	Software Requirements Specification.
UI	User interface.
XP	Extreme Programming.
API	Application Programming Interface.
OS	Operating System.

CHAPTER (1)
INTRODUCTION

1.1 Background

Educational Technology (ET) is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources [1]. Educational technology (ET) is the use of both physical hardware and educational theoretical. It encompasses several domains, including learning theory, computer-based training, and online learning [2]. And it is a way that supports the process of education and transforms it from the traditional way to creation, innovation, interaction, and improves abilities, so that the best ways in the field of education and fun are used in depending on the personal computers and mobile devices and its storage media and its networks.

In addition, the speed innovation and improvements in the technology led to the appearance of new ways for education and teaching, which enhanced the concept of self-learning, so that the student keep learning depending on his energy, ability, and his speed of learning according to his experiences and abilities.

Learning to play is an activity carried out by prompt children to develop their behavior and mental and physical abilities. And it achieves at the same time fun and entertainment.

When we talk about "games," that term covers a huge range. From video games to board games, from Kindest to pencil-and-paper games, all of these can contribute to student learning [3].

Use of technology helps the child to develop his skills and learn more new skills. And Technology Education stimulates thinking among students. Increase the process of attracting students of lessons through diversification in the presentation of the lesson. Also give the area to the teacher through sophistication in the delivery of information to students.

Augmented Reality (AR) is the integration of digital information with the user's environment in real time. Unlike virtual reality, which creates a totally artificial environment, augmented reality uses the existing environment and overlays new information on top of it [4].

There is no doubt that learning by doing more effective methods of different education than reading and writing. And it can thus enhance reality to participate strongly in this area, and to enter the classrooms that would be a catalyst for learning, and increased focus. Natural augmented reality through the presentation of virtual objects in the real environment for students, would work to improve student performance and increase their interaction, moreover it provides them with the opportunity to see the pictures three dimensions and agitated, and interact with them through books designed for it.

This project employs the new technology and augmented reality in the education field for the students 3th class about Islamic studies book, where the lesson will be explained when directing the camera of the application toward it, and the lesson will be presented through video, 3D object, or image HD.

1.2 Motivation of the Study

The use of technology helps the child to develop his skills and learn more new skills, so Teachers and parents must be involved in the education process in order to motivate children to use their brains to think in better ways, raising the level of education, and facilitate the delivery of information to the child, so education using a AR display makes it easy to simplify information in a child's mind and add fun to educational process. Also, the school aims to improve teaching ways and that was one of the study motivations.

1.3 Problem Statement

Technology has impacted almost every aspect of life today, and education is no exception. in some ways, education seems much the same as it has been for many years. Now, the approved teaching way in schools in our current time needs to modern interactive ways in spite of the existence of new technologies that makes us able to do that. Also, teaching system is not interactive enough to make the children able to improve their skills.

1.4 Study Questions

In relation to the problem statement, this study aims to investigate the following:

- How to utilize Augmented Reality to support the educational process?

1.5 Objectives of the Study

This study utilized Application mobile technology for kids by use augmented reality in education. The objectives of the study are:

- To develop an Augmented Reality application for the students3th class.
- Make learning easy and Enjoyable to children.
- To evaluate the Augmented Reality application.

1.6 Significance of the Study

This application is important for students. Consequently, the significance of this study arises from several points as follows:

- Easy way for education.
- Make students love the process of education because it has simple interfaces for children.
- Make it easy to deliver the information.
- Mixed the education and play.
- The development of thinking of a child.
- Raising the level of creativity of the child.

1.7 Scope and limitation

1.7.1 Study Scope

- The study will focus on the book of Islamic studies for 3th grade students.
- The application support Arabic language.
- The application runs on android platform.
- Study development time from September 2016 to June 2017.

1.7.2 Study Limitation

- The study does not support English language.
- The study does not support IOS and Windows Phone operating systems.

CHAPTER (2)
LITERATURE REVIEW

2.1 Introduction

This chapter clarifies an overview of the project technologies, shows other related works that are similar to this project that already exist, clarifies each one of them, their advantages and disadvantages, compare between them and this project, and declare what is this project added technologies and services more than the previous works.

2.2 Technologies

This part will present definitions and concepts of technologies; these definitions will be categorized as follows. The definition of multimedia as use modes of presentation (text, audio, and video, animation) to produce a particular program is characterized by lively, interactive and motion. Through the previous definition of multimedia, we find that we can draw the components of multimedia projects and properties, so we can recognize the fact that the projects and how to differentiate between multimedia projects and regular projects. Vallosaút multiple consisting of a mixture of the following communities: Text, Sound, Video and Movie.

2.2.1 Android

Android is one of the most widely used mobile operating systems these days. It is based on the Linux kernel and it is developed by Google and is primarily designed for smartphones and tablets. Since Android is an open source, it has become the fastest developing mobile operating system. Owing to its open nature, it has become preferred for many consumers and developers [5]. Moreover, developers can easily modify and add enhanced features to meet the latest requirements of the mobile technology. According to the Android developer statistics, users download more than 1.5 billion applications and games from Google Play each month. Furthermore, its powerful development framework enabled users as well as software developers to create their own applications for wide range of devices [6]. Some of the key features of Android operating system are application framework, Dalvik virtual machine, integrated browser, optimized graphics, SQLite, media support, GSM Technology, Bluetooth, Edge, 3G, Wi-Fi, Camera, GPS and many others. Android provides Android software development kit (SDK) to help the developers for better software development. It also provides Java programming Language for application development [7].

2.2.2 Unity (Game Engine)

Unity is a cross-platform game engine developed by Unity Technologies and used to develop video games for PC, consoles, mobile devices and websites [8]. Unity is the award-winning development platform for games and interactive content on the web, iOS, Android, consoles and beyond [9]. Unity Technologies is revolutionizing the game industry with Unity, a free game engine software you can use to make your own game. Unity has been chosen by over 2 million developers because it provides all the core functionality needed, right out of the box, to develop great games. Using Unity, you can assemble your game from art and assets, add interactivity, and publish your final work to desktop computers, mobile platforms and the web with no charge whatsoever and no strings attached. With the added functionality of a Unity Pro license available when you and your team want to tackle creating even more ambitious games, and add-on licenses enabling you to better reach players on iOS, Android, other mobile platforms and even consoles like the Wii, PS3 and Xbox 360, you'll quickly discover why Unity is the favorite choice of everyone from students and hobbyists to major game studios. Unity Mission is Democratize game development and enable everyone to create rich interactive content. Unity currently supports Windows, Mac, Linux, Unity Web Player, iOS, Android, Windows Phone 8, Windows Store Apps, BlackBerry 10, Xbox 360 and PS3. Upcoming platform support includes Xbox One, Wii U, PlayStation 4, PlayStation Vita, PlayStation Mobile and Tizen [8].

2.2.3 Augmented Reality Technology

Augmented reality is a live direct or indirect view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data. It is related to a more general concept called mediated reality, in which a view of reality is modified (possibly even diminished rather than augmented) by a computer. As a result, the technology functions by enhancing one's current perception of reality. By contrast, virtual reality replaces the real world with a simulated one. [10] Augmentation is conventionally in real time and in semantic context with environmental elements, such as sports scores on TV during a match. With the help of advanced AR technology (e.g. adding computer vision and object recognition) the information about the surrounding real world of the user becomes interactive and digitally. Information about the environment and its objects is overlaid on the real world. This information can be virtual or real, e.g. seeing other real sensed or measured information such as electromagnetic radio

waves overlaid in exact alignment with where they actually are in space [11]. Augmented reality brings out the components of the digital world into a person's perceived real world. One example is an AR Helmet for construction workers which displays information about the construction sites. The first functional AR systems that provided immersive mixed reality experiences for users were invented in the early 1990s, starting with the Virtual Fixtures system developed at the U.S. Air Force's Armstrong Labs in 1992 [12].

2.2.4 3D Max

Autodesk 3ds Max, formerly 3D Studio, then 3D Studio Max is a professional 3D computer graphics program for making 3D animations, models, games and images. It is developed and produced by Autodesk Media and Entertainment. It has modeling capabilities and a flexible plugin architecture and can be used on the Microsoft Windows platform. It is frequently used by video game developers, many TV commercial studios and architectural visualization studios. It is also used for movie effects and movie pre-visualization. For its modeling and animation tools, the latest version of 3ds Max also features shades (such as ambient occlusion and subsurface scattering), dynamic simulation, particle systems, radiosity, normal map creation and rendering, global illumination, a customizable user interface, new icons, and its own scripting language [13].

2.2.5 Vuforia Software Development Kit (SDK)

Vuforia is an Augmented Reality Software Development Kit (SDK) for mobile devices that enables the creation of Augmented Reality applications [14]. It uses Computer Vision technology to recognize and track planar images (Image Targets) and simple 3D objects, such as boxes, in real-time. This image registration capability enables developers to position and orient virtual objects, such as 3D models and other media, in relation to real world images when these are viewed through the camera of a mobile device. The virtual object then tracks the position and orientation of the image in real-time so that the viewer's perspective on the object corresponds with their perspective on the Image Target, so that it appears that the virtual object is a part of the real world scene [14]. The Vuforia SDK supports a variety of 2D and 3D target types including 'marker less' Image Targets, 3D Multi-Target configurations, and a form of addressable Fiduciary Marker known as a Frame Marker. Additional features of the SDK include localized Occlusion Detection using 'Virtual Buttons', runtime image target selection, and the ability to create and reconfigure target sets programmatically at runtime

[15]. Vuforia provides Application Programming Interfaces (API) in C++, Java, Objective-C++ (a language utilizing a combination of C++ and Objective-C syntax), and the Net languages through an extension to the Unity game engine. In this way, the SDK supports both native development for IOS and Android while also enabling the development of AR applications in Unity that are easily portable to both platforms. AR applications developed using Vuforia are therefore compatible with a broad range of mobile devices including the iPhone, iPad, and Android phones and tablets running Android OS version 2.2 or greater and an ARMv6 or 7 processors with Floating Point Unit (FPU) processing capabilities. Vuforia has been acquired in November 2015 [15].

2.2.6 Mobile Technologies

Mobile phone (also called mobile, cellular telephone, or cell phone) is an electronic device used to make mobile telephone calls across a wide geographic area. Mobile phones are different from cordless telephones, which only offer telephone service within a limited range of a fixed land line, for example within a home or an office. A mobile phone can make and receive telephone calls to and from the public telephone network which includes other mobiles and fixed-line phones across the world. It does this by connecting to a cellular network owned by a mobile network operator. In addition to being a telephone, modern mobile phones also support many additional services, and accessories, such as SMS (or text) messages, emails, Internet access, gaming, Bluetooth and infrared short range wireless communication, camera, MMS messaging, MP3 player, radio and GPS. Low-end mobile phones are often referred to as feature phones, whereas high-end mobile phones that offer more advanced computing ability are referred to as smartphones. The first handheld mobile phone was demonstrated by Dr. Martin Cooper of Motorola in 1973, using a handset weighing 2 kg [16]. In 1983, the DynaTAC 8000x was the first to be commercially available. In the twenty years from 1990 to 2010, worldwide mobile phone subscriptions grew from 12.4 million to over 4.6 billion, penetrating the developing economies and reaching the bottom of the economic pyramid [17].

2.3 Related Works

There are many similar applications for our study such as: SketchUp, Quiver, Google translate, SKCM.

2.3.1 SketchUp Mobile Viewer Project.

The SketchUp Mobile Viewer brings 3D models to life on Android Tablets. View models in your own 3D Warehouse account, or explore the millions of free designs in the 3D Warehouse the world's largest collection of 3D models

This project has many of advantages, for example (download models to your device from 3D Warehouse for seamless offline viewing, search and browse through over 2 million, free 3D models on 3D warehouse and easily navigate complex models using intuitive multi-touch gestures for orbit, pan, zoom). And it has many of disadvantages, for example (the application is limited to engineering drawings only and accuracy of the results is low compared with other applications) [18].

Figure (1) Show the SketchUp Mobile Viewer Project.

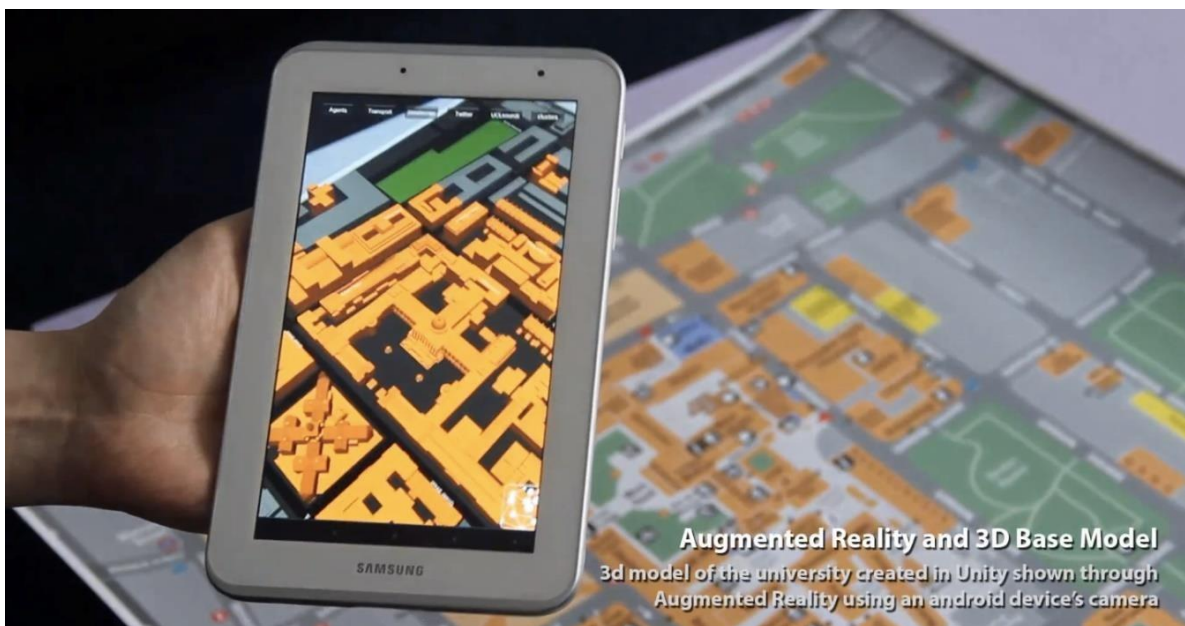


Figure 1: SketchUp Manageable Viewer Project

2.3.2 Quiver Vision Project

Quiver Vision is an augmented reality coloring book. The way it works is you download and print out coloring book pages from the app's official website. Color them in and then use the app to bring the pages to life. The Quiver App combines physical coloring from “back in the day” with state of the art augmented reality technology

This project has many of advantages, for example (designed with educators in mind, Quiver Education provides the same magical augmented reality coloring experience, but with a greater focus on educational content than the awesome Quiver Vision App). And it has many of disadvantages, for example (it’s not perfect and has a few issues here and there and coloring books will always be popular because they allow children to apply their own artistic vision to templates of their favorite characters, items, and places) [19].

Figure (2) Show the Quiver Vision Project.



Figure 2: Quiver Vision Project

2.3.3 SKCM Project

SKCM Projects an Android application that show the pictures in the particular curriculum to (KG) in 3D or cartoon modeling in attractive way. User application via android smartphone application opens directly the mobile camera on the picture to show the 3D or cartoon modeling for the selected picture.

This project has many of advantages, for example (easy to use, it works without internet and is a free). And it has many of disadvantages, for example (few shapes and slow in processing operations).

Figure (3) Show the SKCM Project.



Figure 3: SKCM Project

2.3.4 Related Work Comparison

Table (1) shows Summary comparison between several similar projects and AR-LPS.

Table 1: Related Work Comparison

Features	SketchUp	Quiver Vision	SKCM	AR-LPS
Easy to use			✓	✓
Arabic language support			✓	✓
A Free		✓	✓	✓
Augmented Reality	✓	✓	✓	✓
Supported all shapes				✓
It works without internet	✓		✓	✓

In the above table, all the projects are common in augmented reality which the main subject of them. In our project the main advantage is the presence of many shapes that help the child to learn for example (video, picture HD and 3D object). Other advantage, our project is a free and work without internet.

2.4 Summary

in this project we used many technologies like 3D model that have Augmented Reality and This project will make the learning easier and fun for the students in a simple way on other hand we talked about the scope of the project.

CHAPTER (3)
RESEARCH METHODOLOGY

3.1 Introduction

This chapter will describe XP methodology and its phases, knowledge flows and the outputs, it depicts Extreme Programming as the software development methodology followed during the study.

3.2 Extreme Programming (XP)

Extreme Programming (XP) was developed by Kent Beck in 1996. It is a discipline of software development based on values of simplicity, communication & feedback. It works by bringing the whole team together in the presence of simple practices, with enough feedback to enable the team to check where they are and to tune the practices to their unique situation. XP recognizes that the end goal of a development study is to produce quality, production code that can be executed and maintained [20]. Anything in a project that does not directly support this goal is questioned and discarded if appropriate. XP takes 12 software development "best practices," and applies them to the extreme. Every contributor to the Project is a part of the 'TEAM' and the Team interacts with the 'Customer' daily.

Figure (4) Show The Extreme Programming (XP).

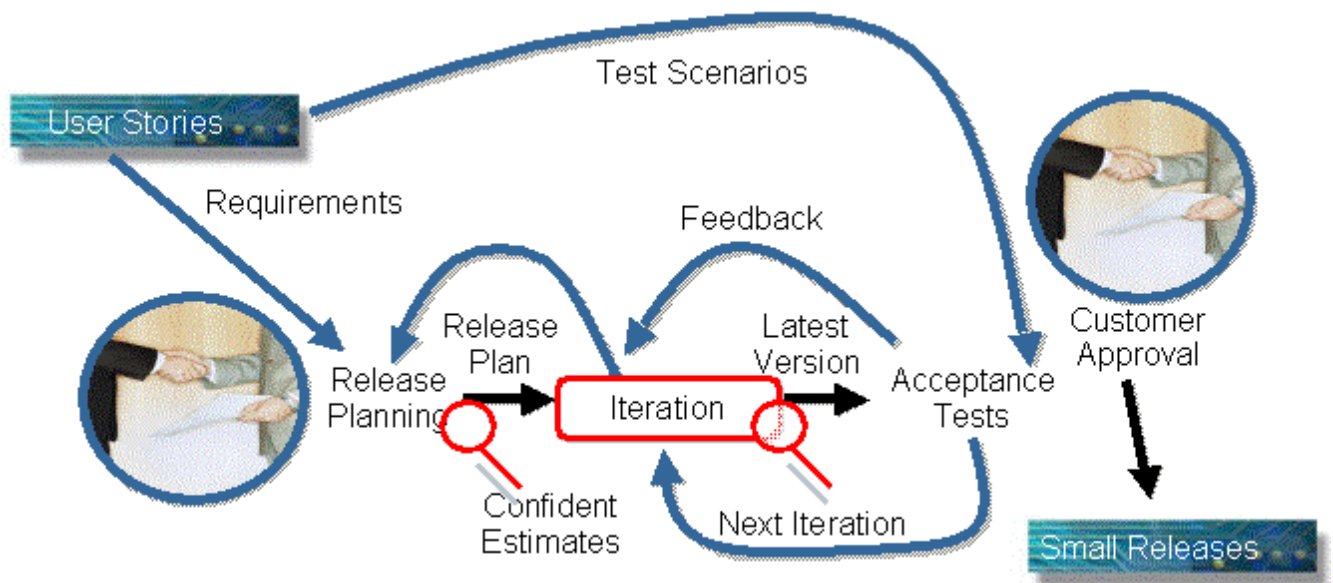


Figure 4: Extreme Programming (XP).

3.3 Advantages of Extreme Programming

XP has several advantages, some of these:

- Customer focus increase the chance that the software product will actually meet The needs of the users
- The focus on small, incremental release decreases the risk of your project:
 - By showing that your approach works and
 - By putting functionality in the hands of your users, enabling them to provide timely feedback regarding your work.
- Continuous testing and integration helps to increase the quality of your work
- XP is attractive to programmers who normally are unwilling to adopt a software process, enabling your organization to manage its software efforts better.

3.4 Extreme Programming Values

XP is not really a set of rules, but rather a way to work in harmony with your personal and corporate values. It is a lightweight discipline of software development based on values of simplicity, communication, feedback, and courage. These are values, which, if implemented correctly, will improve any software development project [21]. These values can be summarized as follows:

- **Simplicity:** XP is betting that it is better to do a simple thing today and pay a little more tomorrow to change it if it needs it, than to do a more complicated thing today that may never be used anyway. Further, it encourages starting with the simplest solution then, extra functionality can be added later. This maximizes the value created for the investment. Programmers take small simple steps to their goal and mitigate failures as they happen.
- **Communication:** XP aims to keep the right communications flowing by employing many practices that cannot be done without communicating. They are practices that make short-term sense, like unit testing, pair programming, and task estimation. The effect of testing, pairing, and estimating is that programmers and customers and managers have to communicate. Everyone is part of the team and

they communicate face to face daily. The teams work together on everything from requirements to code.

- **Feedback:** Feedback works at different time scales. At the scale of minutes and days, programmers write unit tests for all the logic in the system that could possibly break. The programmers have minute-by-minute concrete feedback about the state of their system. When customers write new "stories", the programmers immediately estimate them, So the customers have concrete feedback about the quality of their stories. The person who tracks progress watches the completion of the tasks to give the whole team feedback about whether they are likely to finish everything they set out to do in a span of time. Feedback also works at the scale of weeks and months, where customers and testers write functional tests for all the stories implemented by the system. They have concrete feedback about the current state of their system. The customers review the schedule every two or three weeks to see if the team's overall velocity matches the plan, and to adjust the plan.
- **Courage:** the team tells the truth about progress and estimates. They do not document Excuses for failure because they plan to succeed. Communication supports courage because it opens the possibility for more high-risk, high-reward experiments. Simplicity also supports courage because you can afford to be much more courageous with a simple system. Further, courage supports simplicity because as soon as you see the possibility of simplifying the system you try it. Concrete feedback supports courage because you feel much safer trying radical surgery on the code if you can push a button and see the tests turn green at the end [22].

3.4 Extreme Programming Phases

Extreme Programming can be implemented by a disciplined methodology that focuses prim airily on customer satisfaction. As all other software engineering methods, the process in XP is similar to the process used elsewhere. In fact, we can divide the

above discussed practices into four clear progressions that are the planning, the design, the coding and the testing.

Figure (5) Show The Extreme Programming Phases.

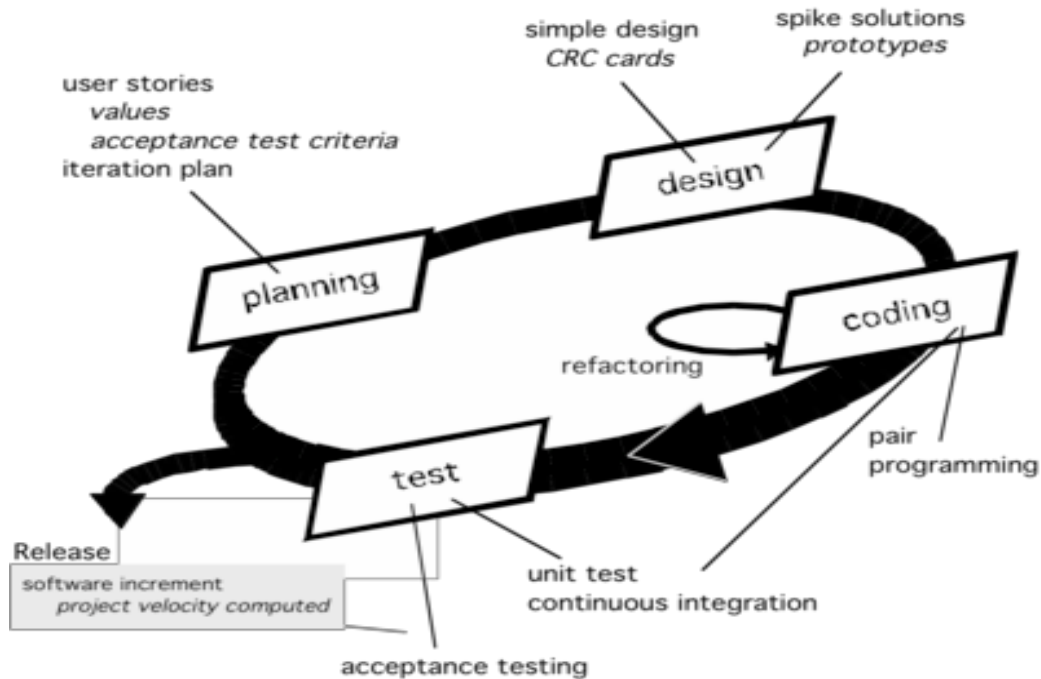


Figure 5: Extreme Programming Phases

3.4.1 Planning phase

The development team interviewed the customer to determine user stories about how the system will work: project is a mobile app prototype for primary schools supported by Augmented Reality. Camera of the application will be opened when user open the application. When the students make any page of the Islamic Studies book appears on the camera, the application will show a 3d object or video according to the lesson and the page that is opened.

Then, user stories were combined or split to come up with a story that can be described on a Class-Responsibility Collaboration (CRC) card and completed by a pair of programmers during one release cycle. The customer prioritized the cards according to the business value of the user stories, which puts stories into the release schedule based

on the development resources available. This lets customers have an accurate commitment schedule. After each release, the customer had a system that works according to the stories completed so far; they do not have to wait for the whole thing to be done to start using the initial functionality. The development group identified which stories are risky to complete on time and does worst things first based on a spike solution. The project requirement specification will be described based on requirements gathering mechanisms which used in project analysis by using modeling language (UML) that shown below.

3.4.1.1 Use Case Diagram

Use case diagram will be developed to show the interactions between the user and the system and to capture the dynamic aspects of the system [23].

As shown in figure (6), Student can open the application, turn on the camera, and start using the application. Also, students can open about the application interface. Finally, after turning the camera on, the application can detect the images and view video, 3d shapes.

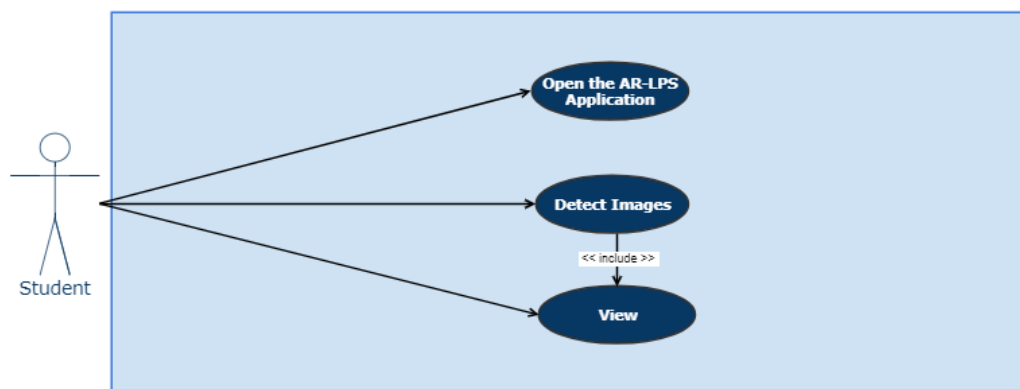


Figure 6: User Use Case

Brief Use Case Description

The Student who is the main actor in AR-LPS app, he can do some of the process:

- Open the application.
- Go to about app page: when the user presses on about app button in the main menu page, he will go to about app page.
- Open camera: when the user presses on start button, he will go to AR camera.

- Exit: when user presses on exit button, app will be closed.
- The camera include detects image to make process and view 3d shapes or videos.

3.4.1.2 User Sequence Diagrams

As shown in figure (7). When the user opens the application, camera will be opened, then the image that the camera see will be detected and it will send the image to unity process. After that, the unity process will translate the image that the cameras show into 3d objects or videos.

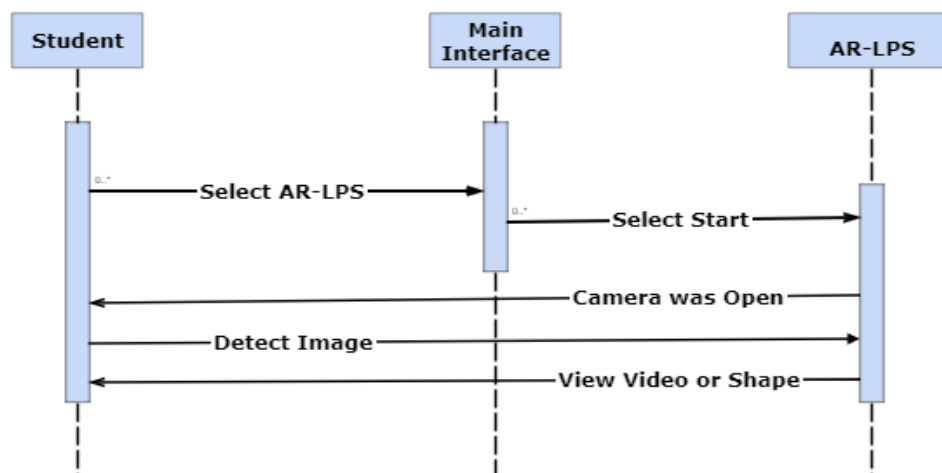


Figure 7: User Sequence Diagrams

3.4.2 Design Phase

We started design our project by built some sketches especially for it to show how the product will become after the design is finished.

Figure (8): Show The User Interface Sketches.

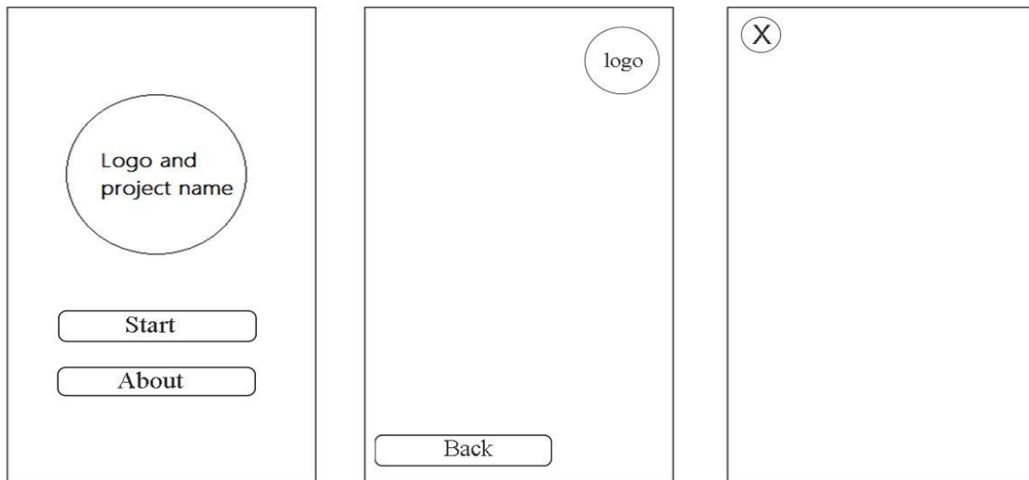


Figure 8: User Interface Sketches

Then we convert the sketches into design by used photo shop program, we designed project logo, main menu, about page and loading page, follow the graphics below.

3.4.2.1 Project logo

Figure (9): Show the Project Image Logo.



Figure 9: Project Image Logo

3.4.2.2 Main Menu

Figure (10): Show the Project Main Menu that can access to AR camera or about page.

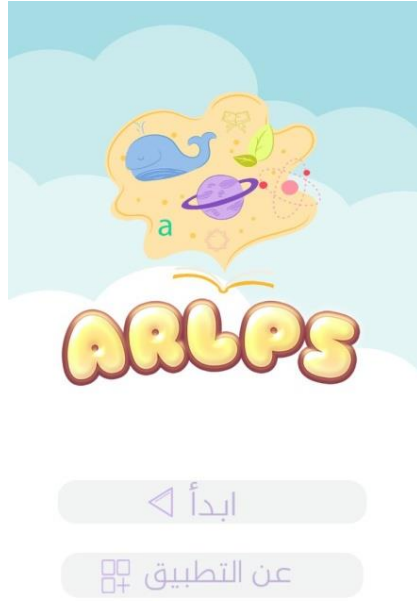


Figure 10: The Project Main Menu Page

3.4.2.3 Loading

Figure (11): show the Project Loading Image.

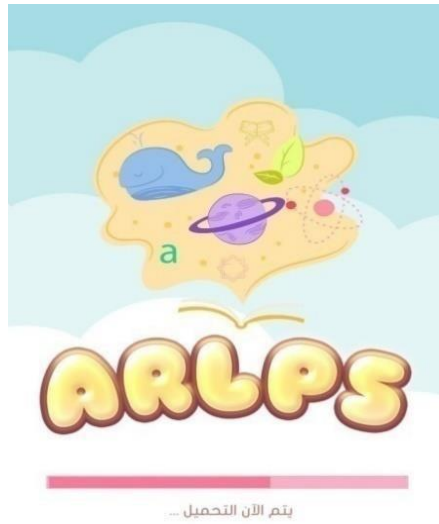


Figure 11: The Project Loading Image

3.4.2.4 About Application

Figure (12): Show the Project Overview and some Instructions to Use it



Figure 12: Project Overview and some Instructions to Use it

3.4.2.5 Design Implementation

The system developed by using development tools and platform, this project used many tools and 3D engine to become app ready to use.

The tools which this program use:

Camtasia studio 8: Camtasia is video editor has everything you need to make amazing videos, we used it to make our learning videos, firstly we collected the senses and the picture we made on Adobe Photoshop, then we recorded our sounds and added it to the movies.

3D Max: 3D Max is a professional 3D computer graphics program for making 3D animations, models, games and produced by Autodesk Media and Entertainment, it has modeling capabilities and a flexible plug-in architecture and can be used on the

Microsoft Windows platform and we used 3D max to design some 3D objects like: trees.

Unity 3D Engine: Unity is a cross-platform game engine developed by Unity Technologies and used to develop games for mobile devices. On the other hand, we used unity 3d to build Scene and AR APK app in some steps, firstly was building AR camera Scene Which Contain the base image targets, then we created other object, videos and added them to unity to combine to the old shape that add recently, after that we built other scene in unity such as: about application scene and lodging scene, finally we created the main menu scene and its contain the start button and About application button which built by Adobe Photoshop. On the other hand, this project used Vuforia videos packages and imported it to unity to apply it on image targets.

3.4.3 Coding Phase

Team working together in the code, to insure that the entire development team achieves Code Stewardship. Code Stewardship is the opposite of Code Ownership, emphasizing that code is the team's property, and not the sole province of any one person or pair. Programmers coded Unit Tests first. Programmers followed the coding conventions (standards) whenever they wrote a new code, and while them refractory mercilessly. Then written code was integrated, typically each day and was optimized as it is written so that there is no need for revision afterwards. Coding was done according to the corresponding user stories written in the order that the customer informs. Each story was written stand alone and at the end of the day integrated into the rest of the project.

A program was written based on piece of code for every scene and for every object. We used C# for unity to develop the software. First code was to made video package active

in unity, second code give the button function, such as: exit button, we wrote the function that can exit the app, then the start button: we wrote a method that go to augmented reality camera and finally the back button, its function written in c# to back to the main menu Scene and in this way the buttons work last.

We wrote c# function that turn on sound when the image target found then sound stop when the image.

Notice: all codes and functions attached in the CD with the APK file and document.

3.4.4 Testing Phase

Included Unity Tests for all code, creating tests when bug was found, and run Acceptance Tests. With extreme testing the software was developed more quickly, with more confidence, and with higher quality. Extreme Testing was conducted by two tests: unit tests and functional tests. Unit Tests let developers evolved the system rapidly and with confidence. Unit Tests for every feature were written before coding to ensure that new features work. Then, all; the Unit tests in the entire system were run before any code is released. When every Unity Test in the entire system run 100% that showed us not just that the new feature works, but that the changes had not broken anything anywhere. On the other hand, functional tests were used to check each increment to see if the value was there. These tests gave customers and developers confidence that the whole product is progressing in the right direction.

System testing is the prime objective of any software product. It conducts testing of whole software product to identify the errors in software.

There are two Category of Software Testing:

1. **Black box testing:** is a testing technique that ignores the internal mechanism of the system and focuses on the output generated against any input and execution of the system. It is also called functional testing [24].

We tested AR-LPS application using Sony, Samsung device that support android operating system. android devices we tested the functionality of an application open

camera correctly and augmented reality details about the prototype was viewed correctly.

- 2. White-box testing:** is a testing technique that takes into account the internal mechanism of a system. It is also called structural testing and glass box testing [25]. We tested AR-LPS application using Manymo emulator to check if the C# code and the unity scene components are built and written correctly.

3.4.4.1 Unity Testing

Testing in unity mean Validate the APK file, all component On the other hand we test that by play it in unity game engine before try it to the android devices and we used Manymo emulator to try it on virtual operating system Android Devices.

The application was tested for compatibility with different screen sizes and with different version of android, the app was tested and run on Samsung galaxy S3, Sony xperiaZ2 and HTC desire 820. The code was tested during programming phase with Mano C# Compiler that by check if the class and function are write correctly and by developer check if the correct code are given to the correct button and test all function doing the correct process.

3.4.4.2 Program Testing

The project was tested during the usage of students where they were conducting several experiments in Al-Zahra school in Gaza. Some of students tried it.

3.4.4.2 Test Environment

Mobile applications are first tested within the development environment using emulators and later subjected to real device testing. Emulators provide an inexpensive way to test applications on mobile phones the following tools that used for test environment our Android project.

- **Emulators:** Mobile emulators help us test our project on different devices without having to actually have them on hand. These technologies serve as virtual pieces of hardware that operate on a PC or laptop. By emulator, we can choose the sizes and OS versions, or even modules to test. And verify certain functionality that is not specific to any device, carrier or operating system.
- **Real Devices:** AR-LPS experimented by running on real devices for android application devices like Sony, Samsung, HTC are used. Testing on real handsets gives reliable and accurate results, gives interoperability testing because performed on a live provide UX user experience by end users.

3.4.4.3 Checklist AR-LPS App Testing

This checklist is specifically designed to test the characteristics of AR-LPS project. Obviously, it tests only generic project characteristics and not the functionality of the project. For this, a separate test approach and test script must be created. The same goes off course for performance testing, usability testing, security testing and other testing activities necessary for our app.

For business advisor app, the checklist split into three different fields:

- Device specific characteristics. These are characteristics that are related to the device on which the app is installed.
- The application checks. These are things to check that have to do with functionality that is frequently used in an app.
- App user interface checks.

1. Device Specific Checks.

Table 2: Device Specific Checks

#	Description	Yes / No	Remarks
1.1	Does the app continue its work as desired when there is an incoming SMS ?	Yes	A
1.2	Does the app continue its work as desired when there is an incoming call ?	NO	A
1.3	Does the app continue its work as desired when the charger is connected ?	Yes	A
1.4	Does the app continue its work as desired when the charger is disconnected ?	Yes	A
1.5	Does the app continue its work as desired when a local message is coming from another app ?	Yes	A
1.6	Does the app continue its work as desired when the device starts again from lock screen ?	Yes	A
1.7	Does the app continue its work as desired when the device is tilted ?	Yes	A
1.8	Does the app continue its work as desired when the device starts again from sleeping mode ?	Yes	A
1.9	Does the app continue its work as desired when a push message is coming from another app ?	No	A
1.10	Is the functionality of all the buttons or keys on the device defined for this app ?	NO	A
1.11	Does the app express its content ?	Yes	A
1.12	Does the back button active and goes back to the previous page ?	Yes	A
1.13	Does the exit button go out from application?	Yes	A
1.14	Does the app continue its work as desired when the device is in Airplane mode?	Yes	A

1.15	Does the app continue its work as desired when the sound on the Device is turned off ?	Yes	A
1.16	Does the app continue its work as Desired when the Battery low? Message is pushed ?	Yes	A
1.17	Can the app be uninstalled from the device ?	Yes	A
1.18	Does the back button get the user back to the home screen of the device, In status there's a true "back" button available on the device?	Yes	A
1.19	Does the app continue its work as desired when a notification is Coming from another app?	Yes	A

2. The Application checks

Table 3: The Application checks

#	Description	Yes / No	Remarks
2.1	Does The name of the application must be clear and expressed?	Yes	A
2.2	Does the app limit or clean the amount of cached data?	Yes	N
2.3	In status the size of the application is greater than allowed on these networks, does the download of the application blocked through cellular networks?	No	A
2.4	Confirm most common signal used to control the app?	Yes	A
2.5	Does The application has been examined on more than one device and different versions of OS?	Yes	A
2.6	Stability check: if the app has a list (for instance of pictures) in it, try scrolling through it at high speed	Yes	A

2.7	Stability check: if the app has a list (for instance of pictures) in it, try scrolling to before the first picture or behind the last picture.	Yes	A
2.8	Does the app goes into sleep mode if it's done Running in the background?	Yes	A
2.9	Integration: does the app connect correctly to the different social networks (LinkedIn, twitter, face book, etc.).	No	N

3. App User interface checks.

Table 4: App User Interface Checks

#	Description	Yes / No	Remarks
3.1	Availability for users to go back to a previous screen for instance by adding a back or cancel button.	Yes	A
3.2	In the application, the user ought to not be detected the permissions of specific files	Yes	A
3.3	The appearance of buttons that perform standard actions are not altered in the app	Yes	A
3.4	The basic function of the application should be straightforward And to explain herself with herself	Yes	A
3.5	If the performance is weak, show it through the icon (loading), preferably with a message showing the reason.	No	A
3.6	The definition of gestures in an application that has a standard or general meaning is not redefined For example: (drag on screen from top to bottom does center notifications).	Yes	A

3.7	Do not use standard buttons for functions other than the basic functions that are designed for them	Yes	A
3.8	The app must interact with changes in device orientation (horizontal, vertical), as well as changes in design	Yes	N
3.9	Can you differentiate between the active buttons The buttons are inactive	Yes	A
3.10	Tap able elements should be about 7x7 mm in size, using the pixel density of the target device you can calculate the amount of pixels (chapter documentation contains a link to different devices compared).	Yes	A
3.11	Use at least one action in the most commonly used user interface	Yes	A
3.12	In an app, the user should not be able to store files locally, outside the app sandbox.	Yes	A

3.4.5 Maintenance

Bugs and errors are removed at this phase; Application maintenance was automated in this system for the purpose of correcting faults, improving performance or adapting the system to a new environment. The programmatically implemented software module is tested for the correct output.

In the process of testing, a series of tests and test cases are performed to check the module for bugs, faults, and other errors. Erroneous codes are written and tested again until desired output is achieved.

3.5 Summary

We choose carefully the methodology that will help us to develop the project perfectly

and leading it to the success. According to the project objectives and the advantages of each methodology we decide to use the Extreme Programming (XP) which is the most appropriate methodology for our project because of the reasons we discussed in this chapter.

CHAPTER (4)
USABILITY AND EVALUATION

4.1 Introduction

This chapter will explain usability and evaluation phase, how the usability of the project is. In addition, the evaluation of the system will be viewed.

4.2 Usability

The usable system is one that enables users to perform their job effectively and efficiently.

Usability is one of the most important attributes of the system quality, it includes efficiency and effectiveness. It also includes the satisfaction of performing the system's tasks by users of the system.

In the other hand, Usability describes the quality of user experience of using the system and interacting with it. The process of evaluation the system is an essential part of the system development process. A variety of usability evaluation methods are needed in a development process, because usability is a complex multidimensional concept that should be looked at in many ways in the other hand we asked teachers and students who used AR-LPS app to write Their opinion and answer the questioner and Count on that our app is easy to learn and easy to use. This application is easy to use by user like viewing it by simple interfaces, Through the use of user experience (UX) designs Simplicity Usability based on learnability, efficiency, memorability, errors and satisfaction. It includes looking at, capturing, and stating requirements based around user interface issues, things such as accessibility, interface aesthetics and consistency within the user interface. Usability requirements include: Attractiveness: -The system shall be designed so that it attracts the user. Ease of Use: -The critical path (e.g. image detection, auto select) shall be clear, with no distractions on route. -Graphical user interfaces shall be well formed.

4.3 Evaluation

It is important that users take the system's view and take their observations, so that the strengths and weaknesses of programs, policies, employees, products and organizations are evaluated to improve their effectiveness. Since the system has users whose opinion of the system is very important, a sample of school teachers and some students were consulted to evaluate the mobile application.

4.3.1 End-user evaluation

Thirty teachers were selected to test the mobile application by using it. After that, a questioner has been distributed to those chosen 30 teachers in order to evaluate the mobile application. After that, a number of students in 3rd grade in Al-Zahra primary school were asked to use the mobile application and test it in order to evaluate the system based on the users of the application.

The questioner was divided into two parts; the first one includes general information about the user who fulfills the questioner including the gender, age, qualification, and their experience in using the web systems, websites and mobile applications.

The second part of the questioner is to evaluate the system, it includes three groups. Each group evaluates the participant's opinion about specific consideration about the system. The data was entered, filtered, and analyzed using MS Excel. **The questioner is shown in Appendix A.**

4.3.2 Questioner results.

As shown in figure (13), 63% of participants were males and 37% were females.

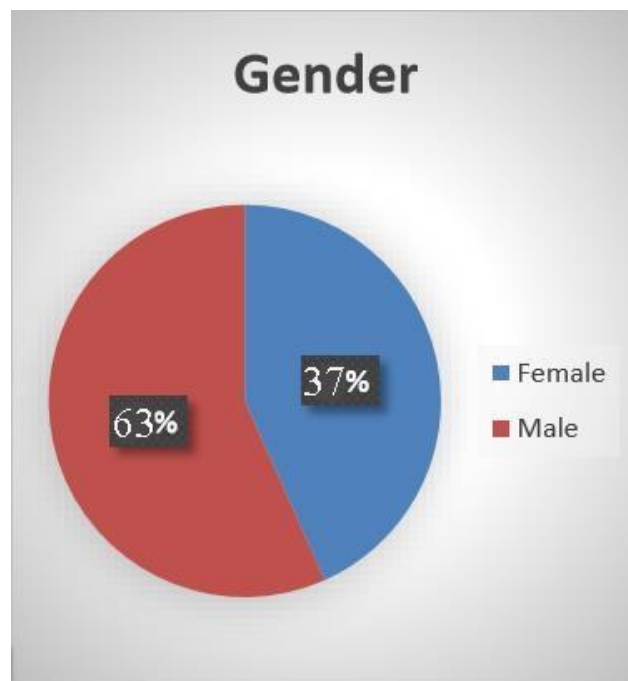


Figure 13: Distribution of Users According to Gender

On the other hand, about 40% of them were between 25-30 years old, 30% between 19-24 years old, and 20% above 30 years old and finally, 10% of them were between 15-18 years old. Shown in figure (14).

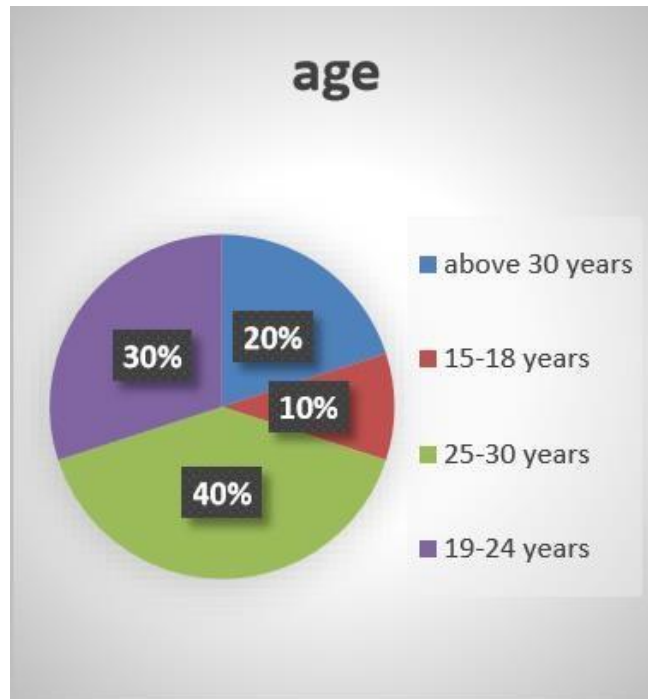


Figure 14: Distribution of Users According to Age

As it shown in figure (15), 53% have a bachelor's degree, 27% have diploma degree, 17% have master degree, and only 3% have doctor degree.



Figure 15: Distribution of Users According to Qualification

As shown in figure (16), unexpected number of participants have never deal with Augmented Reality systems, they were 87% of the participants. The other 13% of them know the augmented reality systems for one or two years, but no one deal with AR systems for more than two years.

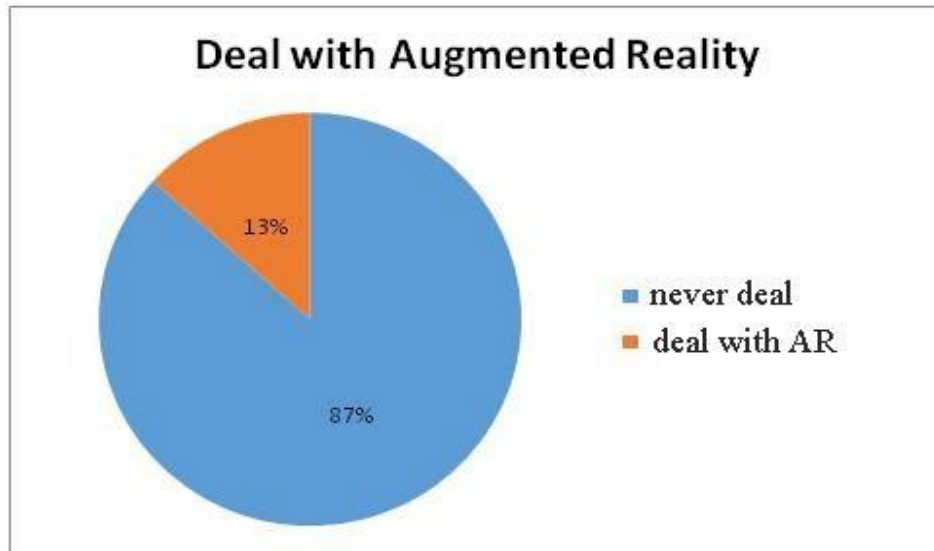


Figure 16: Experience in using AR

Regarding Benefit of the project, participants were asked to evaluate the Benefit of The project from their point of view and after using the system. Result shown in figure (18), About 42% of them strongly agree that the project is benefit for learning objectives About 53% of them strongly agree that the system is provides learning in a short period of time about 64% of them agree that easy to learn by use the project About 50% of them agree that in general, the system improve education for children.

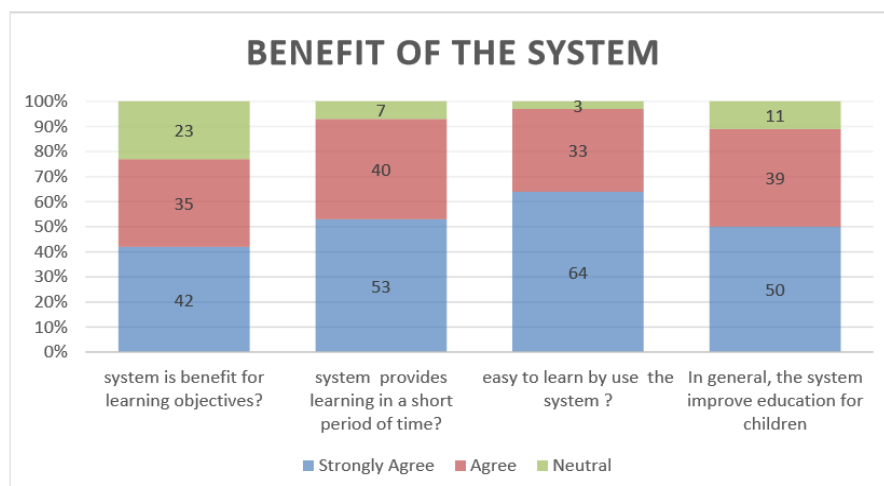


Figure 17: Benefit of the Project

Concerning the Satisfaction of the application Result shown in figure (19), about 47% of them agree Happy and grateful for the use of the application. About 55% of them strongly agree pleased with the application, about 60 % of them agree application works the way that’s I want. About 40 of them agree in general, satisfied with ease of use of the application.

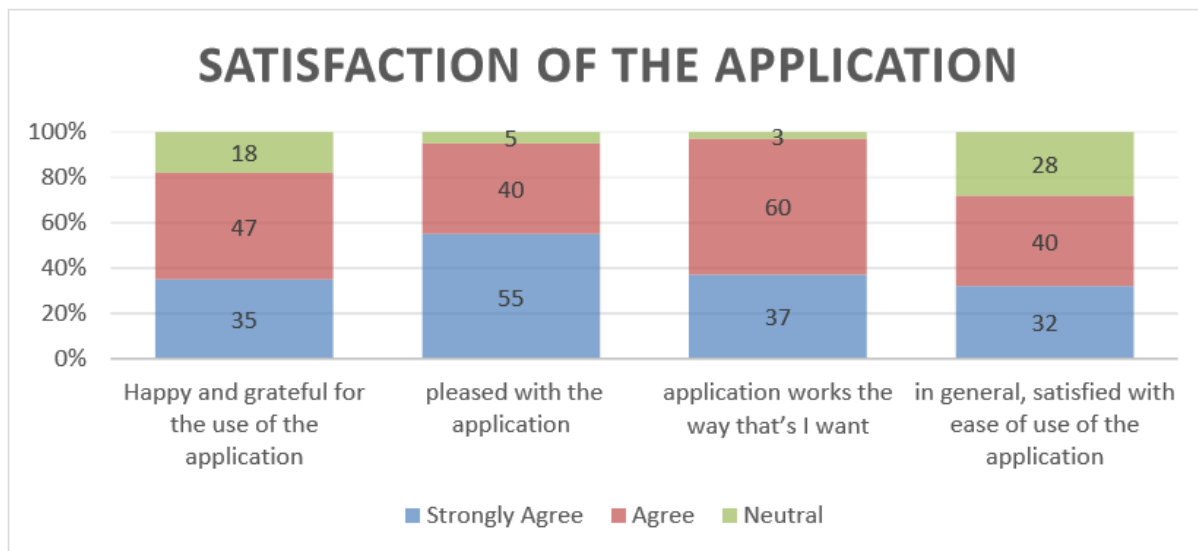


Figure 18: End-users’ perceptions about Satisfaction of the project

The last group in the evaluation was about the Intend to use the application Result shown in figure (20), about 58% of them strongly agree intend to use an application for educational purposes, about 54% of them strongly agree intend to use the application constantly. About 54% of them agree prefer AR-LPS over other applications, about 73% of them agree recommend using the application.

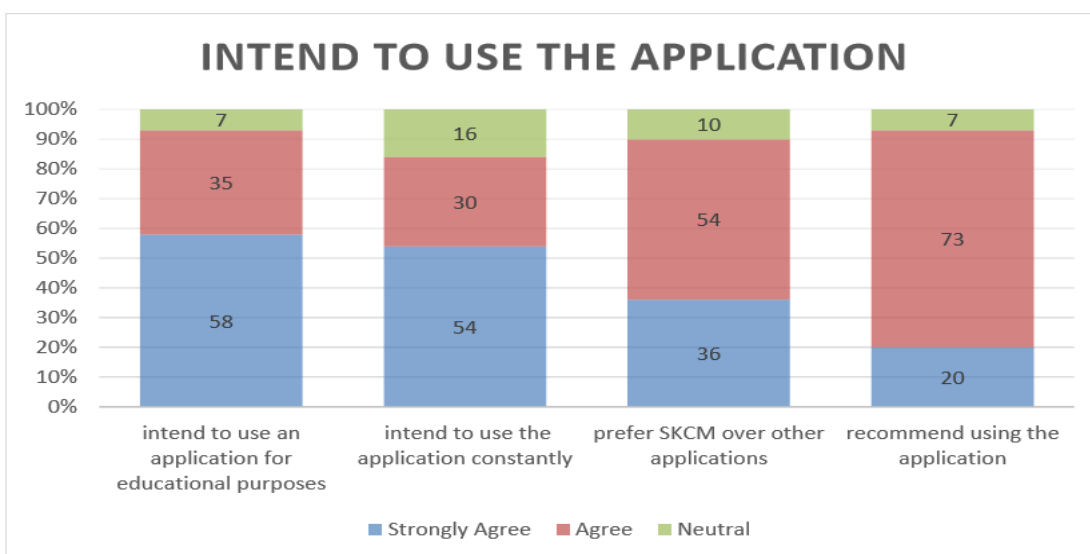


Figure 19: End-users’ perceptions about intend of the Application

4.4 Summary

This chapter summarizes the usability and evolution process for AR-LPS project along with shading some light upon the purpose of evaluation checklist which shows major evaluation criteria that essential to our project and how it will operate in different levels and which will explain the main points that have been relied upon to evaluate the application, to include all aspects of the project.

CHAPTER (5)
DISCUSSION , FUTURE WORK, AND CONCLUSIN

5.1 Introduction

This chapter displays the life of the project, how we inspired the idea, how we implemented it. Also, the chapter includes the conclusion of the study and suggested future works to develop the System, make it more reliable and make it able to satisfy learning requirements.

5.2 Discussion

The spread of augmented reality in the last few years led us to form a concept to support it. We searched for a suitable category to apply the concept on a specific field. In this category, we aimed to increase people's awareness about augmented reality, then we chose the children category for enforcing our concept because they are the generation of the future, also parents are supposed to have a comprehensive knowledge about the concept. So we found that the education field is the most attractive & important one for the children's life, after that we visited AL Zahra Private school then we met the director & the staff we talked along to have a lot of information to decide the best class which is suitable for applying our notion. We selected the Islamic Subject as a first model of our concept because it contains different types of subjects, in addition it is the most important subject that children want to learn because it has a lot of educational means about our Islam.

We designed 3D objects on 3Max & some simple videos on Camtasia multimedia programs, then we entered them into UNITY programs to convert it in the augmented reality environment, we started enforcing the application.

5.3 Future work

There are some features and ideas that can be considered as a future work for this project. These ideas and features can be summarized in the following points:

- Implement all of the materials of all basic schools from 1st grade to 6th grade.
- Improve the application content in which after every lesson there is an exercise the student should do.
- Implement Virtual Reality technology on the lessons which needs interaction from the students.

- Allow the users to modify the content of videos and 3d images in which they can move it and change its place.
- Develop an application that works on Apple IOS mobile platforms.

5.4 Conclusion

With the continuous development of technology in recent years, demanding in terms of quality of life still increasing.

In the other hand, E-learning has become the biggest concerns of the world.

We decided to use the Augmented Reality technology as a solution to follow international trends and development in schools in Gaza. Technology can be a valuable assistant to the students in order to increase interactive with kids drive to achieve better results in education.

This project discussed the design and development of a Simulating 3rd class curriculum in Al-Zahra school by this mobile application for kids in schools. Extreme Programming was used to develop the system as the software development Methodology.

It began by examining the functional and non-functional requirements of the system through different brainstorming sessions, interviews with experts and Teachers in kindergarten. The functional and non-functional requirements were formed and analyzed using different UML techniques which are use -case diagrams, sequence diagrams and activity diagrams.

The design of the system was then presented and analyzed. After the design, the implementation of the design is discussed. Then, is the test analysis section, which discussed whether the proposed system met its objectives. Performance is also evaluated near the end of the paper along with possible extensions of the system.

Regarding to the evaluation and feedback and multiple positive opinions of the system, and we can say that that the idea of simulating school's curriculum is applicable and can be implemented in Gaza Strip.

Appendix A

Questionnaire of evaluation AR-LPS Project

استبيان

الأخ الفاضل / الأخت الفاضلة : السلام عليكم ورحمة الله وبركاته
تهدف هذه الاستبانة لمعرفة مدى رضاك وقبولك لدمج التكنولوجيا مع التعليم وتطبيق نظام الواقع المعزز في مناهج المدارس الأساسية في مدينة غزة.

شكراً على تعاونك معنا

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أولاً: معلومات عامة:

هذا القسم يتعلق بالمعلومات الشخصية الخاصة بك، لذا يُرجى ملئ الفراغات ووضع علامة (√) حول الإجابة المناسبة (يُرجى وضع علامة واحدة فقط).

- 1- الجنس ذكر [] أنثى []
- 2- العمر من ٢٠ إلى ٣٠ [] من ٣٠ إلى ٥٠ [] أكثر من ٥٠ سنة []
- 3- المؤهل العلمي دبلوم [] بكالوريوس [] ماجستير [] دكتوراه []
- 4- تجربتك مع أنظمة الواقع المعزز ومدى معرفتك عنها؟ [] لم تعامل مع أنظمة الواقع المعزز [] أكثر من سنتين
- 5- هل تمتلك هاتف ذكي بنظام أندرويد ؟ [] نعم [] لا

ثانياً: عوامل قبول نظام الواقع المعزز في التعليم

بعد قراءتك للخيارات أدناه، يمكنك استخدام الأرقام من ١ إلى ٥ كالتالي:

(١ = معارض بشدة ، ٢ = معارض ، ٣ = محايد ، ٤ = موافق ، ٥ = موافق بشدة)

١. تهدف هذه المجموعة من الأسئلة لفهم وجهة نظرك تجاه الفائدة من استخدام نظام الواقع المعزز في التعليم						
1	استخدام نظام الواقع المعزز في التعليم يساعد على إنجاز المهام بسرعة أكبر.	1	2	3	4	5
٢	استخدام نظام الواقع المعزز في التعليم أسهل من استخدام النظام التقليدي.	1	2	3	4	5
٣	أجد الفائدة في تطبيق الواقع المعزز في البيئة التعليمية.	1	2	3	4	5

١. تهدف هذه المجموعة من الأسئلة لفهم وجهة نظرك تجاه سهولة استخدام نظام الواقع المعزز في التعليم						
1	أجد سهولة وبساطة في تعلم واستخدام نظام الواقع المعزز في التعليم	1	2	3	4	5
2	التفاعل مع نظام الواقع المعزز في التعليم واضح ومفهوم	1	2	3	4	5
٣	من وجهة نظري أجد أن التفاعل مع نظام الواقع المعزز في التعليم سهل وواضح	1	2	3	4	5

١. تهدف هذه المجموعة من الأسئلة لفهم النتائج المترتبة على استخدام نظام الواقع المعزز في التعليم في المستقبل						
1	أجد أنه من الجيد تطبيق نظام الواقع المعزز في التعليم في المستقبل.	1	2	3	4	5
٢	أعتقد أنه من الجيد استخدام نظام الواقع المعزز في التعليم بشكل منتظم في المستقبل.	1	2	3	4	5
٣	أنصح باستخدام نظام الواقع المعزز في التعليم.	1	2	3	4	5

شكراً لتعاونكم معنا

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