Mobile Application for Simulated Archaeological Places

(M-SAP)

Submitted by

Ahmed Alagha
Ahmed Tabash
Alaa Tabash
Jawad Alghlainy

Supervised by

Eng. Rasha Atallah

University of Palestine (UP)

©2016
Acknowledgment

Some days has passed from our age that we started with step, and we are here now collecting the frail suck years. Our goal was clear and we tried every day to achieve it no matter how difficult it was. Here we are new front of you holding a torch of knowledge that we keeping from being dark.

Firstly, we thank Allah for his help and who support us. To our beloved mothers who stood with us in all that difficult times, they are our Candles what burnt to light up our ways. And to our fathers who taught us how to fight. Allah bless them all.

To our teachers who are our idols and guides to the way of knowledge and Science and who we are proud of. To our friends and relatives who supported us in our educational walk and who gave us their lights in the dark nights what beautiful days we lived together.
Abstract

Creativity meaning become in the use of optimal technology as solution of human life problems. Tourist around the world are expanding structurally at a rapid rate especially when the number of tourist gets greater and greater with every enrollment period. Due to a weakness in tourism and a lack of Number of mentors less than required inside the museums. Software provider that supports the Android platform are dealing with a class of tourists to explain details of archaeological artifacts in the museum as a tour guide feature augmented reality (AR) where archeological masterpiece shows the name, and there is a global archaeological antiques written about the details of the application, and there are archaeological places Omari Mosque, and the Augmented Reality a technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view, we have been used phases (RAD Methodology) in the application of project by The lack of extensive pre-planning allows General have software much faster also makes it easier to change the requirements.

After the process of collecting the questionnaires are encoded and inserted a computer and processed statistically using the (SPSS) Here are the results many of questioners has distributed to companies and acceptance ratio got 88%, Although we have not reached the final aim of creating an application which was able to show all objects (relics) in the museum, but we just introduced two pieces of objects, we have done most of the necessary steps to achieve it.
Table of contents

CHAPTER 1 ........................................................................................................ 1

INTRODUCTION ................................................................................................. 1

1.1 Background ................................................................................................. 2
1.2 Motivation for the Project ........................................................................... 2
1.3 Problem Statement ..................................................................................... 3
1.4 Project Objectives ....................................................................................... 3
1.5 Significance of the Project .......................................................................... 3
1.6 Scope and limitations .................................................................................. 3

CHAPTER 2 ....................................................................................................... 4

LITERATURE REVIEW ...................................................................................... 4

2.1 Introduction .................................................................................................. 5
2.2 Technologies used ....................................................................................... 5
2.2.1 Software technology for MySQL database: ........................................... 5
2.2.2 Software Technologies for i3D Applications: ...................................... 5
2.2.3 Texture Creation Tools ......................................................................... 5
2.2.4 3D Landscape and Plant Creation Tools ............................................. 6
2.3 Archaeology ............................................................................................... 6
2.4 Usability Evaluation ................................................................................... 6
2.5 Related Work............................................................................................. 6
2.5.1 “Wikitude” ........................................................................................... 6
2.5.2 "SketchUp Mobile Viewer" ................................................................... 8
2.5.3 "ViewUp" ............................................................................................. 8
2.5.4 M-SAP application VS existing systems ............................................ 9
2.6 Summary .................................................................................................... 9

CHAPTER 3 ....................................................................................................... 10

METHODOLOGY ............................................................................................ 10

3.1 Introduction ................................................................................................ 11
3.2 Design Research Methodology ................................................................... 11
3.3 RAD model ............................................................................................... 12
3.3.1 Advantages of RAD Software Development ..................................... 13
3.3.2 RAD Software Development – Tip ................................................... 13
3.4 RAD Model Phases .................................................................................. 13
CHAPTER 4
REQUIREMENT AND ANALYSIS

4.1 Introduction
4.2 Functional Requirements
4.3 Non-functional Requirements
4.3.1 Usability Requirements
4.3.2 Availability Requirements
4.3.3 Security Requirements
4.4 Application Perspective
4.5 Requirements Analysis
4.6 Use Case Diagrams
1.6.1 User Use Case Diagrams
1.6.2 Admin Use Case Diagrams
4.7 Sequence Diagrams
4.7.1 User Sequence Diagrams
4.7.2 Admin Sequence Diagrams
4.8 Activity Diagrams
4.8.1 User Activity Diagrams
4.8.2 Admin Activity Diagrams

CHAPTER 5
DESIGN AND IMPLEMENTATION

5.1 Introduction
5.2 System Requirement
5.3 System Architecture
5.4 Technology Choices
5.5 Android Application GUI
5.6 Database Tables
5.7 Implementation
5.8 Development Tools
# CHAPTER 6

**TESTING AND EVALUATION**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 Testing</td>
<td>36</td>
</tr>
<tr>
<td>6.2 Purpose of testing</td>
<td>36</td>
</tr>
<tr>
<td>6.3 Important of testing</td>
<td>37</td>
</tr>
<tr>
<td>6.4 What is involved in a software test program?</td>
<td>37</td>
</tr>
<tr>
<td>6.5 Test Environment</td>
<td>38</td>
</tr>
<tr>
<td>6.6 Checklist M-SAP App Testing</td>
<td>38</td>
</tr>
<tr>
<td>6.7 Maintenance</td>
<td>48</td>
</tr>
<tr>
<td>6.8 Evaluation</td>
<td>49</td>
</tr>
<tr>
<td>6.9 Usability Evaluation</td>
<td>49</td>
</tr>
<tr>
<td>6.10 User Evaluation</td>
<td>49</td>
</tr>
<tr>
<td>6.11 Availability Evaluation</td>
<td>49</td>
</tr>
<tr>
<td>6.12 Security Evaluation</td>
<td>50</td>
</tr>
<tr>
<td>6.13 Results</td>
<td>50</td>
</tr>
</tbody>
</table>

# CHAPTER 7

**CONCLUSION AND FUTURE WORK**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1 Conclusion</td>
<td>53</td>
</tr>
<tr>
<td>7.2 Future Works</td>
<td>53</td>
</tr>
</tbody>
</table>

**References**

**Appendix A: Explanation some points in documentation**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1 Android Architecture</td>
<td>55</td>
</tr>
<tr>
<td>A.2 System Architecture</td>
<td>56</td>
</tr>
</tbody>
</table>

**Appendix B: Evaluation Questionnaire of M-SAP**

<table>
<thead>
<tr>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
</tr>
</tbody>
</table>
List of figures

Figure 1: Following image illustrates the RAD Model [4] .................................................. 11
Figure 2: User Use Case Diagrams .................................................................................. 19
Figure 3: Admin Use Case Diagrams .............................................................................. 21
Figure 4: User Sequence Diagram for unity ................................................................. 23
Figure 5: User Sequence Diagrams for museum .......................................................... 23
Figure 6: Admin Sequence Diagrams ............................................................................. 24
Figure 7: User Activity Diagrams .................................................................................. 25
Figure 8: Admin Activity Diagrams .............................................................................. 26
Figure 9: Database System Architecture ...................................................................... 29
Figure 10: Logo of project ............................................................................................. 30
Figure 11: Loading .......................................................................................................... 31
Figure 12: About ............................................................................................................. 31
Figure 13: Main Activity ................................................................................................. 32
Figure 14: List of relic’s simulation ............................................................................... 32
Figure 15: Database Tables ............................................................................................ 33
Figure 16: Database schema ........................................................................................ 33
Figure 17: Android Architecture ................................................................................... 55
Figure 18: System Architecture .................................................................................... 56
List of Table

Table 1: M-SAP application VS existing systems................................................................. 9
Table 2: User Use Case requirement ..................................................................................... 20
Table 3: Admin Use Case requirement .................................................................................. 22
Table 4: Device specific checks .............................................................................................. 39
Table 5: Checking the availability of network ................................................................. 42
Table 6: The application checks ........................................................................................... 44
Table 7: App User interface checks ...................................................................................... 46
Table 8: Evaluation results ..................................................................................................... 51
# List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-SAP</td>
<td>Mobile Application for Simulated Archaeological Places</td>
</tr>
<tr>
<td>AR</td>
<td>Augmented Reality</td>
</tr>
<tr>
<td>3D</td>
<td>Three Dimensional.</td>
</tr>
<tr>
<td>JVM</td>
<td>Java virtual machine.</td>
</tr>
<tr>
<td>SDLC</td>
<td>Systems Development Life Cycle.</td>
</tr>
<tr>
<td>RAD</td>
<td>Rapid application development model.</td>
</tr>
<tr>
<td>UML</td>
<td>Unified Modeling Language.</td>
</tr>
<tr>
<td>Wi-Fi</td>
<td>Wireless Networking Technology.</td>
</tr>
<tr>
<td>PDA</td>
<td>Personal digital assistant.</td>
</tr>
<tr>
<td>CRC</td>
<td>Class-responsibility-collaboration</td>
</tr>
<tr>
<td>AVD</td>
<td>Android Virtual Device</td>
</tr>
<tr>
<td>SQL</td>
<td>Structured Query Language.</td>
</tr>
<tr>
<td>UML</td>
<td>Unified Modeling Language.</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package Social Sciences</td>
</tr>
<tr>
<td>ADT</td>
<td>Android Development Tools</td>
</tr>
<tr>
<td>XML</td>
<td>Extensible Markup Language.</td>
</tr>
<tr>
<td>API</td>
<td>Application Programming Interface.</td>
</tr>
<tr>
<td>SDK</td>
<td>Software Development Kit.</td>
</tr>
<tr>
<td>UI</td>
<td>User Interface.</td>
</tr>
<tr>
<td>OS</td>
<td>Operating system.</td>
</tr>
<tr>
<td>PC</td>
<td>Personal computer.</td>
</tr>
<tr>
<td>UX</td>
<td>User Experience.</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System.</td>
</tr>
<tr>
<td>GUI</td>
<td>Graphical User Interface.</td>
</tr>
<tr>
<td>App</td>
<td>Application.</td>
</tr>
<tr>
<td>(Relics)</td>
<td>Mean: old relics, bibelot, archeology, Historical pieces.</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION
1.1 Background

Today tourism is important for the country's economy tourism economically important fields and rich in the country for the piece is easier for tourists in the application simulates place archaeological chronology shows that over the place to convey the idea has the easiest and best ways detail as possible.

The Cultural Heritage Experiences through Socio-personal Interactions and Storytelling project takes a similar approach – using slightly more sophisticated profiling. Due to a weakness in tourism and a lack of mentors, so you must strengthen our monuments, from here came the idea of the project.

Mobile Application for Simulated Archaeological Places (M-SAP) is a project that investigates the use of Augmented Reality within Archaeological Practice. The system is built using a smartphone, an android microcontroller and a Unity3D application that brings the sights, sounds of the past directly into the present – into the very place in which they happened. This application contains a number of articles that detail the process and show where I am up to with the development.

User application via the mobile application opens directs mobile camera on the relic to show him the 3D object of relic’s or details and the period time when this place was the objective of this research work application simulates archaeological places users connected to this application idea in the simplest way possible.

1.2 Motivation for the Project

No application is similar to the help of local and international tourists (foreigners) to see the places and artifacts in the Gaza Strip with:
Increase International Economics, increasing number of tourists, bring tourists and love the idea (Easy to use and beautiful design) and community service (This project help native tourists).
1.3 Problem Statement

because weakness in tourism and a lack of number of tour guides, they are less than required, and Tourist around the world are expanding structurally at a rapid rate especially when the number of tourist gets greater and greater from tour guides.

1.4 Project Objectives

This project utilizes mobile technology for Simulated Archaeological Places, The objectives of the study are:

1. To develop a Simulated Archaeological Places By Camera Mobile (m-sap).
2. To develop Augmented Reality for archaeological places.
3. To conduct user evaluation on the Simulated Archaeological Places.

1.5 Significance of the Project

The significance of this study are as follows:
Ease of use and work without Internet (offline) was made available for free without any fees, and view details about the target to be discovered automatically been allocated to archeological places.

1.6 Scope and limitations

We have been added to the two pieces of relics as a sample to complete the project. "Women statue & Handa", the developer only can add all of the archaeological pieces in unity.

1. Our study work focuses on the Android platform, with a simple interface to easily use it.
2. English language support. To help tourists or foreign non-Arab people, a common as a language in the world, easily communicate with different people differ with Languages.
3. Each application specialist archaeological places located in Gaza City.
4. Archeological artifacts are stored in a file unity code on the mobile memory.
CHAPTER 2

LITERATURE REVIEW
2.1 Introduction

This chapter reviews and identify the technologies systems which were used to create the M-SAP system, also clarify business concepts and related work in the Tourists.

2.2 Technologies used

2.2.1 Software technology for MySQL database:
Many of the Android software running on a database so that this rule include data and include pictures, storage and photo galleries store information about their images (for example, some of the Android software that allows users to image rate, are stored Category numerical each image in the database) [1].

Many programs support the computer database called "SQL" the language (often pronounced as "sequel"). SQL has been designed specifically for this purpose.

Programs that you want to database software to handle work on a low level of data management to just use that language to send instructions.

2.2.2 Software Technologies for i3D Applications:
A review of Virtual Heritage research related to landscape reconstructions and Virtual Environments inhabited by living entities found a little more than ten examples. This may be due to the fact that Virtual Heritage research really.

Content generation tools for i3D creations are abundant these days. This section evaluates the more popularly used tools for the entire process of creating an interactive Virtual Environment [1].

2.2.3 Texture Creation Tools
The most powerful tool for texture creation is Adobe’s Photoshop™ CS, currently version 2.0.

Photoshop™ is an industry standard tool and the market leader for commercial bitmap graphical editor. Most 3D texturing tutorials found on the WWW uses Photoshop™ with its host of plug-ins for effects generation.
2.2.4 3D Landscape and Plant Creation Tools

By nature, 3D modelling packages are able to model landscapes and plants, although not as automated as proprietary landscape and plant creation tools. 3D Nature’s World Construction Set™ (WCS™) and Visual Nature Studio™ (VNS™) are widely recognized as the best terrain visualization software packages. It allows modelling, rendering, and animating natural and manmade environments with photorealistic quality.

2.3 Archaeology

Archaeology, or archeology, is the study of human activity in the past, primarily through the recovery and analysis of the material culture and environmental data that has been left behind by past human populations, which includes artifacts, architecture, bio facts (also known as eco-facts) and cultural landscapes (the archaeological record). Because archaeology employs a wide range of different procedures, it can be considered to be both a social science and a humanity.

2.4 Usability Evaluation

The usability considers an important attribute of software quality. It is concerned with making systems easy to learn and easy to use. The term is used to describe the quality of a user’s experience when interacting with a system whether a website, a software application, mobile technology, or any other human operated device. A usable system is one which enables users to perform their job effectively and efficiently.

2.5 Related Work

2.5.1 “Wikitude”

Wikitude is a convenient program demonstrating augmented reality (info about objects surrounding a user, which can’t be seen with naked eye). The app works when your mobile gadget is connected to Internet and GPS.
You need to direct your gadget camera or “show” the place where you are to the app, on the gadget screen there will appear notes in small figures which will report you about objects location. [2]

**Advantages of “Wikitude”:**

1. Wikitude allows you to see more than your eyes only could capture. Wikitude's "computer vision" is a bit like magic and connects you with the world in a completely new way.
2. Use Wikitude as a tool to experience augmented reality content, campaigns, projects, promotions, games and so much more by simply scanning the things you see.
3. Wikitude is an application that allows users to gain instant knowledge about their surroundings that they might not know otherwise.
4. Allows the user to have more mobility than a computer. It gives users information.
5. Opportunity to see your friends’ favorite places.
6. Usability.
7. Displays points of interest, 3D models. [2]

**Disadvantages of “Wikitude”:**

1. Anyone can add information to the internet, but this app only presents information. It does not allow users to add information through the application itself.
2. There's the obvious drawback of looking a bit of a nerd as you stroll along holding your phone out in front of you (and it has to be right out, at 90 degrees, or the icons don't appear), with the attendant possibilities of tripping over a kerb or getting mugged.
3. Wikitude is still immature and requires work before it's ready for mass market adoption.
4. Annoying is the general 'flat' menu structure, in which it's currently far too easy to dive into a menu item such as 'Settings' and then find yourself exiting the app when you merely thought you were getting out back to the main interface. [2]
2.5.2 "SketchUp Mobile Viewer"

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.

**Advantages of “SketchUp Mobile Viewer”:**

1. Easily navigate complex models using intuitive multi-touch gestures for orbit, pan, zoom.
2. Use the Camera menu to select any of the standard camera views (top, side, bottom, etc.) or choose from the list of preserved scene-based camera angles.
3. Search and browse through over 2 million, free 3D models on 3D Warehouse.
4. Use the detailed search result info to preview model info before downloading to your device.
5. Download models to your device from 3D Warehouse for seamless offline viewing.

**Disadvantages:**

1. The application is limited to engineering drawings only.
2. Slow in processing operations.
3. Accuracy of the results is low compared with other applications.

2.5.3 "ViewUp"

ViewUp is a remarkable application for viewing SketchUp and other 3D models offline on your Android device. It can handle even very large models, over 2 GB in size. All your projects in your pocket - whether you’re a maker, designer or an architect, you no longer have to carry a cumbersome laptop around just to give your customers a virtual tour of what the finished project will look like – in 3D [3].

**Advantages of "ViewUp":**

Rotate – Zoom – Clip – Hide elements – Measure – Turn to face.
Disadvantages of "ViewUp":

1. Zoom out to the extents of a model instantly to easily reorient your view.
2. Opportunity to see your friends’ favorite places.
3. This app only presents information. It does not allow users to add information through the application itself [3].

2.5.4 M-SAP application VS existing systems

<table>
<thead>
<tr>
<th>Features</th>
<th>Wikitude</th>
<th>SketchUp</th>
<th>ViewUp</th>
<th>M-SAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to use</td>
<td>✔️</td>
<td>✗</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>It works with Internet</td>
<td>✔️</td>
<td>✗</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>It works without Internet</td>
<td>✗</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Free downloading</td>
<td>✔️</td>
<td>✗</td>
<td>✗</td>
<td>✔️</td>
</tr>
<tr>
<td>English language support</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>View details of the target</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✔️</td>
</tr>
<tr>
<td>Supporting archaeological sites</td>
<td>✔️</td>
<td>✗</td>
<td>✗</td>
<td>✔️</td>
</tr>
<tr>
<td>Auto show of objects</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✔️</td>
</tr>
</tbody>
</table>

This comparison explain deficiencies that exist in other applications that have been avoided and exploited as a solution in the application, the developer only can control, including the ease of use and work without Internet was made available for free without any fees, and view details about the target to be discovered automatically been allocated to archeological places. As show in (table 1)

2.6 Summary

This chapter discussed a background and programs of the project that did about mobile applications are a successful example in augmented reality. That has identified the approaches to be used for developing a Mobile interface to help user to do his work anywhere and anytime in place.
CHAPTER 3

METHODOLOGY
3.1 Introduction

This chapter will describe the methodology phases and advantage and present the reasons for employing this methodology in this study.

3.2 Design Research Methodology

![RAD Model Diagram]

Business modeling: The information flow is identified between various business functions and will design the interfaces of the system components then design the communication between them [5]. (Figure 1)

1. Requirements planning phase – combines elements of the system planning and systems analysis phases of the Systems Development Life Cycle (SDLC). Users, managers, and IT staff members discuss and agree on business needs, project scope,
constraints, and system requirements. It ends when the team agrees on the key issues and obtains management authorization to continue.

2. User design phase – during this phase, users interact with systems analysts and develop models and prototypes that represent all system processes, inputs, and outputs. The RAD groups or subgroups typically use a combination of Joint Application Development (JAD) techniques and CASE tools to translate user needs into working models. User Design is a continuous interactive process that allows users to understand, modify, and eventually approve a working model of the system that meets their needs [6].

3. Construction phase – focuses on program and application development task similar to the SDLC. In RAD, however, users continue to participate and can still suggest changes or improvements as actual screens or reports are developed. Its tasks are programming and application development, coding, unit-integration and system testing.

4. Cutover phase – resembles the final tasks in the SDLC implementation phase, including data conversion, testing, changeover to the new system, and user training [5].

3.3 RAD model
In this study RAD model will be used:

Rapid application development (RAD) is a software development methodology that uses minimal planning in favor of rapid prototyping. A prototype is a working model that is functionally equivalent to a component of the product. In RAD model the functional modules are developed in parallel as prototypes and are integrated to make the complete product for faster product delivery [4].

Since there is no detailed preplanning, it makes it easier to incorporate the changes within the development process. RAD projects follow iterative and incremental model and have small teams comprising of developers, domain experts, customer representatives and other IT resources working progressively on their component or prototype.
The most important aspect for this model to be successful is to make sure that the prototypes developed are reusable [5].

### 3.3.1 Advantages of RAD Software Development

1. Reduced development time.
2. Increases reusability of components.
3. Collect management project requirement a dynamic way.
4. Encourages customer feedback.
5. Integration from very beginning solves a lot of integration issues.
6. It promotes better documentation through written test cases. [5]

### 3.3.2 RAD Software Development – Tip

RAD is best used when you are developing something which is basically being built upon the foundations of an existing prototype [5]. The reason being that a key part of this methodology is the re-use of prototypes which reduces both the process of software development and the testing time required.

### 3.4 RAD Model Phases

#### 3.4.1 Phase one: Requirements Gathering phase

A rad model begins with. They usually involve documenting the detailed requirements for the Project and then using them to write Use Cases which are vital for testing as well as Software Requirements Specification (SRS) [6].

After going to the Almathaf Hotel in Gaza, we collected samples and is designed to unity code.
3.4.2 Phase two: design

After that are approved specification requirements, it is time to determine how the project will be carried out walking. And the design phase of the project is planning to detail so that the application meets the requirements of the user, and also is the interface design formally identify the application form and Recycling form to ensure coverage of all the rules, the spectrum to build a successful application before entering the application development phase. All designs are used in the application easy to use and meet the demands of the users.

3.4.3 Phase three: implementation

Implementation is the carrying out, execution, or practice of a plan, a method, or any design for doing something. Such as, implementation is the action that must follow any preliminary thinking in order for something to actually happen. In an information technology context, implementation encompasses all the processes involved in getting new software or hardware operating properly in its environment, including installation, configuration, running, testing, and making necessary changes for Histography App.

3.4.4 Phase four: testing and installation

At this stage is placed the test plan which a must follow carefully. It will set out every single test they are to do on the application, what data they should enter and what result they should expect to obtain. Once this has been the development of the application should be chosen to make sure it works as expected, and there is also a test team to test the application and make sure he does everything exactly as specified in the application. And also this team achieve if this easy to use application or complex. The phase has been called the installation of the implementation phase and phase of the installation may be the development of the application installation, test and operate properly and do everything that it was agreed during the design phase, and business is waiting in anticipation for the new application is eager to hand him over to them.
3.4.5 Phase five: Maintenance

Our goal is to create a lasting relationship with users by Facilitate application management and facilitate the control of the application and also our goal to create competition with other applications and directed application and high-quality workmanship. Our mission is to gain the trust and confidence with users so that we may fulfill all their needs confidently and consistently for many years to come.

After the completion of the application, it is fully put into operation. The most important procedure by this phase is the maintenance process to ensure the application runs without errors. If there is a features and specifications, it is advisable to incorporate them at the maintenance phase. Whereas there are so many variable along the application development life cycle, it is, the maintenance phase that ensures the application runs on new operating systems. [6]
CHAPTER 4

REQUIREMENT AND ANALYSIS
4.1 Introduction

This chapter describes the project requirements specification based on requirements gathering ways which used in project analysis by using Unified Modeling language (UML). Which is a standardized modeling language enabling developers to specify, visualize, construct and document artifacts of a software system. Thus, UML makes these artifacts scalable, secure and robust in execution. [7] UML is an important aspect involved in object-oriented software development. It uses graphic notation to create visual models of software system.

4.2 Functional Requirements

The goal of functional requirement is to determine the behavior of users for “M-SAP” in terms of functionality, Add the image to determine the appropriate relics through the work of unique “Code” for image of the website "Unity" and then adding the code to library of "Unity" from the website: http://developer.vuforia.com

For the user in (Android app.):
1. Turn on the camera.
2. Taking the information from the database and synchronize by web service.
3. Showing all the information about relics.

For the administrator in (Web page):
1. Log on the control panel.
2. Add, delete, or modify the relic’s information in the database.

4.3 Non-functional Requirements

In a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviors. This should be contrasted with functional requirements that define specific behavior or functions Such as:
4.3.1 **Usability Requirements**

The application ease of use by the user and the control panel easy of using by admin like adding object and viewing it by simple interface, Through the use of user experience (UX) designs.

4.3.2 **Availability Requirements**

The mobile application should be available at all times the user, can access to it anytime and anywhere, as the application works online or offline (without the Internet).

When you run the application is detected the artifact, and then compared the images in the database, if you find the picture displays the information, if it did not find the image, the application detect relics again.

4.3.3 **Security Requirements**

Adding major admin is not deleted, your password has been encrypted so that he could not identify the other passwords, Open sessions to preventing access to the control panel if the administrator name does not exist cannot log in to any page without login page.

4.4 **Application Perspective**

The application using a database servers that can be accessed with any android device, use simple devices that can be used from any level of user interaction with the project without having a good experience.

4.5 **Requirements Analysis**

Needs analysis in M-SAP including those tasks that go into determining the needs or conditions to meet the service, analyzing, documenting and validating management software or system requirements. Needs analysis is critical to the success of the systems or software project. And must be documented requirements, implementation and measurable, testable, traceable, related to the specific needs of the work, and to determine the level of detail sufficient for system design.
4.6 Use Case Diagrams

A use case diagram is a static description of some way in which the application is used. This diagram shows how the application use cases are related to each other and how the users can get at them. [7] Each bubble represents a use case, and each actor person represents a user, M-SAP has two main actors include (admin and android user) which have many different processes, Here we describing as the following UML description. Why? Describes all the Process and relations with the users are using the system in the analysis stage until it is very clear image of the subject put before starting the design phase.

1.6.1 User Use Case Diagrams

Figure 2 discuss the user when the application is running, when choosing a camera where the discovery and capture of artifact, when choosing a museum comparison in the database data is displayed for the user information is displayed on this piece and the period of time the image of relic.

![User Use Case Diagrams](image)
<table>
<thead>
<tr>
<th>Case number</th>
<th>C0</th>
<th>C1</th>
<th>C2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case name</td>
<td>application</td>
<td>Camera</td>
<td>Museums</td>
</tr>
<tr>
<td>Pre</td>
<td></td>
<td></td>
<td>Camera</td>
</tr>
<tr>
<td>post</td>
<td>language English</td>
<td>View</td>
<td>-Picture</td>
</tr>
<tr>
<td>Description</td>
<td>Select choice</td>
<td>When you start the application is run the device camera</td>
<td>Showing artifact data</td>
</tr>
<tr>
<td>Constraint</td>
<td>Choose one option</td>
<td>The application must be given access to the camera validity</td>
<td>The image must be present in the database</td>
</tr>
<tr>
<td>Reliability</td>
<td></td>
<td>Depends on the language</td>
<td>Camera</td>
</tr>
</tbody>
</table>
1.6.2 Admin Use Case Diagrams

Figure 3 discuss login to the system administrator process is verified if this right person allowed access to the system to: addition, modification and deletion relics or admins, as if it was not the right person is out of order.

![Admin Use Case Diagrams](image_url)
### Table 3: Admin Use Case requirement

<table>
<thead>
<tr>
<th>Case number</th>
<th>C0</th>
<th>C1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case name</strong></td>
<td>Login</td>
<td>Control panel</td>
</tr>
<tr>
<td><strong>Pre</strong></td>
<td>___</td>
<td>Login</td>
</tr>
<tr>
<td><strong>post</strong></td>
<td>Control panel</td>
<td>-delete -add -modify</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>Check the name and Password</td>
<td>The admin you can add, delete or edit the artifact Information</td>
</tr>
<tr>
<td><strong>Constraint</strong></td>
<td>The user must enter the name in letters English Language and Password least 8 values. e.g. (A,a-1,2,...,$,#)</td>
<td>When the edit and delete must choose number artifact in the database</td>
</tr>
<tr>
<td><strong>Reliability</strong></td>
<td>___</td>
<td>login</td>
</tr>
</tbody>
</table>

### 4.7 Sequence Diagrams

A sequence diagram, in the context of UML, represents object collaboration and is used to define event sequences between objects for a certain outcome. Sequence diagram is an essential component used in processes related to analysis, Design and documentation. [8] Why? We use sequence in the follow-up system step by step and clearly and make it easier for the programmer to readers system with ease.
4.7.1 User Sequence Diagrams

Figure 4 discuss When choosing a camera, it's take a picture and compared by unity Code and display 3D image of this relic

Figure 4: User Sequence Diagram for unity

Figure 5: User Sequence Diagrams for museum
4.7.2 Admin Sequence Diagrams

Figure 6 discuss how the official introduction of the name and password are checked in the database if the acceptance is on to the system there are operations and after the completion of these operations are saved in the database or modification of the data within the database.
4.8 Activity Diagrams

Activity diagrams can be used to describe the business and operational step-by-step workflows of components in a system. [8] Why? Is a painting begins to be vertically from top to bottom The painting shows this stage to enter the system and the user and the type of operations performed by the user. Here we describe all necessary processes as the following:

4.8.1 User Activity Diagrams

Figure 7 discuss Run the application, the camera is off and then are discovered artifact where data is displayed for the user, but in the absence of image re-discovery process Widget.

![User Activity Diagrams](image-url)
4.8.2 Admin Activity Diagrams

Figure 8 discuss after entering a user name and password, to verify of user ID to enter the control panel for deletion, addition or modification to the database then logout from page.
CHAPTER 5

DESIGN AND IMPLEMENTATION
5.1 Introduction

This chapter is display with design stage activities like: System architecture, entity relationship diagram, and user interfaces. After all design stages complete implementation starting using development tools.

5.2 System Requirement

Since we have mobile application and external database server, we need different hardware and software requirement for each.

❖ Operation Requirements:

Software requirements which were used during the development processing:

- Operating system: any computer OS.
- Android Operating system.
- Database: SQLite.

❖ Development Requirements:

Tools used to develop the system

- MS word version: 2013 professional
- MS Project version: 2013 professional
- Visio version: 2013 professional
- Adobe Photoshop version: CC Creative Cloud
- Eclipse version: 4.2.3
- Android studio version: 1.4.1
- unity version: 5.3.0f4
- Notepad++ version: 6.5
- APPSERV version: 2.5.9
- Blender 2.7
Hardware Requirements:

Hardware requirements which were used during the development processing:

- Mobile devise with Android Operating system

5.3 System Architecture

When there is no internet connection to take the application data from the local database on the mobile, and in case there are online data synchronization in the local database with the database on the server, it is controlled on the server data by administrators through the Web page for the adding or deleting or modifying. As show in (figure 9).
5.4 Technology Choices

At first the client will have to install an Android application so they can access to Share Experience app, for the mobile application android provides a variety of pre-build UI components such as structured layout objects and UI controls that allow you to build the graphical user interface for your app [9]. Android also provides other UI modules for special interfaces such as dialogs, notifications, and menus. Also we will use XML to build an interactive interface for the users, with a compatible version for the mobile users too.

5.5 Android Application GUI

Project logo:

![Figure 10: Logo of project](image)
**Loading:**

When you run the application, the data is downloaded from the server and check the network connection to synchronize the internal database with the data on the server, as show in (figure 11).

**About us:**

Overview the idea of the project and how to deal with the application for facilitate use of users, as show in (figure 12).
Main Activity:

The main interface in the application of which is access to the camera (Unity), museums and close the application, as show in (figure 13).

List of relic’s simulation:

All relics are displayed inside the museum, which added by the system administrator, as show in (figure 14).
5.6 Database Tables

Main tables that are dealt with in the application of the control panel to edit the relic’s information, as show in (figure 15).

![Database Tables Diagram]

**Figure 15: Database Tables**

**Table’s scheme:**

Illustrate relationships between tables and fields. So that each museum has a set of archeological relics, as show in (figure 16).

![Database Schema Diagram]

**Figure 16: Database schema**
5.7 Implementation

The implementation phase takes the requirements and design phase product and implements them using appropriate technologies. In the case of validation testing, it is during this phase that test cases are completed and automated in preparation for validation testing. Typically, a lot of testing on the early system versions is also performed during this phase, not only to validate the system, but to validate that there are no problems with the test cases themselves.

A program will write based upon the algorithm designed in the last phase (design). A piece of code is written for every module and checked for the output. We will use the Java for android to develop the software. At this phases must match between the requirements and the output of the application to determine the verification for it. As mentioned, the implementation language will be Java because mostly Android applications are written in it.

5.8 Development Tools

The following tools have been used to develop M-SAP application:

MySQL: is the database where all data related to requests, records and logs is stored.

APPSERV: is an open source tool for Windows with Apache, MySQL, PHP and other additions, in which these applications are configured automatically, allowing us to run a full web server. As extra features php my admin to manage MySQL

ADT Bundle: Android Development Tools (ADT) is a plug in for the Eclipse IDE that is designed to give a powerful, integrated environment in which to build Android applications. ADT extends the capabilities of Eclipse to let quickly setup new Android projects, create an application UI, add packages based on the Android Framework API, debug applications using the Android SDK tools, developing in Eclipse with ADT is highly recommended and is the fastest way to get started. With the guided project setup it provides, as well as tools integration [9], custom XML editors, and debug output pane, ADT gives an incredible boost in developing Android applications.
CHAPTER 6

TESTING AND EVALUATION
6.1 Testing

Software testing is more than just error detection; testing software is operating the software under controlled conditions, to (1) verify that it behaves “as specified”; (2) to detect errors, and (3) to validate that what has been specified is what the user actually wanted [10].

1. Verification is the checking or testing of items, including software, for conformance and consistency by evaluating the results against pre-specified requirements. [Verified: Are we building the system right?]

2. Error Detection: Testing should intentionally attempt to make things go wrong to determine if things happen when they shouldn’t or things don’t happen when they should.

3. Validation looks at the system correctness – i.e. is the process of checking that what has been specified is what the user actually wanted. [Validation: Are we building the right system?]

In other words, validation checks to see if we are building what the customer wants/needs, and verification checks to see if we are building that system correctly. Both verification and validation are necessary, but different components of any testing activity.

6.2 Purpose of testing

There are two fundamental purposes of testing: verifying procurement specifications and managing risk. First, testing is about verifying that what was specified is what was delivered: it verifies that the product (system) meets the functional, performance, design, and implementation requirements identified in the procurement specifications. Second, testing is about managing risk for both the acquiring agency and the system’s vendor/developer/Integrator. The testing program is used to identify when
the work has been “completed” so that the contract can be closed, the vendor paid, and the system shifted by the agency into the warranty and maintenance phase of the project. [11]

6.3 Important of testing

A good testing program is a tool for both the agency and the Integrator/supplier; it typically identifies the end of the “development” phase of the project, establishes the criteria for project acceptance, and establishes the start of the warranty period. [12]

6.4 What is involved in a software test program?

In general, the software test program can be broken into three phases as described below.

Design Reviews – There are two major design reviews:

- The preliminary design review conducted after completion and submission of the high-level design documents
- The detailed design (or critical) review conducted after submission of the detailed design documents. [10]

Development Testing – For software, development testing includes prototype testing, unit testing, and software build integration testing. This testing is normally conducted at the software developer’s facility. Site Testing – Site testing includes hardware/software integration testing, subsystem testing, and system testing. Some integration testing can be conducted in a development environment that has been augmented to include representative system hardware elements (an integration facility) but must be completed at the final installation site (i.e., the transportation management center) with communications connectivity to the field devices.
6.5 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

M-SAP experimented by running on a real devices for android application devices like Sony, Samsung, HTC and LG are used, and web application tested using different computers with windows operating systems. Testing on real handsets gives reliable and accurate results, gives interoperability testing because performed on a live network and provide UX user experience by end users.

6.6 Checklist M-SAP App Testing

This checklist is specifically designed to test the characteristics of M-SAP. Obviously, it tests only generic app characteristics and not the functionality of the app. For this a separate test approach and test script must be created. [9] The same goes off course for performance testing, usability testing, security testing and other testing activities necessary for our specific app.
For business advisor app, the checklist split into four different fields [13]:

- Device specific characteristics. These are characteristics that are related to the device on which the app is installed.
- Checking the availability of network connectivity to synchronize data base
- 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 4: Device specific checks

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
<th>OK/NOK?</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Can the app be installed on the device?</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>1.2</td>
<td>Does the app behave as designed/desired if there is an incoming call?</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>1.3</td>
<td>Does the app behave as designed/desired if there is an incoming SMS?</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>1.4</td>
<td>Does the app behave as designed/desired if the charger is connected?</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>1.5</td>
<td>Does the app behave as designed/desired if the charger is disconnected?</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Question</td>
<td>Result</td>
<td>Notes</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------------------------------</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>1.6</td>
<td>Does the app behave as designed/desired if the device goes to sleeping mode</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>1.7</td>
<td>Does the app behave as designed/desired if the device resumes from sleeping mode</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>1.8</td>
<td>Does the app behave as designed/desired if the device resumes from lock screen?</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>1.9</td>
<td>Does the app behave as designed/desired if the device is tilted?</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>1.10</td>
<td>Does the app behave as designed/desired if the device is shaken?</td>
<td>NOK</td>
<td>A</td>
</tr>
<tr>
<td>1.11</td>
<td>Does the app behave as designed/desired if a local message is coming from another app (think of: calendar reminders, to-do task etc.).</td>
<td>NOK</td>
<td>A</td>
</tr>
<tr>
<td>1.12</td>
<td>Does the app behave as designed/desired if a push message is coming from another app (think of: twitter mentions, what'sapp message, wordfeud invitation, etc.).</td>
<td>NOK</td>
<td>A</td>
</tr>
<tr>
<td>1.13</td>
<td>Is the functionality of all the buttons or keys on the device defined for this app?</td>
<td>NOK</td>
<td>A</td>
</tr>
<tr>
<td>1.14</td>
<td>Verify that buttons or keys which have no defined function have no unexpected behaviour on the app when activating.</td>
<td>NOK</td>
<td>A</td>
</tr>
<tr>
<td>Question</td>
<td>OK</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>----</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>1.15 In case there’s a true “back” button available on the device does the “back” button take the user to the previous screen?</td>
<td>OK</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>1.16 In case there’s a true “menu” button available on the device, does the menu button show the app’s menu?</td>
<td>OK</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>1.17 In case there’s a true “home” button available on the device, does the home button get the user back to the home screen of the device?</td>
<td>OK</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>1.18 In case there’s a true “search” button available on the device, does this get the user to some form of search within the app?</td>
<td>OK</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>1.19 Does the app behave as designed/desired if the “Battery low” message is pushed</td>
<td>OK</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>1.20 Does the app behave as designed/desired if the sound on the device is turned off?</td>
<td>OK</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>1.21 Does the app behave as designed/desired if the device is in airplane mode?</td>
<td>OK</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>1.22 Can the app be de-installed from the device?</td>
<td>OK</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>1.23 Does the application function as expected after re-installation?</td>
<td>OK</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>
1.24 Can the app be found in the app store? (Check after go-live)  
OK  N

1.25 Can the app switch to different apps on the device through multitasking as designed/desired?  
OK  A

1.26 Are all touch screen positions (buttons) working when a screen protector is used.  
OK  A

2. Checking the availability of network

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
<th>OK/ NOK?</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Does the app behave according to specification if connected to the internet通过Wi-Fi?</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>2.2</td>
<td>Does the app behave according to specification if connected to the internet通过4G?</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>2.3</td>
<td>Does the app behave according to specification if connected to the internet通过3G?</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>2.4</td>
<td>Does the app behave according to specification if connected to the internet通过2G?</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Does the app behave according to specification of the app is out of network reach?</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>---</td>
<td>---------------------------------------------------------------------------------</td>
<td>----</td>
<td>---</td>
</tr>
<tr>
<td>2.5</td>
<td>Does the app resume working when it gets back into network reach from outside reach of the network?</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>2.6</td>
<td>Update transactions are processed correctly after re-establishing connection.</td>
<td>OK</td>
<td>N</td>
</tr>
<tr>
<td>2.7</td>
<td>Does the app still work correctly when tethering or otherwise connected to another device</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>2.8</td>
<td>What happens if the app switches between networks (Wi-Fi, 4G, 3G, 2G)</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>2.9</td>
<td>Does the app use standard network ports (Mail: 25, 143, 465, 993 or 995 HTTP: 80 or 443 SFTP: 22) to connect to remote services, as some providers block certain ports.</td>
<td>NOK</td>
<td>A</td>
</tr>
</tbody>
</table>
3. The application checks

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
<th>OK/NOK?</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Has the app been tested on different type of devices and different versions of OS?</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>3.2</td>
<td>Stability check: if the app has a list (for instance of pictures) in it, try scrolling through it at high speed.</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>3.3</td>
<td>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.</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>3.4</td>
<td>Is downloading of the app prevented in case it’s bigger than the OS allows downloading when connected to cellular networks?</td>
<td>NOK</td>
<td>A</td>
</tr>
<tr>
<td>3.5</td>
<td>Integration: does the app connect correctly to the different social networks (LinkedIn, twitter, facebook, etc.).</td>
<td>NOK</td>
<td>N</td>
</tr>
<tr>
<td>3.6</td>
<td>The app does not interfere with other apps when in background/multitasking mode (using GPS, playing music, etc.).</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can the user print from the app (if applicable)</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>3.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.8</td>
<td></td>
<td>The search option in the app displays relevant results</td>
<td></td>
</tr>
<tr>
<td>3.9</td>
<td></td>
<td>Verify most common gestures used to control the app.</td>
<td></td>
</tr>
<tr>
<td>3.10</td>
<td></td>
<td>What happens if you select different options at the same time (undesired multi touch, for example – select two contacts from the phone book at the same time).</td>
<td></td>
</tr>
<tr>
<td>3.11</td>
<td></td>
<td>App name should be self-explanatory</td>
<td></td>
</tr>
<tr>
<td>3.12</td>
<td></td>
<td>Does the app limit or clean the amount of cached data.</td>
<td></td>
</tr>
<tr>
<td>3.13</td>
<td></td>
<td>Reloading of data from remote service has been properly designed to prevent performance issues at server-side. (manual reloading of data can reduce the amount of server calls)</td>
<td></td>
</tr>
<tr>
<td>3.14</td>
<td></td>
<td>Does the app go to sleep mode when running in the background (prevent battery drain)</td>
<td></td>
</tr>
</tbody>
</table>

Table 7: App User interface checks.

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
<th>OK/NOK?</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>To keep controls as unobtrusive as possible for instance by fading them out if they are not used for a while.</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>4.2</td>
<td>Make it possible for users to go back to a previous screen for instance by adding a back or cancel button</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>4.3</td>
<td>The main function of the app should be apparent immediately. It should speak for itself.</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>4.4</td>
<td>Use at most one action on the screen that is highlighted as the most likely for the user. (Example: in iOS a blue button represents the default or most likely action).</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>4.5</td>
<td>Minimize user actions by using a picker or a table view where users can select a certain choice over a data entry field where users have to type a choice</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>4.6</td>
<td>In an app, the user should not be able to store files locally, outside the app sandbox.</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>4.7</td>
<td>In an app, the user should not be exposed to the permissions of a specific file</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>4.8</td>
<td>If there is a long list of data to scroll through, provide a search option above the list.</td>
<td>OK</td>
<td>N</td>
</tr>
<tr>
<td>4.9</td>
<td>If performance is slow, indicate a progress status icon (&quot;Loading…&quot;), preferably with specific message.</td>
<td>NOK</td>
<td>A</td>
</tr>
<tr>
<td>4.10</td>
<td>In case of ‘live’ filtering of data while the user enters his search query, verify the performance.</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>4.11</td>
<td>The appearance of buttons that perform standard actions are not altered in the app (for instance: refresh, organize, trash, Reply, back, etc.)</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>4.12</td>
<td>Do not use standard buttons for other functions then that they are normally used for</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td>4.13</td>
<td>The app should respond to all changes in device orientation, as per the design</td>
<td>OK</td>
<td>N</td>
</tr>
<tr>
<td>4.14</td>
<td>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).</td>
<td>OK</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>4.15</td>
<td>Do not redefine gestures in your app that have a standard meaning (example: swiping from top to bottom enables the notification centre)</td>
<td>OK</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>4.16</td>
<td>Requirement to login is delayed in the app as long as possible</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td>4.17</td>
<td>If the app is stopped at an unexpected time, user data should be saved locally and available at start-up.</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td>4.18</td>
<td>Users should be warned of the consequences of deleting a document</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td>4.19</td>
<td>Keyboard adjusts to expected input (for instance numbers/letters when expected).</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td>4.20</td>
<td>Are inactive buttons clearly distinguished from active buttons?</td>
<td>OK</td>
</tr>
</tbody>
</table>

6.7 Maintenance

Application maintenance is 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. Bugs and errors are removed at this phase.

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.
The system can be maintained when needed or required as such:

(1) A new functionality is added.
(2) The software models change.
(3) Software must be updated to run on improved hardware or with improved software.

6.8 Evaluation

We collected 61 of the 70 model to identify a sample model of study in the university. The results showed good about the idea and the performance of the application by acceptance ratio got 88% as shown in (appendix B page 59)

6.9 Usability Evaluation

Usability evaluation is an essential step in human-centered design. 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. Different methods serve different evaluation purposes and reveal different problems. Therefore, several methods should be used as a complement to each other.

6.10 User Evaluation

User evaluation conducts to determine user's perception on the usability aspect of the prototype. Despite user evaluation based on the scores of evaluation instruments, the success results not from high post test scores but from effective behavior [14].

6.11 Availability Evaluation

The mobile application should be available at all times the user, can access to it anytime and anywhere, as the application works online or offline (without the Internet).

When you run the application is detected the artifact, and then compared the images in the database, if you find the picture displays the information, if it did not find the image, the application detect relics again.
6.12 **Security Evaluation**

Adding major admin is not deleted, your password has been encrypted so that he could not identify the other passwords, Open sessions to preventing access to the control panel if the administrator name does not exist cannot log in to any page without login page.

6.13 **Results**

The purpose of this study was to investigate the study of the extent of Applicability (Histogram), also aimed at identifying the role of the variables of the study about the subject of the study, and to achieve the goal of the study was to develop a questionnaire were confirmed sincerity and coefficient of stability, after the process of collecting the questionnaires are encoded and inserted a computer and processed statistically using the package statistical social Sciences (SPSS) Here are the results of the study according to its questions and hypotheses, [Table 8] depicts the demographic information of participants, where all respondents own smartphone. Overall, females and males comprise 47.5% and 52.5% of respondents, respectively. Respondents are with different qualifications, 19.6% holds Diploma degree, 65.5% Bachelor degree, 11.1% holds Master degree, and 3.2% PhD degree. Furthermore, respondents are from different age’s domain, 86.8% of (18-30) years, 8.1% of (31-40) years, 3.2% of (41-50) years, and 1.6% of (more than 50) years.
### Questionnaire Result

*Table 8: Evaluation results*

<table>
<thead>
<tr>
<th></th>
<th>Gender: 47.5% Female</th>
<th>52.5% Male</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>86.8% 18-30</td>
<td>08.1% 31-40</td>
</tr>
<tr>
<td></td>
<td>03.2% 41-50</td>
<td>01.6% &gt;51</td>
</tr>
<tr>
<td><strong>Qualification</strong></td>
<td>19.6% Diploma</td>
<td>65.5% Bachelor</td>
</tr>
<tr>
<td></td>
<td>11.1% Master</td>
<td>03.2% PhD</td>
</tr>
<tr>
<td><strong>Do you own android smartphone</strong></td>
<td>11.4% No</td>
<td>88.5% Yes</td>
</tr>
<tr>
<td><strong>Do you dealt with the application for archaeological places</strong></td>
<td>77.0% No</td>
<td>22.9% Yes</td>
</tr>
</tbody>
</table>
CHAPTER 7

CONCLUSION AND FUTURE WORK
7.1 Conclusion

When we began this project several months ago, it was a big challenge for us. It was the first time, we use some of these technologies, Augmented Reality. We all have had to do a hard work to learn how to manage them and reach our aims. It has been a very nice experience for us, and we have had the possibility to do a true team work with other very qualified people. This has permitted us to benefit each other and, improve my personal skills quickly.

Regarding the M-SAP, we achieved important goals. Although we have not reached the final aim of creating an application which was able to show all objects in the museum, but we just introduced two pieces of objects, we have done most of the necessary steps to achieve it. It is a very complex Project and requires a lot of intermediate steps, which we were not able to imagine at the beginning due my lack of knowledge of the technologies involved in. Despite this, we think that linking the achieved mid-steps and adding few more features we could reach the goal we proposed at the beginning. We also think that, with the knowledge acquired during this time, achieve the new aims would be more easy and quickly due to the most difficult parts have already been done.

7.2 Future Works

For a future evolution of my work on the M-SAP Project, We propose to do the following steps to solve the problems we have found or to add new features:

- Add Arabic Language in addition to the English language
- Application to activate all the museums in Palestine
- The work of a virtual museum to identify objects by images I think that Augmented Reality technology has an amazing future and there is a wide range of applications where it could be used.
References


Appendix A: Explanation some points in documentation

A.1 Android Architecture

(Figure 17) determine Android operating system is a stack of software components which is roughly divided into five sections and four main layers that are:

1. Linux kernel
2. Libraries
3. Android Runtime
4. Application Framework
5. Applications

![Android Architecture Diagram](image-url)
A.2 System Architecture

When there is no internet connection to take the application data from the local database on the mobile, and in case there are online data synchronization in the local database with the database on the server, it is controlled on the server data by administrators through the Web page for the adding or deleting or modifying. As show in (figure 18).

Figure 18: System Architecture
Appendix B: Evaluation Questionnaire of M-SAP

المؤسسة الموقرة

الأخ الفاضل/الأخت الفاضلة: السلام عليكم ورحمته الله وبركاته

يقوم الباحثون بإجراء دراسة بعنوان: "محاكاة الأماكن الأثرية" وذلك لدراسة وجهة نظر المستخدم وإطلاعاته حول Histography تطبيق وهو تطبيق يهدف بالدرجة الأولى محاكاة تحفة أثرية، وإجراء هذه الدراسة تطلب الأمر إعداد استبانة للإجابة على بعض التساؤلات. لذا أرجو منكم التكرم بالاجابة عن فقراتها بكل دقة وموضوعية بما يتلاءم مع وجهة نظركم، وذلك بوضع اشارة (√) أمام ما ترون مناسباً، وذلك لغرض البحث العلمي فقط.

وتفضلوا بقبول في الأعلى الاحترام والتقدير.

الطلاب:

- أحمد الأغا
- أحمد طبش
- جواد الغلاييني
- علاء طبش

كلية تكنولوجيا المعلومات

جامعة فلسطين

مدينة الزهراء

توجيهات التطبيق:

1. بدأ قم بتنزيل التطبيق على هاتفك الذكي "الأندرويد" وتصبيحه من خلال قوقل بلاي.
2. قم بتصبح التطبيق وتشغيله في وضع الاتصال بالإنترنت (متطلب في المرة الأولى للتشغيل)
3. ينقسم البرنامج إلى نظام صور جاهزة لتحفيز عالمية وكميرا تعمل على نظام الواقع المعزز.
4. يبين لك اسم وتاريخ التحفة الأثرية.
5. الكاميرا تعرض لك اسم التحفة الذي تريد وضع عليها.
تساؤلات الدراسة:

1. ما مدى إدراك المستخدمون لتبني استخدام تطبيق Histography؟
2. ما مدى تصور المستخدمون لتطبيق Histography؟
3. ما العوامل التي تؤثر على نوايا المستخدمين لتبني استخدام تطبيق Histography؟

الجنس:
- ذكر
- إناث

العمر:
- < 51
- 51-60
- 61-70
- 71-80
- 81-90

المؤهل العلمي:
- بكالوريس
- دبلوم
- ماجستير
- دكتوراه

هل تمتلك هاتف ذكي بنظام اندرويد؟
- نعم
- لا

هل تعاملت مع تطبيق يتكلم عن الأثار من قبل؟
- نعم
- لا
<table>
<thead>
<tr>
<th>الفقرات</th>
<th>#</th>
</tr>
</thead>
<tbody>
<tr>
<td>ما مدى تصورك لسهولة استخدام تطبيق Histography؟</td>
<td></td>
</tr>
<tr>
<td>تطبيق Histographyسهل الاستخدام</td>
<td>1</td>
</tr>
<tr>
<td>التفاعل مع تطبيق Histography واضح ومفهوم</td>
<td>2</td>
</tr>
<tr>
<td>ليس لدي أي مشكلة لتعلم استخدام تطبيق Histography بمفردي</td>
<td>3</td>
</tr>
<tr>
<td>أجد أنه من السهل استخدام ميزات تطبيق Histography</td>
<td>4</td>
</tr>
<tr>
<td>من السهل أن تصبح ماهراً في استخدام تطبيق Histography</td>
<td>5</td>
</tr>
<tr>
<td>ماتصورك لمدى الاستفادة من تطبيق Histography؟</td>
<td></td>
</tr>
<tr>
<td>تطبيق Histography مفيد للأغراض التاريخية</td>
<td>1</td>
</tr>
<tr>
<td>تطبيق Histography يتيح إيجاد المعلومات في فترة زمنية قصيرة</td>
<td>2</td>
</tr>
<tr>
<td>من السهل العثور على معلومات باستخدام تطبيق Histography</td>
<td>3</td>
</tr>
<tr>
<td>مخرجات البحث لتطبيق Histography يظهر نتائج كافية ودقيقة</td>
<td>4</td>
</tr>
<tr>
<td>بشكل عام، تطبيق Histography يحسن معرفتي بتاريخ الآثار</td>
<td>5</td>
</tr>
<tr>
<td>ماهدى شعورك بالرضا من استخدام تطبيق Histography؟</td>
<td></td>
</tr>
<tr>
<td>Histography إتسعدي ومبتن للاستخدام تطبيق Histography</td>
<td>1</td>
</tr>
<tr>
<td>Histography أشعر بالرضا باستخدام تطبيق Histography</td>
<td>2</td>
</tr>
<tr>
<td>Histography يعمل بالطريقة التي أريدها</td>
<td>3</td>
</tr>
<tr>
<td>بشكل عام، أنا راض عن سهولة استخدام تطبيق Histography</td>
<td>4</td>
</tr>
<tr>
<td>هل لديك النية لاستخدام تطبيق Histography؟</td>
<td></td>
</tr>
<tr>
<td>أني استخدم تطبيق Histography للغراضات الأثرية</td>
<td>1</td>
</tr>
<tr>
<td>أني استخدم تطبيق Histography باستمرار</td>
<td>2</td>
</tr>
<tr>
<td>أفضل تطبيق أكثر من غيره من التطبيقات Histography</td>
<td>3</td>
</tr>
<tr>
<td>أوصي باستخدام تطبيق Histography</td>
<td>4</td>
</tr>
</tbody>
</table>

**BEST WISHES 😊**