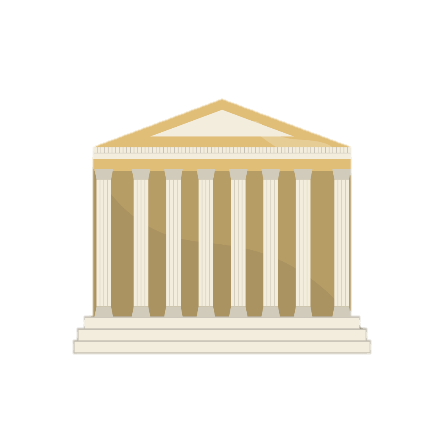
King Abdulaziz University DEPARTMENT OF COMPUTER SCIENCE

Faculty of Computing and Information Technology CPCS-351, First Semester 2023



ERTH|إرث

**DIGITAL MUSEUM SYSTEM**

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# Phase1: Project Description

## Introduction

The most priceless gift somebody can give to another person is knowledge. Education is not only the right, but the obligation of every Muslim, male or female, as the Prophet Mohammed, peace be upon him, said: "Whoever teaches some knowledge will have the recompense of the one who acts upon it, without that detracting in the least from his reward." Education, study, and research are all highly valued in Islam, thus it is not a coincidence that the first word of the Quran to be revealed was: "Read." Everyone should take an active role in seeking out new information and knowledge.

A community or a country's culture reflects its identity. As a result, culture plays a crucial and significant role in shaping how the community behaves, responds, and develops. Every person in the society has a significant impact on culture. In schools, students learn more deeply about the subject matter when working and learning in a classroom with people from different origins and cultures. Additionally, having knowledge of different cultures teaches students how to participate in a diverse workplace.

When two strangers share a culture, an immediate bond is formed. Cities, states, and regions are connected through culture. People experience nurturing and even love in the appropriate sort of society, and this unifies everything. They feel more connected to their ancestors and experience a sense of longevity as a result, which makes them feel as though they are truly living a true life. The subtleties of culture are extensive and have the power to obscure personal ideals and convictions. This is thus because each culture has standards for how its members should behave. Civilizations become ingrown when they don't welcome variety by incorporating different cultures.

It is indisputable that your culture has an impact on who you are, how you view the world and life, and what you value. Your culture has an impact on everything from your morality to the way you interact with others. This kind of impact may cause what is known as a "cultural gap." A cultural gap can be overcome by consciously knowing and accepting others' cultures. Understanding various cultures requires openness and interest.

## Problem Description

The main problem is the lack of knowledge about our culture. Another problem is the limited resources provided in our generation today to that delivers this knowledge, let alone in an entertaining and advanced manner. Whether it be an individual within the heritage of our culture, or a foreigner, we may not be able to afford the costs of traveling or purchasing flight tickets to visit a museum. It stands to reason to have an app that aids in delivering knowledge at the lowest possible cost, without having to step foot out of your front door, and yet still, making it an unforgettable visual experience.

## Project Objectives

* + - Our application allows users to create an account and purchase tickets to take an informative guide around the country.
    - Allow guests to view historical monuments, read, hear about them, and share them.
    - Find locations of each monument.
    - Provide a special audio service for the deaf.
    - Track user knowledgeable advancements and share them with friends and family.
    - Fast on-day delivery of virtual reality glasses to begin the experience.
    - Notify the user of new locations, or sites to be explored.
    - Progressively update the activities, and new historical monuments to be made over the course of the years, for upcoming generations.

## Project Goals

The digital museum system aims to provide a learning platform for the people interested in such knowledge, while making it easy, and entertainable. It helps delivering our culture in a well-organized manner, as millions of people in our society today do not know the beauty of Saudi Arabia. Moreover, the system is motivated to make better use of children’s time nowadays, as it is mostly spent on tablets that stunt their intelligence.

We seek to accomplish the following:

* + - Reduce the effort and financial costs needed to explore Saudi Arabia.
    - Reduce the lack of knowledge about the history of Saudi Arabia.
    - Ease the process of learning, as well as attracting foreigners and tourists to Saudi Arabia.
    - Encourage society to learn and spread awareness about the importance of learning.

## Sources of Domain Analysis Information

The source of domain analysis was those who were helpful to collect data in this system. They are the children learning in schools, existing museums and museum staff, history books and people who previously needed learning Saudi Arabian culture, and foreigners who are new to our country.

## Scope of the system

An application that provides functions to help learning about the Saudi Arabian culture, using both vision and the option between text or audio. Moreover, delivery for virtual glasses.

### This system includes:

* + - 1. The ability to purchase the learning plan.
      2. Historical sites’ locations.
      3. Competitively sharing advancements with friends.
      4. Leniently providing options for deaf people.
      5. Tracking of knowledge level.

### This system excludes:

1. This system does not operate offline.
2. This system is not a program for tourists, it is only a digital museum that allows you to view Saudi Arabian heritage.
3. This system does not operate without virtual reality glasses.

## System's Stakeholders

People who influence and participate in the system are the administrators, general learners, application developers, domestic and foreign visitors on the app, employees, including consultants and speakers, our course professor, children in schools, teachers, deaf people, museums and museum staff, and anyone who might be against the system.

# Phase2: Business Requirements Specifications

## 2.1. Requirements & Its Types

### 2.1.1. Functional Requirements

R1. The system shall allow the user to log in or create an account.

R1.1. The system shall allow the user to create an account using either phone number or email.

R1.2. The system shall allow the user to pick a username.

R1.3. The system shall allow the user to pick a name.

R1.4. The system shall allow the user to pick a profile picture.

R1.5. The system shall allow the user to enter an address.

R2. The system shall allow the user to choose between learning program options based on whether they are a child or a grown up.

R3. The system shall allow the user to view his personal profile information

R3.1. The system shall allow the user to edit his personal information.

R3.2. The system shall allow the user to save changes after editing his profile.

R4. The system shall allow the user to exit the app and resume with where he stopped with the program later.

R5. The system shall keep track of the monuments/levels the user has completed.

R6. The system shall allow the user to share his achievements.

R7. The system shall allow the user to buy virtual reality glasses or try them once.

R7.1. The system shall allow the user to select the student category, and then the Noor website will be linked to obtain a special discount.

R7.2. The system shall allow the user to select the university student category, and then the university email will be linked to getting a special discount.

R8. The system shall provide the location of every monument in the program.

R9. The system shall provide the user with information about the monument using either text or audio or both.

### 2.1.2. Non-functional Requirements

R1: The system shall have a user-friendly interface.

R2: The system shall be available in both Arabic and English.

R3: The system shall be easy to modify.

R4: The system shall protect the privacy of the user.

R5: The system shall be available for the user 24/7.

R6: The system shall provide different display modes (light mode, dark mode).

R7: The system shall operate on all smartphones (iPhone, androids, Huawei, etc...).

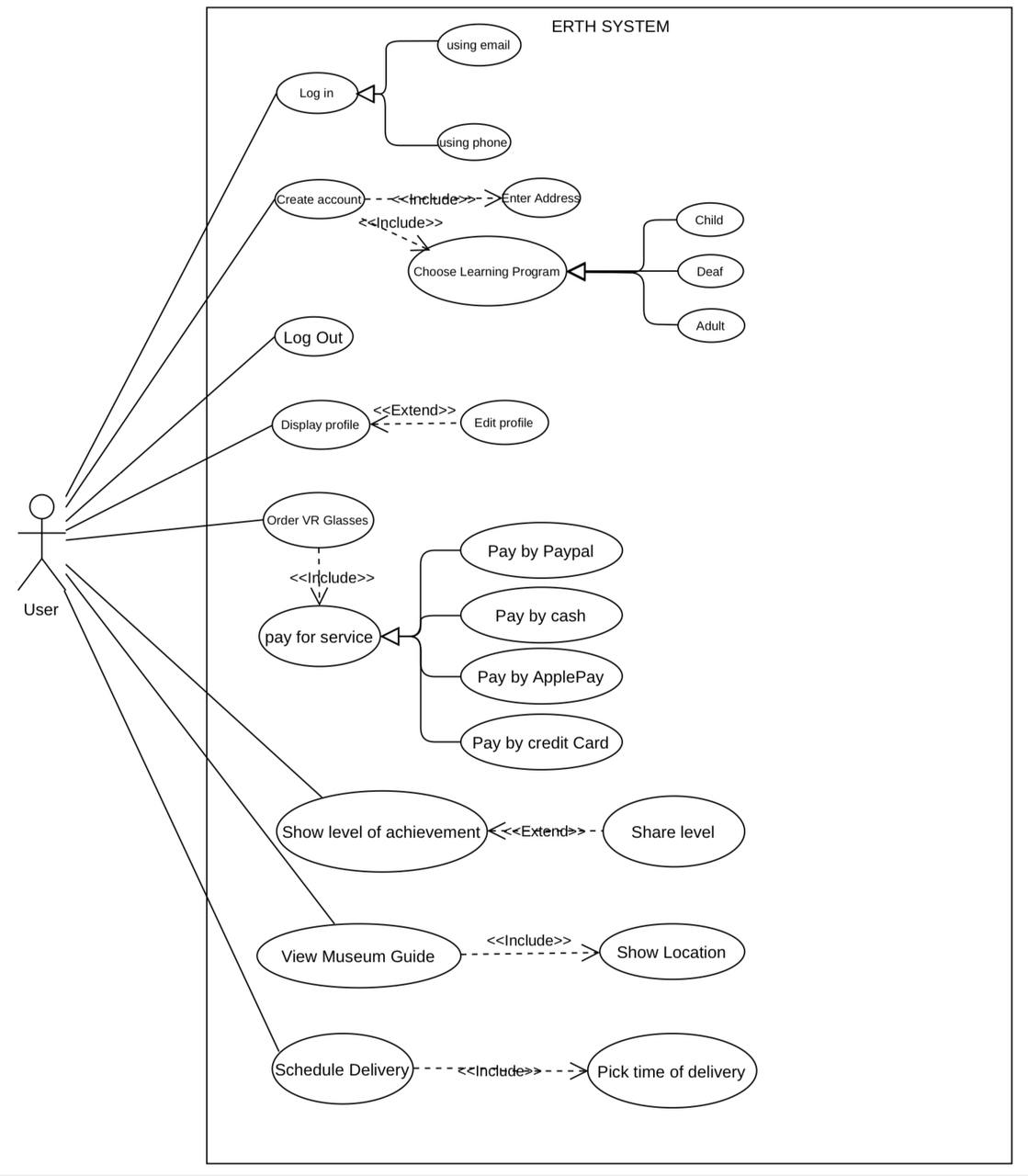
## 2.2. Techniques for Gathering Data

### 2.2.1 Survey

We gathered data using a survey directed towards the system’s users and found that 70.5% of them did not know much about the history of Saudi Arabia, and 98.1% wanted to know more. The most chosen reason is that 60.9% found that they did not enjoy the way they were taught about the history of our culture. Many of them say that ERTH service will encourage them to learn more about our culture. Most of the users have never visited a virtual museum and 97% of the surveyed were excited about our application and eager to try it if it was provided. Check Appendix A for further information in detail.

## 2.3. Use Case Model

**Figure 1** ERTH's System Use Case Diagram



## 2.4. Use Case Description

### 2.4.1. Use case 1

|  |  |
| --- | --- |
| **ID:** | UC-1 |
| **Title:** | Create An Account. |
| **Description:** | The user creates an account. |
| **Primary actors:** | deaf (adult, child), adult, child. |
| **Preconditions:** | The phone number or email must not have been used before to create an account in the system. |
| **Postconditions:** | The account is created and the interface for each actor is different. |
| **Main Success Scenario:** | 1. The system asks the user to choose between creating an account or login. 2. The user should choose to create an account. 3. The user must fill in this information:    * + - * Phone number or email.          * Password.          * Address. 4. Then the next step will be to select the correct learning program” deaf, adult, child”. 5. The user presses the create account button. |
| **Extension:** | 3a. Email or phone has already been used  -----3a1. The system will display an error message to the user saying that the email or phone number entered has already been used and asks the user to enter a different email or phone number.  -----3a2. The user either backs out of this use case or tries again with a different email address, or phone number.  3b. The password chosen by the user does not adhere to the password conditions.  -----3a1. The system will display an error message to the user saying that the password chosen is either too long, too short, or has unallowed special characters, and asks the user to enter a different password.  -----3a2. The user either backs out of this use case or tries again with a different password. |

**Table 1** Use Case 1

### 2.4.2. Use case 2

|  |  |
| --- | --- |
| **ID:** | UC-2 |
| **Title:** | Order VR Glasses |
| **Description:** | University student orders the glasses. |
| **Primary actors:** | deaf (adult), adult. |
| **Preconditions:** | The user must have an account.  The user address must be correct. |
| **Postconditions:** | The order has been placed and the payment is successful. |
| **Main Success Scenario:** | 1. The system asks the user to choose between buying the program or a free trail. 2. The user chooses to buy the program. 3. The user can select an existing address or add a new address. 4. The system provides a student option for a special student discount. 5. The user chooses the student option, and the system will ask the user to enter their university email. 6. The user chooses the payment methods. 7. The user clicks on the paying button. |
| **Extension:** | 5a. The email entered cannot authenticate that the user is a student.  -----5a1. The system will display an error message to the user saying that the email entered does not belong to a student and asks the user to enter a different email.  -----5a2. The user either backs out of this use case or tries again with a different email address.  7a. The payment has been declined.  -----7a1.The system displays an error message informing the user that the payment has not been successful and asks the user to either use a different payment method or try again.  -----7a2. The user either backs out of this use case, tries again, or tries a different card. |

**Table 2** Use Case 2

### 2.4.3. Use case 3

|  |  |
| --- | --- |
| **ID:** | UC-3 |
| **Title:** | Delivery glasses |
| **Description:** | The system will provide delivery of the glasses to the user. |
| **Primary actors:** | deaf (adult, child), adult, child. |
| **Preconditions:** | The user must have already paid for the learning program along with the virtual reality glasses and the order must be confirmed. |
| **Postconditions:** | The delivery is successful, and the user receives his VR glasses. |
| **Main Success Scenario:** | 1. After receiving a confirmation email of the order, a link in the email will redirect the user to the application. 2. The system will show the user the order details. 3. The user must choose the day and time appropriate for the delivery. 4. The user will click the confirm delivery button. |
| **Extension:** | 3a. The user chose a delivery time, but the system is unavailable to deliver at this time.  -----3a1. The system will display an error message to the user saying that the time chosen is unavailable, along with a reason for failure.  -----3a2. The user tries again with a different delivery time. |

**Table 3** Use Case 3

### 2.4.4. Use case 4

|  |  |
| --- | --- |
| **ID:** | UC-4 |
| **Title:** | Share the level achievement. |
| **Description:** | The user can share his accomplishments with his friends, family, and other learners. |
| **Primary actors:** | deaf (adult, child), adult, child. |
| **Preconditions:** | The user must be logged in and be part of the learning program. |
| **Postconditions:** | The user’s achievements have been shared and his rank among other users is shown. |
| **Main Success Scenario:** | 1. The user clicks on his profile interface. 2. Click on my achievements button. 3. Level is shown. 4. A share button is shown at the bottom. 5. User clicks share button. 6. User can select between sharing on other apps, or with the ERTH’s app users. 7. When the user chooses to share with the ERTH app users, he can see his rank among the other users on the app. |
| **Extension:** | None. |

**Table 4** Use Case 4

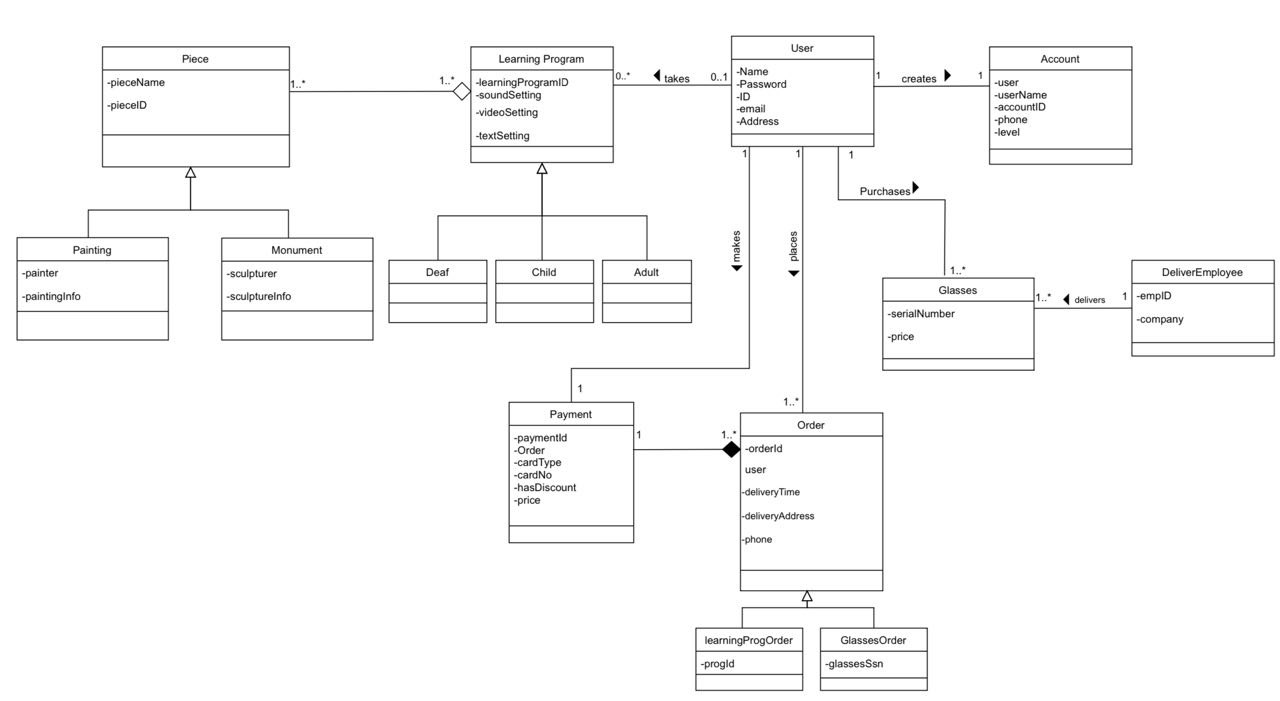
## 2.5. Difficulties & Risk Analysis in the Domain

The difficulties we faced while developing this system are:

1. Lack of information and resources about some museums.
2. The difficulty of finding the most correct information about each piece in museums.
3. Requirements change while working on the system.
4. It is difficult to find a specialist in communicating sound effects to the reader through writing.

# Phase3: Design and Structuring

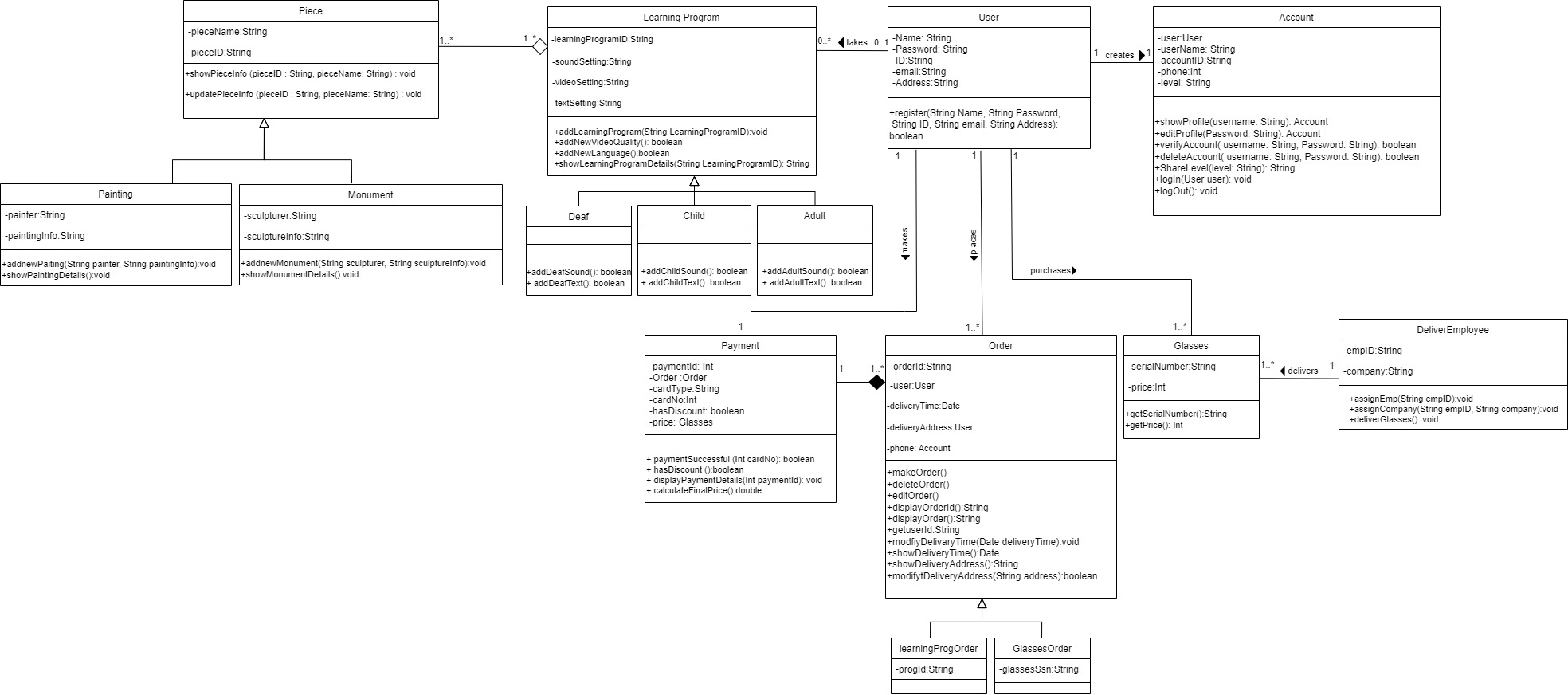
## 3.1. Domain Model



**Figure 2** ERTH's Domain Model

## 

## 3.2. UML class diagram



**Figure 3** ERTH's UML Class Diagram

### 3.2.1 Association Relationships and their Multiplicity

Between User and Learning Program

* User can take one Learning Program
* but many Learning program are taken by many Users

Between User and Account

* User can create exactly one Account
* And one Account is created by one User

Between User and Payment

* User can make exactly one Payment
* And one Payment are made by one User

Between User and Order

* User can place many Orders
* And many Orders are placed by one User

Between User and Glasses

* User can purchase many Glasses
* And many Glasses are purchased by one User

Between Deliver Employee and Glasses

* + - DeliverEmployee can delivers many Glasses
    - And many Glasses are delivered by one DeliverEmployee

### 3.2.2 Composition Relationships and their Multiplicity

Between Payment class and Order class.

* If there is no order, there is no payment.
* A payment can be for one or more orders.
* One or more orders have only one payment.

### 3.2.3 Generalization Relationships

* Painting class and Monument class inherits Piece class attributes and functions.
* Deaf, Child and Adult inherits Learning Program attributes and functions.

### 3.2.4 Aggregation Relationships and their Multiplicity

Between Learning Program class and Piece class.

* A piece is part of a learning program. It can exist alone in the real world.
* One or more learning program can have one or more pieces.
* One or more pieces can be in one or more learning programs

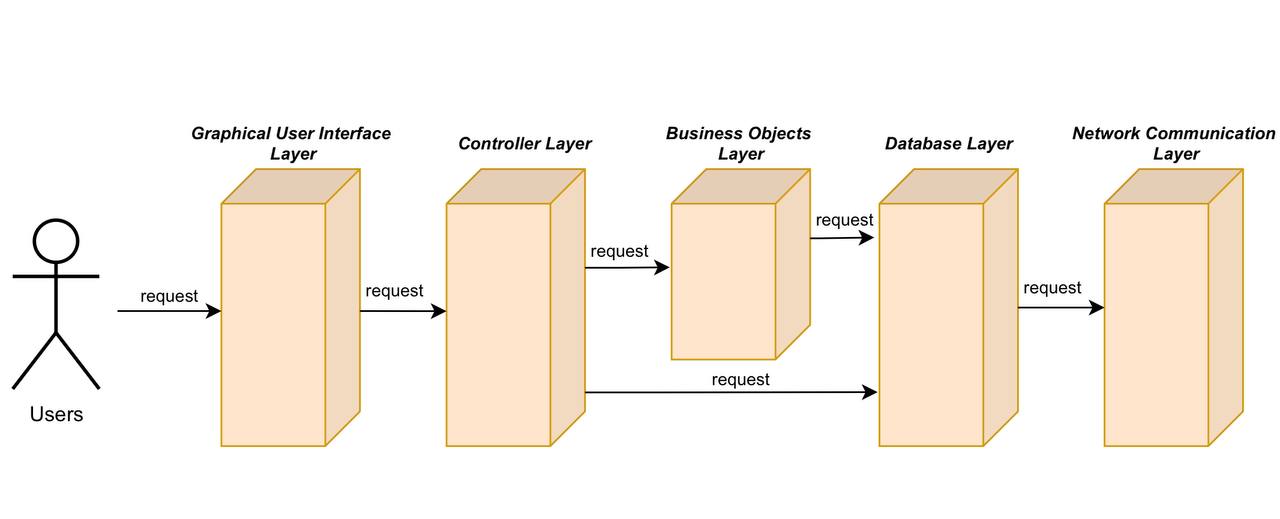
## 3.3. System Architecture

### 3.3.1. Type of System

This interactive system responds to user and learner requests, enables them to view different learning programs and participate in the appropriate. Users can also schedule delivery appointments by enabling them to select their desired time and day. Finally, the system allows the user to compete with other users. So, it is an interactive system.

### 3.3.2. Architectural Design

We used the N-tier architecture for this interactive system.

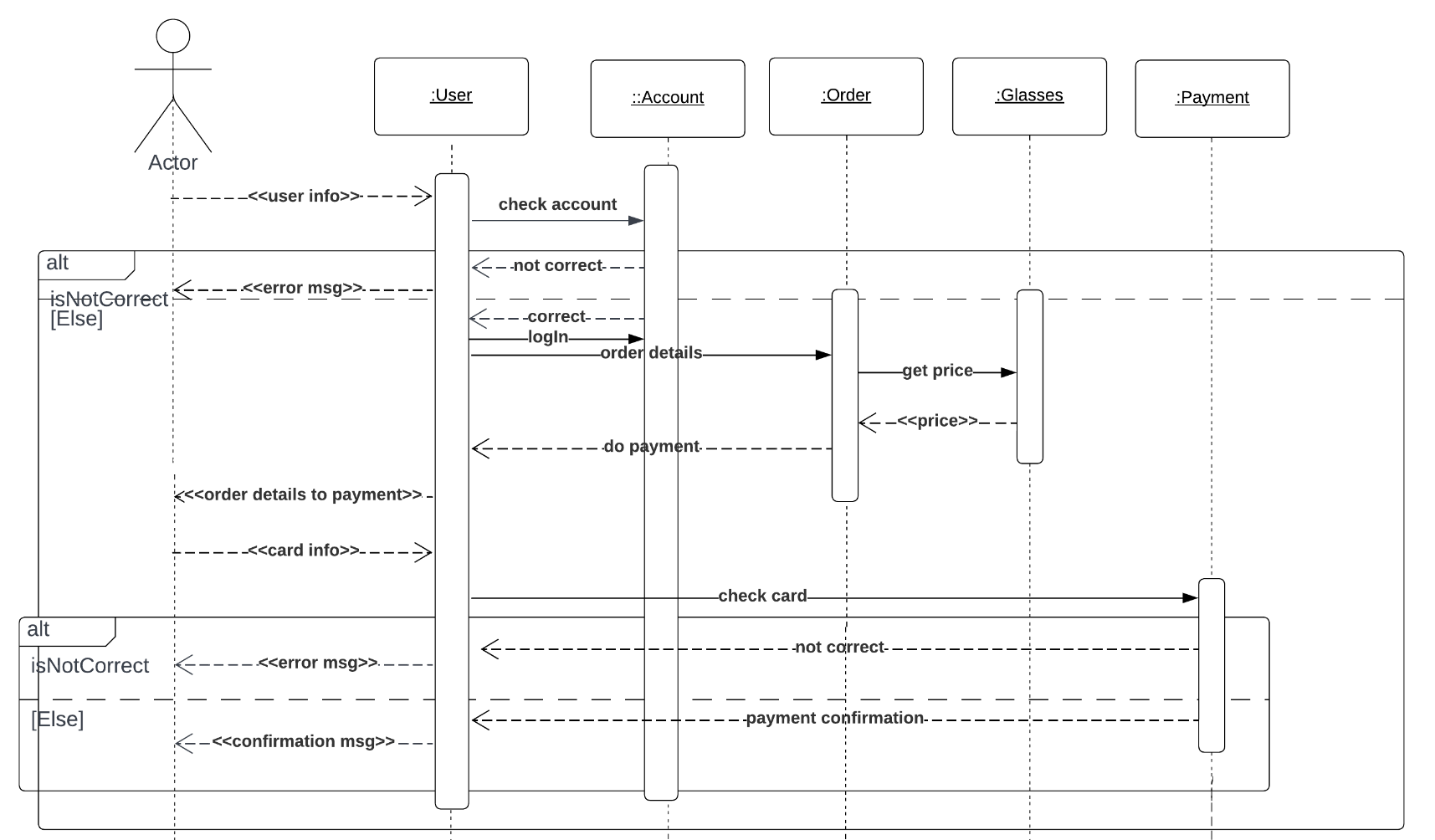


**Figure 4** ERTH's N-Teir Architectural Design

# Phase4: Dynamic modelling

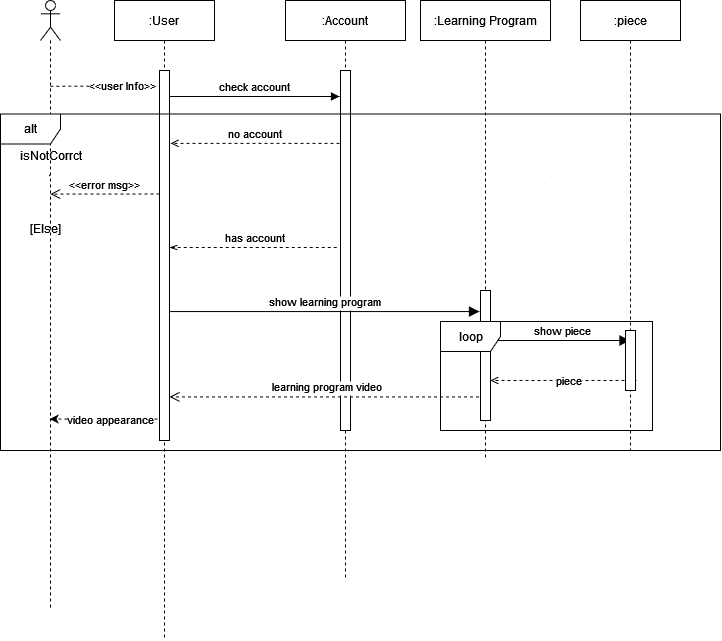
## Interaction diagram

### 4.1.1 Sequence diagram

1. **Make a payment**

**Figure 5** Sequence Diagram for Make a payment

2. **Show a learning program**



**Figure 6** Sequence Diagram for Show a learning program

### 4.1.2 State diagram

**Use Case 1: Purchasing and Payment the Program**

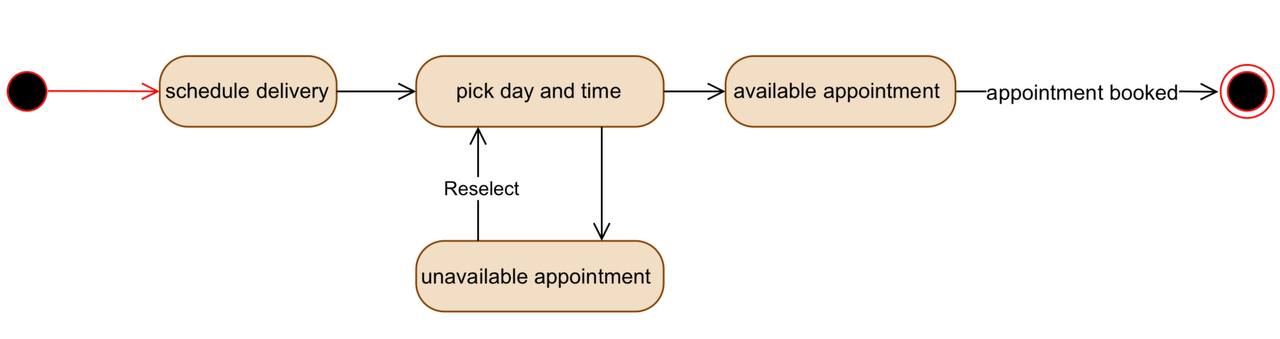
Diagram

Description automatically generated

**Figure 7** State Diagram of Purchasing and Payment the Program

**Use Case 2: Schedule delivery of VR glasses**

**Figure 8** State Diagram of Schedule delivery of VR glasses



### 4.1.3 Activity diagram

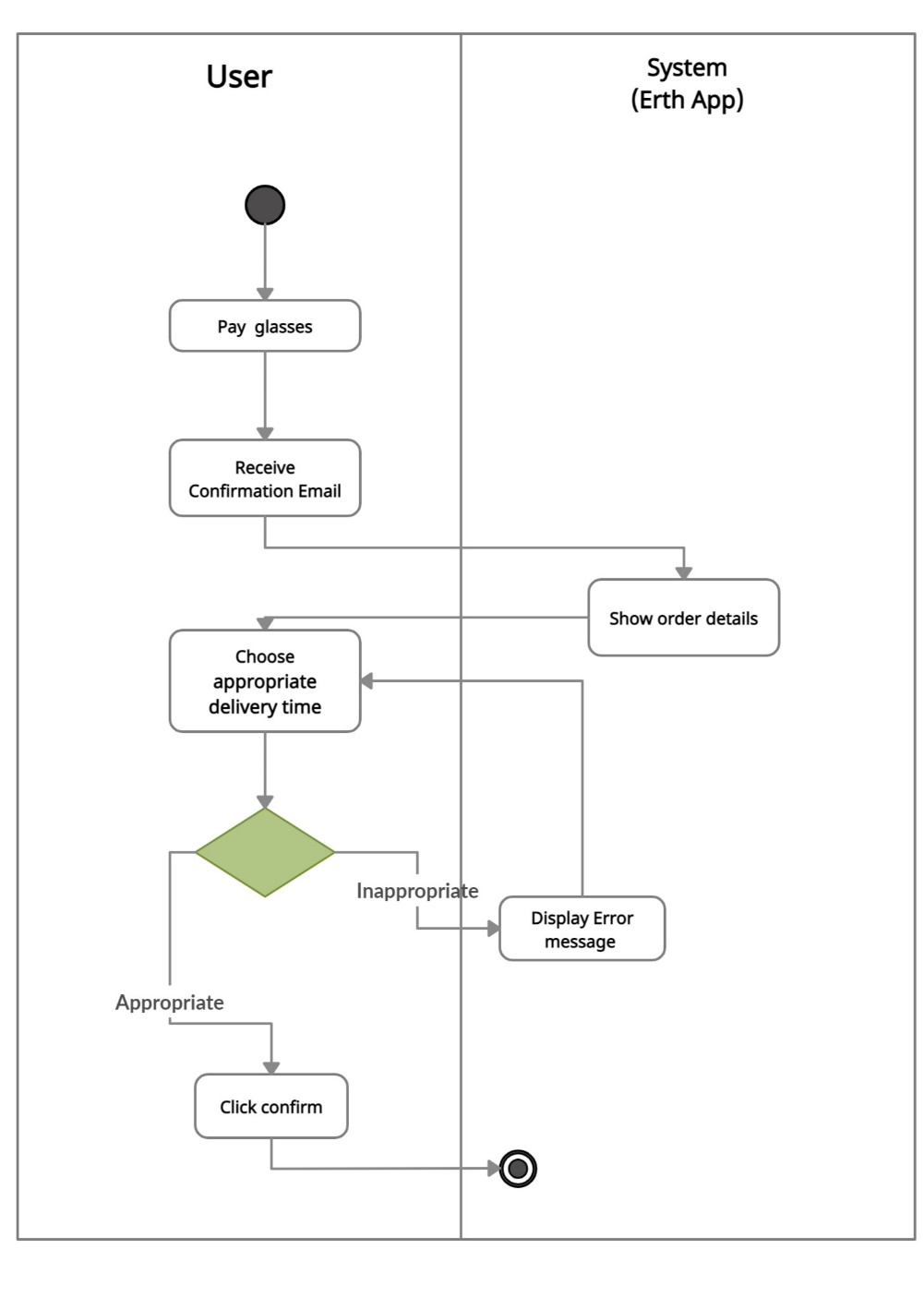
**Create An Account**

Diagram

Description automatically generated

**Figure 9** Activity Diagram of Creating Account

**Delivery Glasses**



**Figure 10** Activity Diagram of choosing delivery time

## 4.2 TESTING

### 4.2.1 Objectives

* To locate system faults and bugs.
* Ensure that the system and all its features operate effectively.
* Confirm that the user interfaces function as intended.
* Assess the design's simplicity and ease of use.
* Determine whether it adheres to specifications or not.

### 4.2.2 Testing Strategy

To make sure the system complies with the needs and requirements, to ensure that the system is operating properly, and to detect any likely faults to fix them, testing is done.

The features that were chosen for testing in our study:

* 1. Schedule delivery of glasses **(Test plan).**
  2. Show level of achievement **(Test plan).**
  3. User registration (Name, password: **Equiveillance Partitioning**. Phone: **Boundary Value Analysis**)
  4. User Payment: **Decision Table Testing**.
  5. User Login : **Decision Table Testing**.

The system result must match the anticipated answer for this test to pass; otherwise, the test is invalid.

### 4.2.3 Approach

The testing strategy utilized in this report is the black box testing strategy. Black Box Testing is based entirely on system requirements and standards and primarily concentrates on the inputs and outputs of software applications. Collectively known as behavioral testing. We chose this strategy because, rather than implementing thorough testing, we would be concentrating on evaluating how the system's user interfaces interact and behave.

### 4.2.4 Test Plan 1

**System:** ERTH System.

**Test case name:** Schedule delivery.

**Description:** Testing the ability of the user to schedule delivery of VR glasses.

**Test Scenario:** Check system’s response when the user enters the date and time for delivery.

**Precondition:**

1. The application is installed.
2. User must be logged into the system as a user taking the program.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test Case ID | Test Scenario | Test Steps | Test Data | Expected Results | Actual Results | Pass? Fail? |
| 1 | Check system behavior when user enters a valid delivery day and time. | 1. Log in. 2. Click on “schedule delivery” tab. 3. Choose date and time. 4. Confirm delivery appointment. | Date and time result: valid delivery day.    Home location: existing home address entered in registration.    Appointment Date: 8/11/2022. Appointment Time 6:30 PM | Delivery is scheduled successfully. | As expected | Pass |
| 2 | Check system behavior when user enters an invalid delivery day and time. | 1. Log in 2. Click on “Make Appointment” tab. 3. Enter date and time. | Date and time result: invalid delivery day or time. | System should show an error message “Sorry, we cannot schedule a delivery appointment for you at this time, please pick another day.” | As expected | Pass |

**Postcondition:** Delivery appointment is created successfully.

### 4.2.5 Test Plan 2

**System:** ERTH System.

**Test case name:** Show level of achievement.

**Description:** Testing the ability of the user to display his level of achievement.

**Test Scenario:** Check system’s response when the user requests to display his/her achievement level.

#### Precondition:

1. The application is installed.
2. User must be logged into the system.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test Case ID | Test Scenario | Test Steps | Test Data | Expected Results | Actual Results | Pass/ Fail |
| 1 | check system behavior when donor want to view his achievement level, and has started the learning program already and reached a certain level. | 1. Log in. 2. Click on “view level of achievements” tab. | User does not need to fill any data. | System should display the level of achievement of the user and show the message” Great job! This is your level in our ERTH program! Share it with friends and family!” | As Expected | Pass |
| 2 | check system behavior when the user wants to view his achievement level, and has not started the learning program or bought one. | 1. Log in. 2. Click on “view level of achievements” tab. | User does not need to fill any data. | System cannot display anything for the user and show an error message” You are not enrolled in ant learning program, once you start one, u can advance in your achievements, we hope to see you soon” | As Expected | Pass |

**Postcondition:** Level of Achievement is shown successfully.

### 4.2.6 Test Plan 3

**System:** ERTH System.

**Test case name:** Pay For service.

**Description:** Testing the ability of the user to pay for his/her service, and identify if the oayment is successful or not.

**Test Scenario:** Check system’s response when the user requests a payment.

#### Precondition:

* The application is installed.
* User must be logged into the system.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test Case ID | Test Scenario | Test Steps | Test Data | Expected Results | Actual Results | Pass/ Fail |
| 1 | check system behavior when user wants to make a payment and enters correct payment information. | 1. Log in. 2. Click on “proceed with payment” tab. 3. Pick payment method 4. Enter payment information 5. Confirm payment | Payment info: valid payment information.    Card Number:  1234 5678 9101 1121    CVV:  688 | System should display the message “Payment Successful” | As Expected | Pass |
| 2 | check system behavior when user wants to make a payment and enters incorrect payment information. | 1. Log in. 2. Click on “proceed with payment” tab. 3. Pick payment method 4. Enter payment information | Payment info: invalid payment information. | System shows an error message “Payment could not be processed. Wrong card number or CVV. Please try again or change your payment method” | As Expected | Pass |

**Postcondition:** Payment is processed successfully.

### 4.2.7 Test Payment (Decision Table Testing)

* click on pay button
* click payment method
* enter payment information.
* Click confirm payment.

|  |  |  |
| --- | --- | --- |
| **Condition** | | **Action** |
| **Entered**  **Card number** | **Entered**  **CVV** | **Expected Response** |
| F | F | Error:  The card you entered is invalid. |
| F | T | Error:  The card you entered is invalid. |
| T | F | Error:  Incorrect CVV |
| T | T | Successful payment |

### 4.2.8 Testing registering a new user

* Click on registration button
* enter information of new user
* login will not be accepted to new users

**User’s Name:** (equiveillance partitioning)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Invalid** |  | **Valid** |  | **Invalid** |
| * (character)   ...  3(character) |  | 4(characters)  5(characters)  …  10 (characters) |  | 11 (characters)  12 (characters)  13 (characters)  … |

**User’s Phone number:** (Boundary value Analysis)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Invalid Partition - Valid Partition Lower Boundary** | | | | **Invalid Partition - Valid Partition Upper Boundary** | | | |
| BV Below The Boundary | BV Above The Boundary | | | BV Below The Boundary | | | BV Above The Boundary |
| 0 | 10 | | | | | | 11 |
| **Password:** (Contain Characters and Numbers): (equiveillance partitioning) | | | | | | | | | |
| **Invalid** | | |  | **Valid** | |  | **Invalid** | | |
| …  4 (characters and numbers)  5 (characters and numbers) | | |  | 6 (characters and numbers)  8 (characters and numbers)  …  20 (characters and numbers) | |  | 21 (characters and numbers) 22 (characters and numbers) 23 (characters and numbers)  … | | |

### 4.2.9 Testing Non-Functional Requirements

* **Performance testing**

The non-functional requirement tested: “the system shall display different display modes (light mode, dark mode).”

The system will display various display modes dependent on the user's desired type of Light mode if it functions properly.

1. **Security testing**

The non-functional requirement tested: “the system shall protect the privacy of the user.”

The system will stop any attempted security breaches and any unauthorized access to our user database if the system operates properly.

1. **Portability testing**

The non-functional requirement tested: “the system shall operate on all smartphones (iPhone, Androids, Huawei, etc..)”

If the system operates properly, the system shall be able to operate on all types of smartphones correctly.

1. **Availability testing**

The non-functional requirement tested: “the system shall be available to the user 24/7”

If the system operates properly, the system shall be able to operate and serve the user in all times possible.

## 4.3 Conclusion

The fundamental issue is a lack of understanding of our culture. It makes sense to have an app that helps offer education for the least amount of money, without requiring you to leave your home, and while maintaining an unforgettable visual experience. The goal of the digital museum system is to make learning about this information accessible and enjoyable for anyone who are interested in it. Since so many individuals in our society today are ignorant of Saudi Arabia's natural beauty, it aids in the systematic delivery of our culture. Additionally, since children spend most of their time these days on tablets, which impair their brains, the system is encouraged to use that time more effectively.

While working on this project, we encountered certain difficulties with information gathering and time management. But by pulling together as a team, we were able to overcome these obstacles. The ERTH system is an intuitive program with special features for all types of users.

# Reference

Kung, D. C. (2014). Object-Oriented Software Engineering: An Agile Unified Methodology. US: McGraw-Hill.

# Appendix A

## Survey answers

<https://forms.gle/iiNqyzx9J1NmsYjz5>



