Sheridan College

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Winter 12-12-2022

Digital Graffiti

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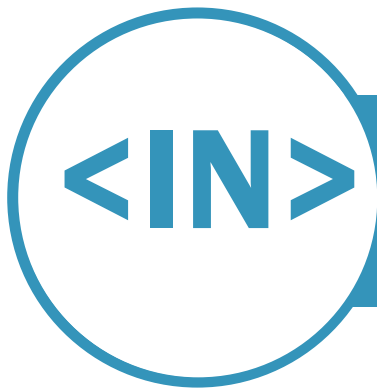*Sheridan College*, munv@sheridancollege.ca

Digital Graffiti

<DOMAIN> | CAPSTONE PROJECT
HONOURS BACHELOR OF COMPUTER SCIENCE
(MOBILE COMPUTING)

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ABSTRACT

It is not easy for a new artist looking to become a professional to find an avenue to sell their art. There are many obstacles, such as reaching the proper audience, having control over how your art is displayed, and making transactions in a safe and secure manner. Furthermore, buying art is also a hardship. What if the art you buy online does not suit the environment it is destined for? What if there was a way to find art closer to what you desire? This application seeks to alleviate these problems by providing a platform for artists and buyers of art to connect in a new and beneficial way. By allowing users who seek to buy art the ability to hone in what type of art they are seeking, and then actually view their art in the setting they wish to decorate it with in augmented reality, we will help buyers have more satisfaction with the experience of buying art. Likewise, by allowing artists to highlight their art in a more realistic manner, it will allow them to reach a broader audience and give their clients what they are looking for.

ABOUT CAPSTONE PROJECTS

TIMELINES • PROGRAM • SCHOOL

- **January 2020 – April 2020**: Capstone Project Inception, 4-credit course (18 hours / week)
- **September 2020 – December 2020**: Capstone Project, 4-credit course (18 hours / week)

PROGRAM • SCHOOL

- Hons. Bachelor of Appl. Computer Science (Mobile Computing)
- Applied Computing, Faculty of Applied Science and Technology

Sheridan | Get Creative

Table of Contents

INTRODUCTION

The purpose of this document is to be an evolving Capstone report where we record our project's overview, requirements, architecture, plans and validation/testing. The structure of this report will follow the table of contents and there will be periodic records on each revision made to this document.

PROJECT OVERVIEW

Our project's name is Digital Graffiti. The scope of our project is the following, the AR art gallery that artists use to show their art to others, the marketplace where artists can customize their storefront and have transactions, and a portfolio where artists can purely upload art, they are proud of for professional review. Our Domain Expert is named Evgeniia Namestnikova and they are a student artist of Sheridan College. Email: Namestni@sheridancollege.ca.

The Doman and Industry Overview describes the domain our project is working in and its relevant industry, the Problem Description subsection talks about in detail the problem our project is solving using mobile and cloud computing with additional support from advanced areas of computer science. In there we will also identify the community that would benefit from this solution. The Solution Description will talk about how our solution combines and employs mobile computing, cloud computing and its areas of advanced computer science to solve the problem mentioned in Problem Description. The Solution Impact subsection explains the impact of the solution being proposed to the industry or community. The Solution Feasibility describes the feasibility of designing and constructing the solution being pursued for the selected problem, the feasibility of deploying the solution to the industry or community partner such that it is used by its intended audience and the feasibility of adoption once the solution has been deployed. This subsection also talks about the risks our team has identified.

DOMAIN AND INDUSTRY OVERVIEW

This application will benefit producers of visual art. From students taking their first steps into the art selling world, to more experienced professionals seeking a better way to connect with their clients, users will find a marketplace to allow a better connection between artists and buyers allowing a more flourishing market.

PROBLEM DESCRIPTION

Utilizing the technologies of mobile and cloud computing, this application will give users the ability to browse and locate the type of artworks they are seeking, while also allowing artists to showcase their art in a manner conductive to finding buyers. Mobile computing will provide the core platform for the application and its advanced features such as augmented reality; and cloud computing will provide the backbone of the application in the form of databases

allowing users to be created and communicate with each other, as well as hosting the actual art itself. Artists often operate in private sales, without a centralized platform to display and sell their art to buyers. By bringing all artists together this application will allow artists to increase their exposure and contribute to the growth of the visual arts industry. Current platforms used by artists aren't tailored to their needs. Artists must adapt to these platforms and risk making their output seem unprofessional due to the nature of the applications. Artists lack the ability to customize how their art is perceived in a digital setting, which undermines their artistic expression, and their ability to convey their intentions to their potential clientele.

SOLUTION DESCRIPTION

This section of the document contains Mobile Computing, Cloud Computing Advanced Areas of Computer Science and Solution Impact. Mobile Computing describes how the solution employs mobile computing (phones or tablets) in solving the real-world problem identified. Cloud Computing describes how the solution uses cloud-computing services to connect the different components of the application and to host web applications or services used in the mobile applications that are part of the solution. Advanced Areas of Computer Science describes the two advanced areas of computer science. One area will act as a primary differentiator for the project while the second will be designated as a supporting area which does not have to exhibit the same level of depth. Solution Impact describes the impact of the solution being proposed to the industry or community partner, to the industry as a whole or the technology being used.

Mobile Computing

To reach the largest possible audience, mobile computing would provide the ideal landscape for this application. By far most Internet users utilize their phones for access. Mobile computing also provides all the necessary technology to implement more advanced features such as augmented reality.

Cloud Computing

Cloud computing would provide the backbone for the entire application. The application will rely on a great deal of user content and will therefore require a cloud-based solution to store and distribute this content. On top of the content, a user database will be essential in allowing a marketplace in which users can connect with artists directly, as well as interact with their art by way of commenting on augmented reality galleries and having search results catered to their personal account.

Advanced Areas of Computer Science

This project will use augmented reality for many of its key features. A major draw of this application is the ability to view the art in its intended location before it is purchased. Using augmented reality, a picture can be placed into that position to see how well it fits in to the surrounding area in terms of color and form. This is intended to help consumers buy the art they will be most content with as well as helping artists make sure their clients are content with their purchase. To help artists increase their earnings, artists can submit their art for evaluation by artificial

intelligence, with the goal of creating a filter based on their unique artistic styles. This will allow users to buy filters of their favorite artist to apply to their personal images for amusement.

SOLUTION IMPACT

This solution is intended to help artists sell more of their works. This will help grow the arts sector by drawing more consumers into the application and exposing them to art they are interested in purchasing.

SOLUTION FEASIBILITY

This section of the document contains Design and Construction, Deployment, and Adoption. Design and Construction describes the feasibility of designing and constructing the solution being pursued for the selected problem and identify foreseeable risks that could prevent a solution from being constructed. Deployment describes the feasibility of deploying the solution to the industry or community partner such that it is used by its intended audience. Adoption describes the feasibility of adoption once the solution has been deployed.

Design and Construction

The application outlined to be designed and constructed is quite feasible. The solution can be designed using available frameworks and tools. One risk, however, is that the augmented frameworks may not be able to provide all the functionality required for our intended purposes. Research and testing must be done to confirm the viability of the chosen framework. Another potential risk is the complexity of adding an augmented reality picture filter system. At present more research must be done as well as determining how the system can be implemented in a user-friendly manner. A major concern among artists that have been queried on the subject is the way their art is represented on current, non-specialized platforms. This application will have to appease their wishes in a manner which encourages their continued usage of the app.

Deployment

The deployment of the solution to potential users would be quite straightforward as it could easily be accessed via the App Store. It would be as simple as demonstrating the application and then asking potential artists and users to search for its name. The cloud services and backend are very scalable and accessible and would not be likely to be the source of any deployment issues.

Adoption

The program could have potential issues in adoption due to costs attributed to the backend cloud services. These services are not free when deployed on a mass scale so that cost would somehow need to be passed along to the users. Any sort of paid model automatically excludes large amounts of potential users so a method of gaining revenue to make the app self-supporting would be essential to its long-term usage.

PROJECT REQUIREMENTS

This section contains System Context, Use-Cases, and User Interface. System Context is where we identify the project stakeholders (primary actors, supporting actors and off-stage actors) and the main top-level use-cases the system can carry out for its users. Use-Cases provides a high-level description of each major use-case to communicate the major capabilities of the system. User Interface includes and describe major user interface elements, first as wire-frames and then as concrete application screenshots when implementation is available.

SYSTEM CONTEXT

Our system has 6 actors in total. 2 main actors, 1 off stage actor and 3 supporting actors. For the first main actor Artist, this is the actor who uploads their art for varied reasons. They upload their art into their portfolio to show to the offstage actor, Hiring Manager, to sell their art in the marketplace, gain exposure for their art by showing it off in the AR gallery or all the above. The other main actor Patron is the actor that views art in the AR gallery and buys art in the marketplace. The first supporting actor is the Art API, where queries on the arts the database has are managed. The Art API will be able find arts depending on user search specification and be edited by the artists who own them. The 2nd supporting actor, the User API, is where the login and creating accounts come in. The 3rd supporting actor is the Transaction API, where safe and fast transactions are handled. The first main top-level use-case the system can carry out for its users is Artists can display their art via AR and patrons can test art in AR at their desired location. Users will be able to visit the AR galleries of artists and comment and rate the art displayed there. For instance, if a patron is looking for a piece of art, they can find an artist they like and choose a location they wish to place the art, they can then view each piece of art in that location via augmented reality, helping them find the right piece for the right location, helping to ensure their satisfaction. The second main top-level use-case the system can carry out for its users is, users can buy art on the marketplace and sell art they uploaded to the marketplace. Patrons will be able to search for art they are interested in and add them to a cart before checkout to purchase their art. Artists will select which art of there they wish to sell on the marketplace, set their prices, add descriptions to sell their art better, etc. The third main top-level use-case the system can carry out for its users is Artist can create the custom layouts and make some works to stand out more than the others. Portfolio should exclude any statistics and provide just pure work itself. Hiring Manager and Customer can observe artist's work and evaluate them without any additional opinion. Additionally, artists can choose the art works they want to publish in the gallery.
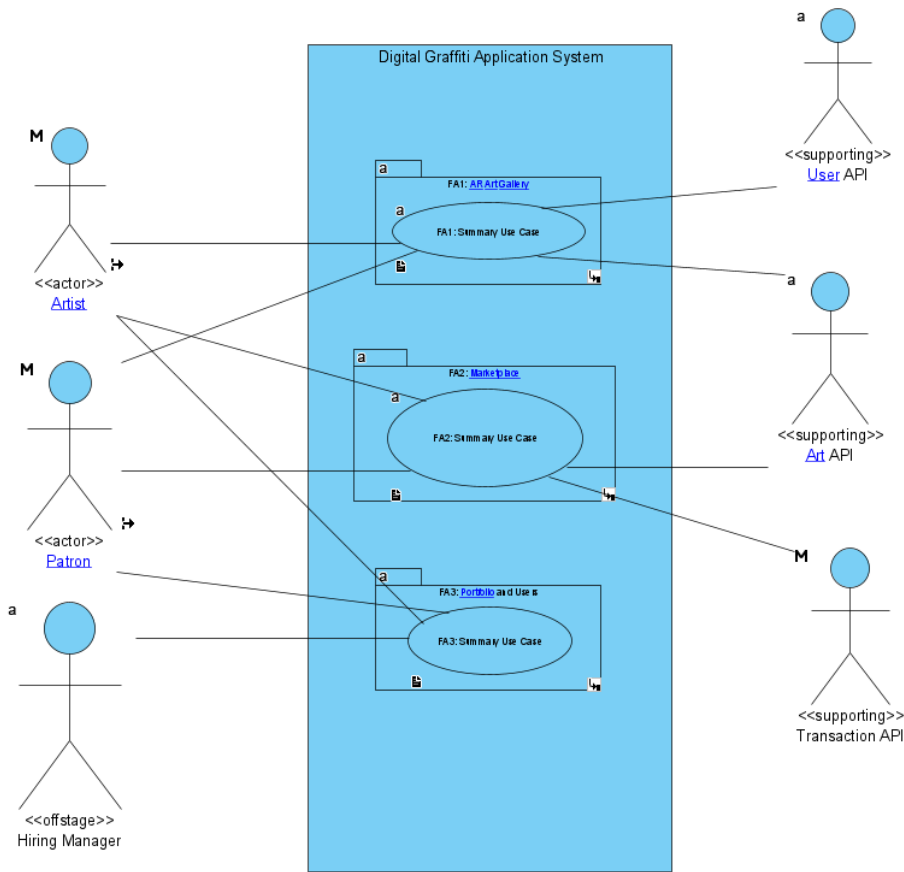
USE-CASES

Functional Area 1: AR Art Gallery has a use-case to allow users to view potential art purchases in augmented reality. They can select the art to display and are transferred to an AR interface where they can locate a wall to place the art, and then have the ability to reset the interface to remove the art, and choose another to replace it. The art will also be manipulatable by the user to increase or decrease its size to get a better fit for its intended environment. Users will be able to rate and comment on the art in this gallery format and other users will be able to see these comments and ratings. The artist will also be able select certain art to be showcased in an art gallery mode, where all the images in the AR interface are pre-selected by the artist.
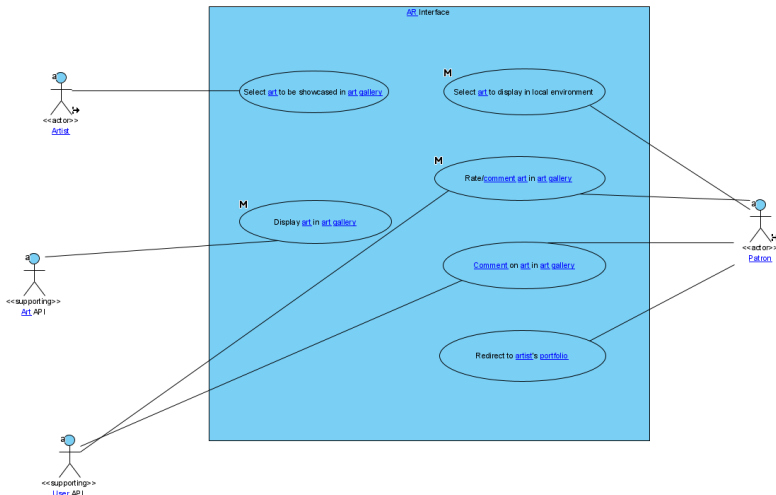
Function Area 2: Marketplace has a summary use-case, Users/Patrons can buy art on the marketplace and sell art they uploaded to the marketplace. Patrons will be able to search for art they are interested in and add them to a cart before checkout to purchase their art. Artists will select which art of there they wish to sell on the marketplace, set their prices, add descriptions to sell their art better, etc. Buy Art use case is where Patrons can add arts to the cart when viewing the details of the art and see their checkout list in the cart. It also includes a transaction system. Manage Art Data is the CRUD for art data. Search for Art can be broken down into 5 parts, Search for all sellable art, search for art by name, search for art by artist, search for art lesser than or equal to price, and search for art greater than or equal to price. Search for all sellable art is search for all arts with the field, marketplaceRevealed equals to True. This flag will be included for all other searchable options as well. Search for art by name is searching for art with the name inputted by the Patron. Search for art by artist is searching for art with the artist's name. Search for art lesser than or equal to price is to search for art less than or equal to the price inputted by the Patron. Search for art greater than or equal to price is to search for art greater than or equal to the price inputted by the Patron. Sell art use case is where Artist can set their art to be sold on the marketplace by making the field marketplaceRevealed equal to True. See Records use case is where Patrons or Artists can see which arts they have brought or sold, respectively.
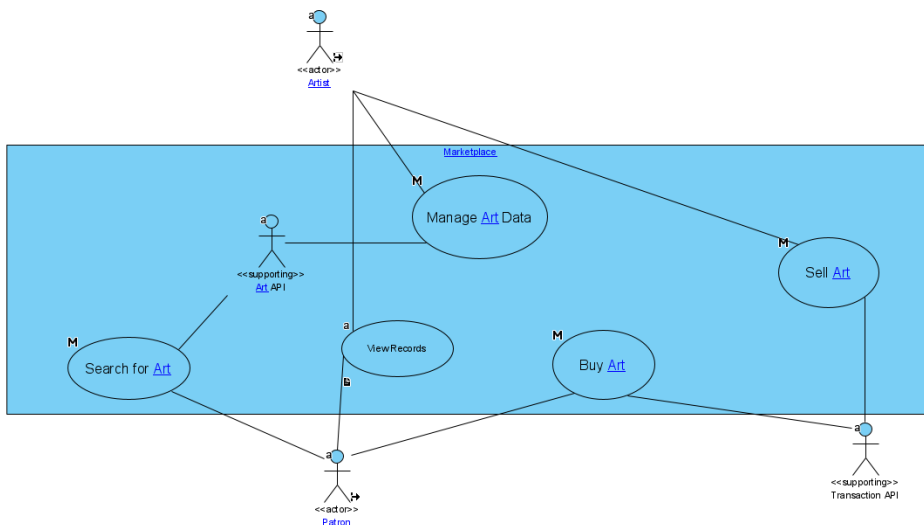
Functional Area 3:

Artist can create the custom layouts and make some works to stand out more than the others. Portfolio should exclude any statistics and provide just with pure work itself. Hiring Manager and Customer can observe artist's work and evaluate them without any additional opinion. Additionally, artist can choose the art works they want to publish in the gallery.

Use case1:

Artist will drag and drop elements, also resize them to create its own personalized portfolio page. Main point of this is to make some works to stand out more than others.

Use case 2:

Artist can select particular works which he likes in order to post them on the AR gallery to reach more audience.

Use case 3:

Artist uploads new works to the portfolio in order to expand it.
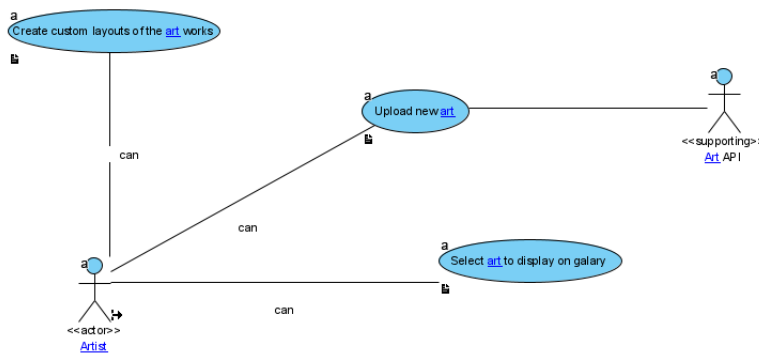

USER INTERFACE

Entering the AR interface will allow users to see which image they're about to display in AR. The user will be able to scroll through different art depending on which art they've queued to view, or which artists portfolio they're in, and choose which they'd like to display. They will also be able to rate and comment on the art from within the AR interface.

1 : Scene1   2 : Scene2   3 : Scene3

4 : Scene4   3 : Scene3
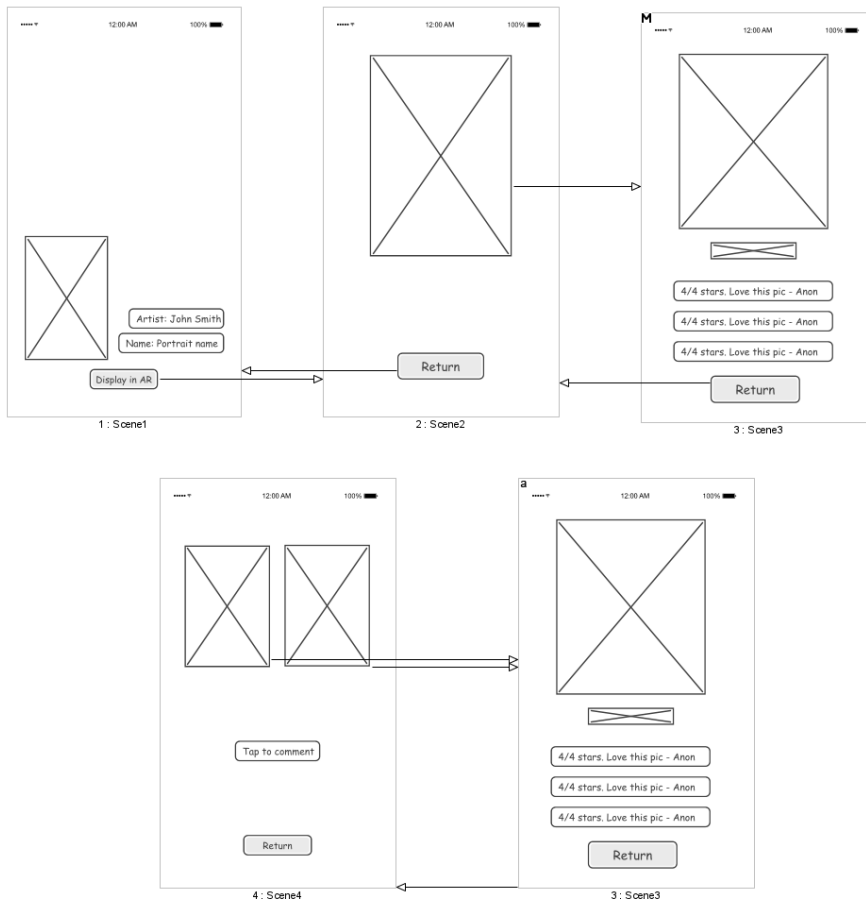
Upon clicking on the Marketplace button, you will see the marketplace view with a list of arts, the search button, the cart button, and the back button. Arts are shown as a Card and when you click on the Card, you go to the Art Details View. The Search button sends you to the Search View, the Cart button sends you to Cart View and the back button sends you to the main menu. In Art Details View, the details of the art, Cart button, Add to Cart Button and the back button is there. Details of the art include, the image of the art, name of the art, artist's name, price, and description. Add to Cart button adds the art to the cart and the back button brings you back to the marketplace view. The Search View shows the search box, the search options, and the back button. The search box is where the search input is placed. The search options are search for art by name, search for art by artist, search for art lesser than or equal to price, and search for art greater than or equal to price. These search options are described in detail in Use-Cases subsection. Back button sends you back to the marketplace view. The Cart view has the checkout list, the buy button and the back button. The checkout list contains add the arts you added to the cart. The buy button starts the transaction for the arts and the back button goes back 1 view, be it the marketplace view or the art detail's view.
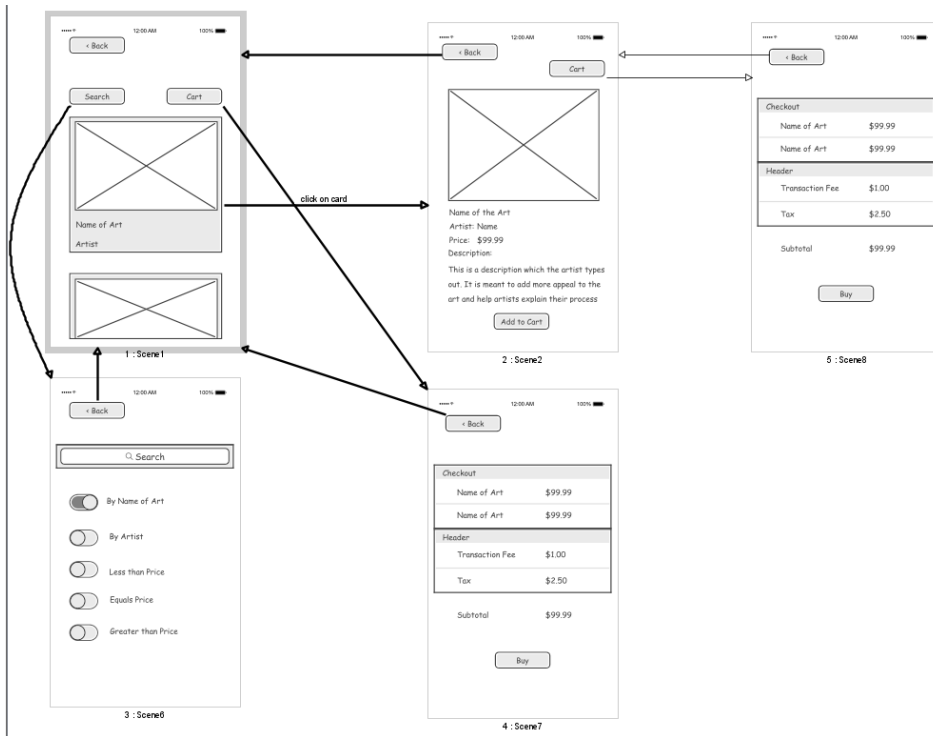
When clicking on the portfolio button the portfolio screen appears with a custom grid filled with artist's work. Three buttons should appear at the bottom of the screen. These buttons are "portfolio page", "add picture" and "edit grid". When clicking the "add picture" button the modal screen with a gallery should appear and user will be able to choose the image from the gallery. As soon as user selects the image modal screen closes and user will be able to add description to the work he is uploading. After hitting the upload button, the work will be sent to the database and stored there. On the last screen user should be able to edit grid in the way he wants it to be aligned. User will select the grid type he wants and will be able to drag and drop images around so that the grid will appear to be custom.
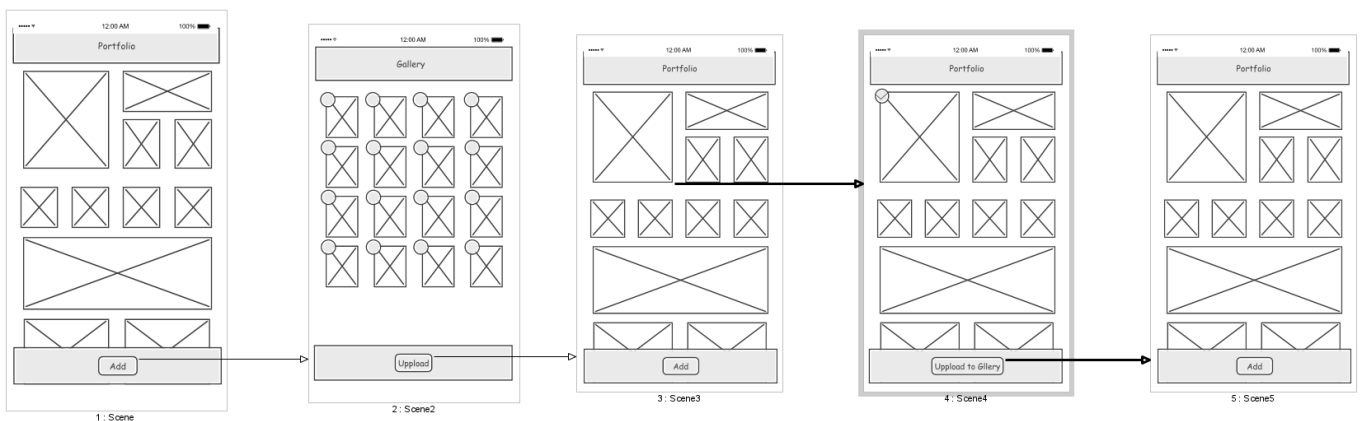
PROJECT ARCHITECTURE

ARCHITECTURE OVERVIEW

The type of system that is currently implemented is a type of Data Centered Systems, called Information Systems. Art Data is shared by users of the system, Patrons and Artists, as information that is available to all/larger sets of users. For example, Patrons can go to the Marketplace to see all sellable art, the Artist label as such. There is controlled access to information using groups. Patrons cannot edit the art details of the art they can view. Artists can only edit the art they own in their portfolios. The best architecture pattern that accompanies Information Systems is the Layered Architecture pattern, which helps justify our architectural pattern choice. For our architectural pattern we choose Layered Architecture. This pattern can be used to structure programs that can be decomposed into groups of subtasks, each of which is at a particular level of abstraction. Each layer provides services to the next higher layer.
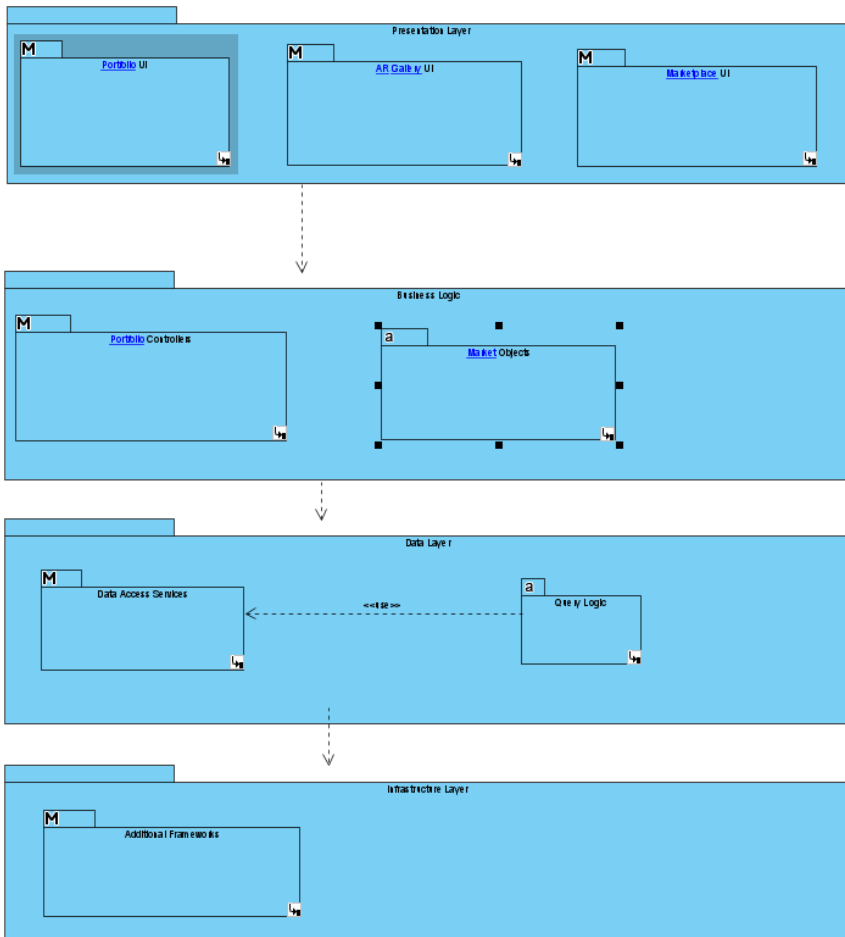
SYSTEM COMPONENTS

We have 4 layers in our Layered Architecture, the Presentation Layer, the Business Layer, the Data Layer and the Infrastructure Layer. The Presentation Layer has our Portfolio UI, the AR Gallery UI and the Marketplace UI.
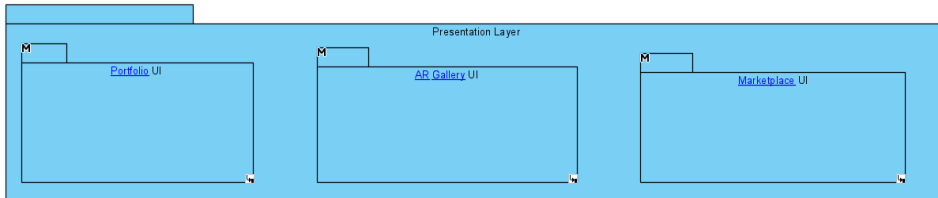

The Business Layer contains the Portfolio Controller, which contains the logic to control the views of the images inside the Portfolio and the Market Objects. Inside the Market Objects are MarketCard and Cart.
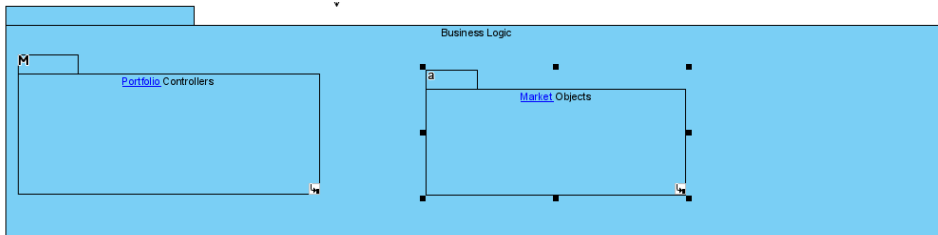
The Data Layer contains the code which queries the database, specifically the Firestore Collection, Storage and Auth. It also contains Stripe, where the credit card information is sent to the server to validate.
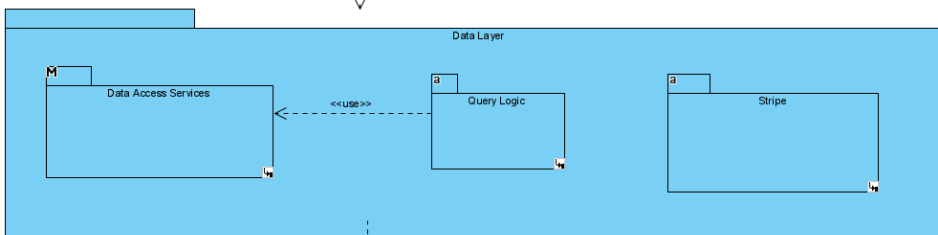
The Infrastructure Layer contains frameworks such as the AR framework, being ARKit, and Drag Drop Resize Framework, which is to edit the view of the images inside the Portfolio.
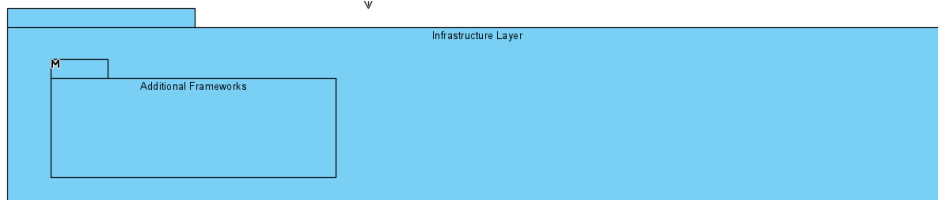
DEPLOYMENT MODEL

Smartphone AR is the device where the application exists with Augmented Reality. ARKit is the component that describes the library that handles Augmented Reality. Camera is a component where the mobile device can view the

real world through its lenses. Local Storage is a component where the mobile device's storage is. Database Server is where Firestore is hosted. Firestore is a component of the Database server, and it contains many datastores, In the context of the project, it is where our collection, where text data is stored and storage, where the images are stored, exists. Collection is a component of Firestore, where text data is stored. This text data includes name of the art, location of the art's image, artist's name, price, etc. Storage is where the image of the art is stored. The device iPhone has an execution environment of iOS 15, it is associated with Smartphone AR and the Digital Graffiti App is deployed on the iPhone in iOS 15. Payment Server is the device where the server validates credit card information. Stripe is a component where the client side of the credit card information input is handled. PaymentIntent is a component where it is returned true if the credit card information is valid and false if the credit card information is not valid.
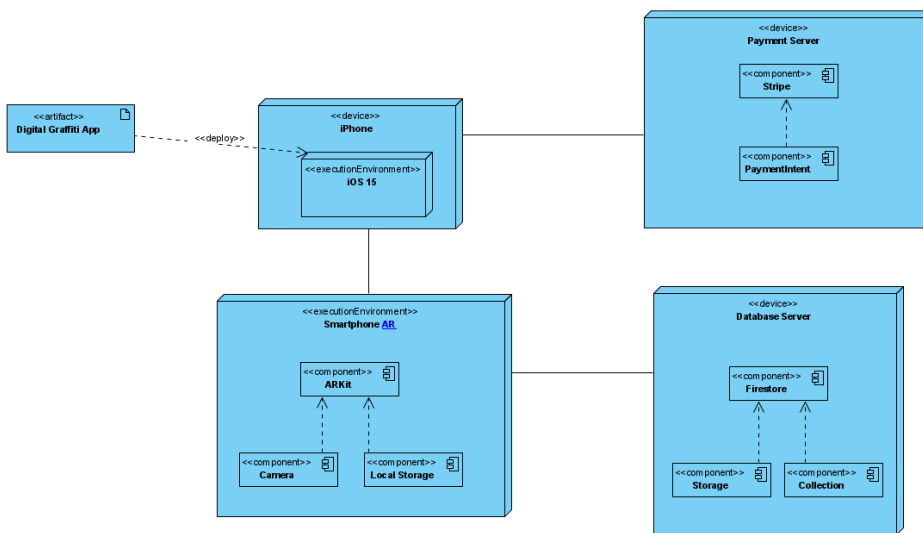
PROJECT PLAN

This section contains the subsections, Iteration Plan and Risk Management Plan. Iteration Plan describes the iteration plan followed in the construction of the project. Risk Management Plan describes the risk management process followed in the construction of the project.

JIRA workspace: https://digitalgraffiti.atlassian.net/jira/projects

ITERATION PLAN

We have 8 Iterations, starting from Iteration 4 to Iteration 11. Iteration 4 is to complete the deliverables for the Project Proposal and Project Plan. Iteration 5's goal is to complete the deliverables for Project Inception Release. Those deliverables include the Project Software Model (PSM) with completed Requirements and Domain Model, a Potentially Shippable Product Increment (PSPI), and an updated Project Plan. The PSPI is the navigation and the UI of

the application complete with some built in interactions to show the use of the application. Iteration 6's goal is to start on the deliverables for Project Architectural Release and to finish 50% of the deliverables and continue the work in Iteration 7. Iteration 7's goal is to finish the deliverables for Project Architectural Release. Those deliverables include the PSM with completed Design, Interaction and Deployment Model, an updated PSPI, a Project Plan Update and updated Project Inception Document (PID). The PSPI will have allow artists to add art to the gallery, a search system, secure login and allow artists to host their portfolio. Iteration 8, 9, and 10's goal is to complete the deliverables for Project Elaboration Release. Those deliverables include a complete PSM with updated Requirements, Design, Interaction, Deployment and Validation models, an updated PSPI, and an updated Project Plan. The PSPI will include customization for artists for their art, with tags and keywords, develop picture overlay, finish user interfaces, descriptions for art the artists put on, user communication and user ratings and comments. Iteration 11's goal is to allow for transactions in the marketplace, securely and easily.

We have 12 iterations, starting from Iteration 12 to Iteration 23. Iteration 12 is to review and revise the software design model and project plan for any new changes or additions. Their deliverables are revised software design model and the revised project plan with the PID. Iteration 13 and 14 will be allocated for tasks that help complete the deliverable for the Alpha Release. Iteration 15 will be used to form the Software Test Plan and to do research on what testing needs to be done. Iteration 16 to 20 will be dedicated to executing the Software Test Plan, fixing any bugs that appear from the testing and to finish the deliverable of the Capstone Beta Release in Iteration 20. Iteration 21 and 22 will be used to prepare the Capstone Defense Presentation which is due in Iteration 22. Iteration 23 will be for the Capstone Final Release which is for completing any critics from the Defense.

JIRA Iteration Plan: https://digitalgraffiti.atlassian.net/jira/software/projects/PMP/boards/1

RISK MANAGEMENT PLAN

Having three separate designers creating UI independently could cause long term problems in terms of cohesion between the different sections. Creating a figma prototype will help us plan a central theme for each designer to work around, hopefully alleviating the differences between pages and presenting a unified design stylization.

The potentially high costs associated with server space are an issue requiring further analysis. The team will seek to alleviate this risk by finding ways to pass potential costs onto the users, as well as finding free solutions during the design process.

AR framework limitations have been identified as a potential issue. We will seek to gain a better understanding of these limitations and find the framework that will allow us to create the functionality we hope to deploy.

The utilization of AI for custom filters will be a process that will require both research and thoughtful execution. From preliminary analysis such a filter must be created through developer tools and can't be done via the application. This will require Additional costs as well as a seemless way to integrate the functionality into the application.

Potential server issues could be a problem. The nature of this application requires large scale distribution of user content. Methods of delivery will have to be discovered and utilized to deliver content quickly and seemlessly at all times.

Payment verification problems have been identified as a potential risk and the greatest risk of all. Artists and customers need this system to work for artists to make a living and for customers to pay for the product. Art

inventory tracking is the database checking if the art piece the artist is selling is sold to a customer or not. If this tracking fails, it could result in customers purchasing an art piece already sold.

Painting will not convert into objects for the portfolio: I want to implement brushes and paintings. To make layering and stacking available I will need to convert artists paintings into objects so that they can tap on drag and move their sketches. But I do not know the limitations of a canvas view and pencil kit thus there is a potential risk that I might not be able to convert drawing into the object.

Json will not be able to capture all dimensions and position of the portfolio elements: to edit the portfolio I will need to first rebuild it using the data available such as dimensions, positions and layer numbers but I am not sure if all the elements will be able to provide the necessary information to rebuild the portfolio thus it might be a potential risk.

JIRA Risk Management Plan: https://digitalgraffiti.atlassian.net/jira/software/projects/RMP/boards/2

VALIDATION AND TESTING

This section contains the subsections, Testing Strategy, and Validation Results. Testing Strategy describes the system validation and testing strategy, types of testing that will / have been performed and how testing is integrated throughout the development process. Validation Results describe the state of the project upon completion: number of issues reported, number of issues fixed. Reflect on the quality of the developed system based on results of testing done during development as well as part of the validation stage. It is expected that the system is tested by independent users (users other than the Capstone team members) and that results are recorded in this section.

TESTING STRATEGY

FA1: AR Art Gallery's test plan has 3 test suites: Comment/Rate Art, Display Art, and Select Art to Display in Local Environment
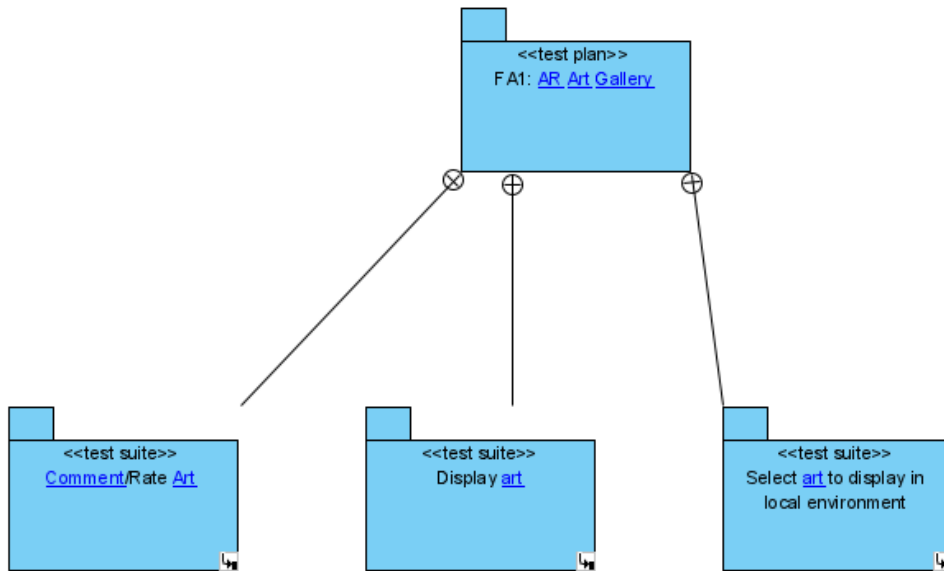
The Comment/Rate Art test suite has 2 test cases. These test cases will be verified by checking that the given data has successfully updated the given database. Rate art's outcome is that a rating has been attributed to a given painting by a given user. Likewise, Comment Art, will attribute a common by a given user to that art.
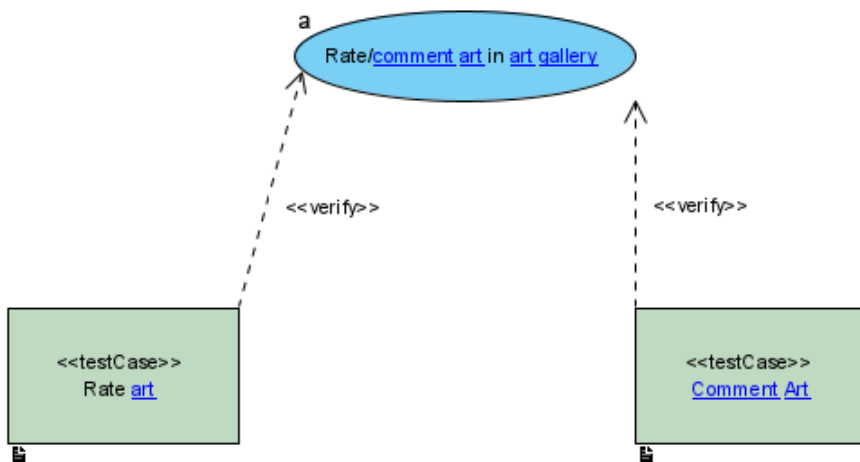

The Display Art in Gallery test suite allows the user to select which artworks they would like to bring into the AR interface to test demonstrate in AR.
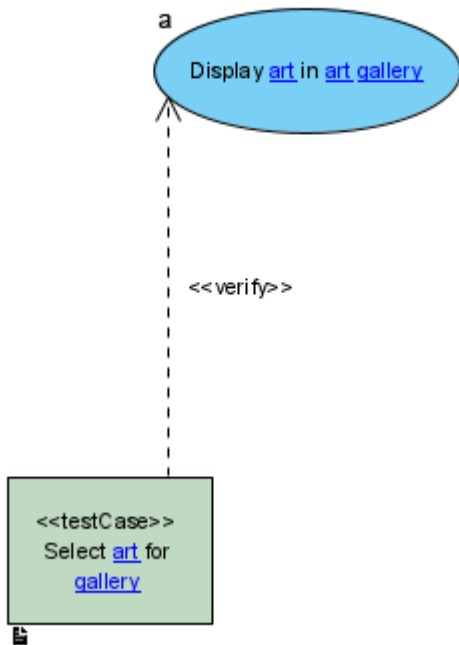
The Select Art to Display in Local Environment test suite contains 4 test cases, Select Art, Next Art Manipulate Art, and Exit AR. Select Art will allow the user to select which art from those they have carried into the AR mode to display in AR. This will be verified if the selected image appear in its intended location. The Next Art will allow the user to move through the artworks they have brought into the AR interface, verified by making sure each art that was selected has been carried over. The Manipulate Art test case will be verified by manipulating each individual art in the interface to ensure that each manipulation is performing as intended. The Exit AR will remove the user from the AR interface and return them to their previous location within the application, verified by initiating the AR mode from where it can be entered and exiting to check the location is the same.
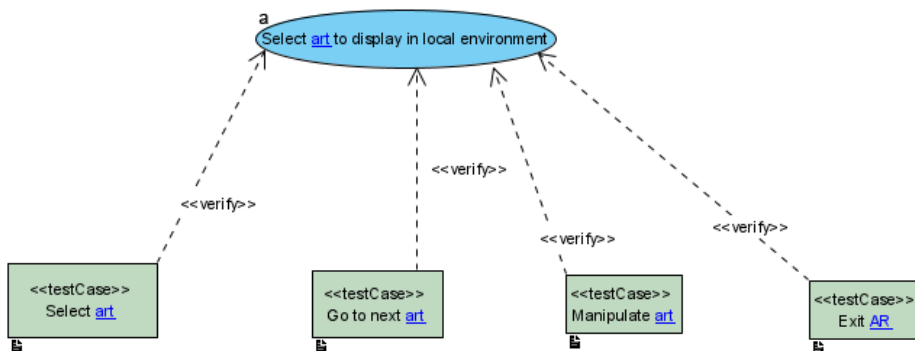
FA2: Marketplace's test plan has 5 test suites. Those are Buy Art, Sell Art, Manage Art Data, View Records and Search for Art.
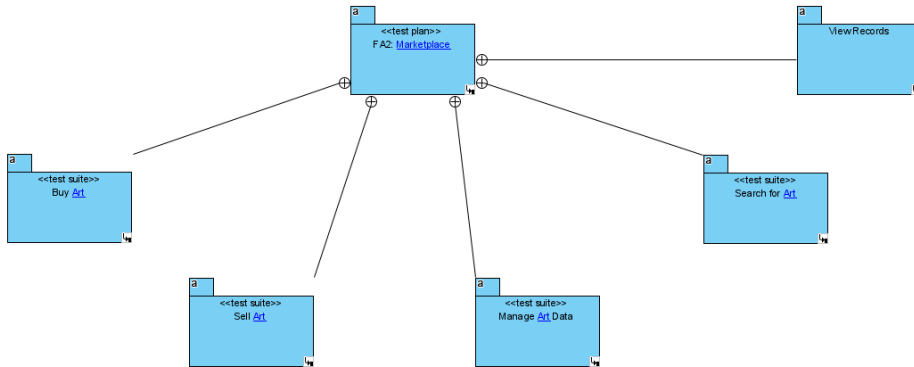

The Buy Art Test Suite has 3 test cases, they are Buy 1 Art, Buy Multiple Arts, and Remove Art from Cart. This Test Suite was developed for the Buy Art use-case. All these test cases are validated by checking the cart. Buy 1 Art Test Case's expected outcome is the Art you want to purchase is in cart. Buy Multiple Arts' expected outcome is the multiple Art you want to purchase is in cart. Remove Art from Cart's expected outcome is the Art is removed from Cart.
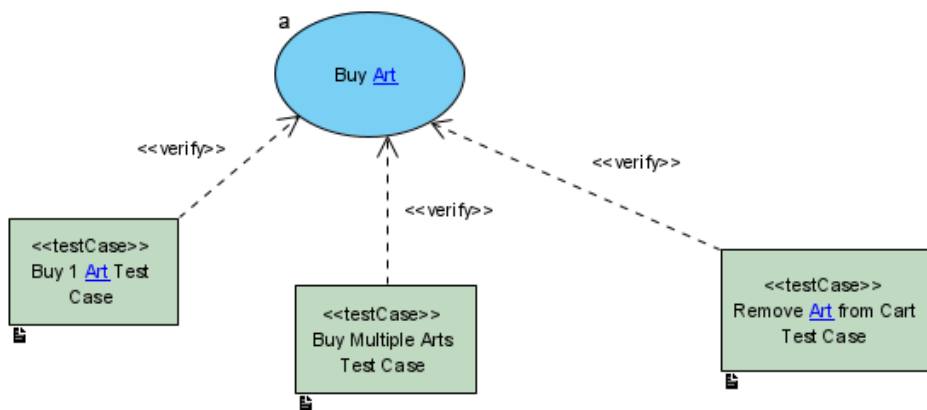

The Manage Art Data Test Suite has 1 test case, and it is Edit Art Data Test Case. This Test Suite was developed for the Manage Art Data use-case. Edit Art Data Test Case is validated by checking the Firestore data of the Art that was edited. The expected outcome is changes to the Art is reflected in the database.
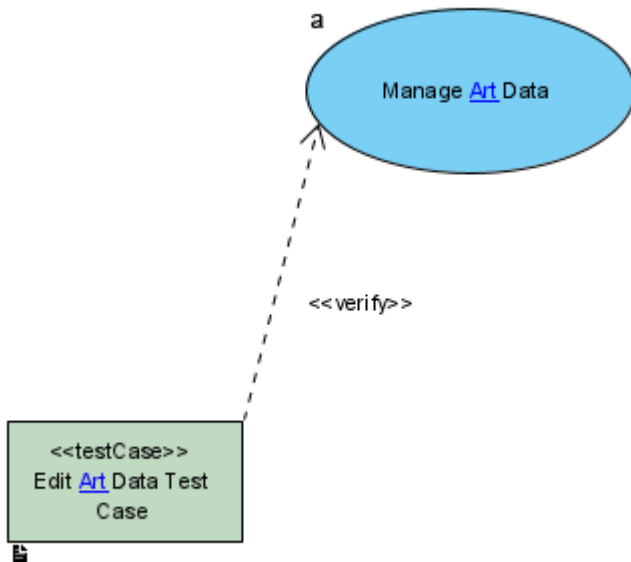
The Search Art Test Suite has 5 test cases, and they are Get All Sellable Art, Get All Art by Name, Get All Art by Artist, Get All Art Less Than or Equal Price and Get All Art Greater Than or Equal Price. This Test Suite was developed for the Search for Art use-case. All these test cases are validated by checking the Marketplace view. Get All Sellable Art's expected outcome is all Art seen in the Marketplace are ones Artist mark as true for field "marketplaceRevealed" . Get All Art by Name's expected outcome is all Art seen in the Marketplace are ones Artist mark as true for field "marketplaceRevealed" and has the name you searched for. Get All Art by Artist's expected outcome is all Art seen in the Marketplace are ones Artist mark as true for field "marketplaceRevealed" and belongs to the Artist you searched. Get All Art Less Than or Equal Price's expected outcome is all Art seen in the Marketplace are ones Artist mark as true for field "marketplaceRevealed" and has price less than or equal to what you searched. Get All Art Greater Than or Equal Price's expected outcome is all Art seen in the Marketplace are ones Artist mark as true for field "marketplaceRevealed" and has price greater than or equal to what you searched.
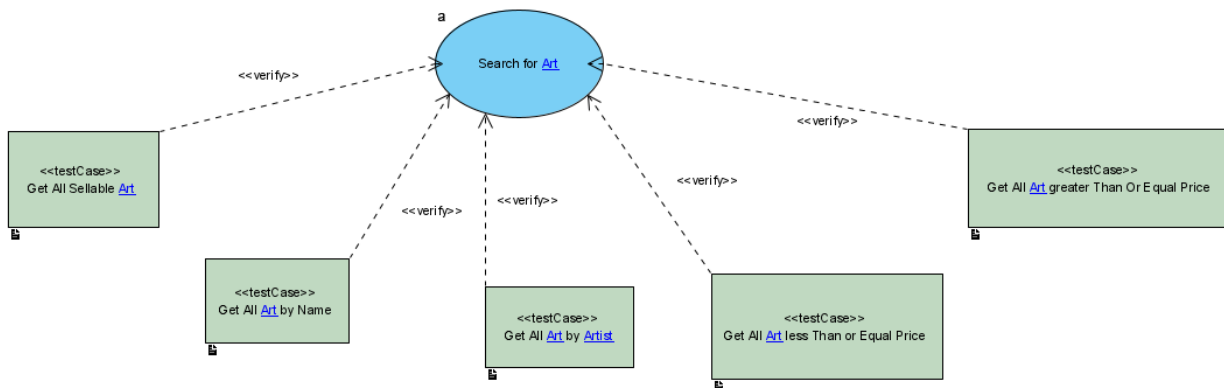
The Sell Art Test Suite has 1 test case, and it is Sell Art Test Case. This Test Suite was developed for the Sell Art use-case. This test case is validated by checking the Firestore data. The expected outcome is the Art has its field, "marketplaceRevealed" set to true.
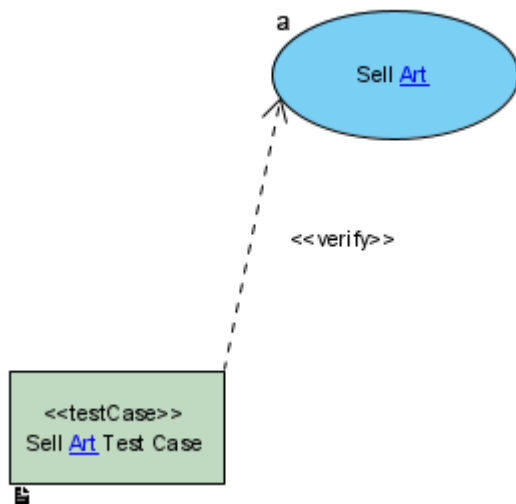
The View Records Test Suite has 1 test case, and it is a View Records Test Case. This Test Suite was developed for the View Records use-case. This test case is validated by viewing the Records view. The expected outcome is the records of the buyer or artists brought or sold art, respectively.
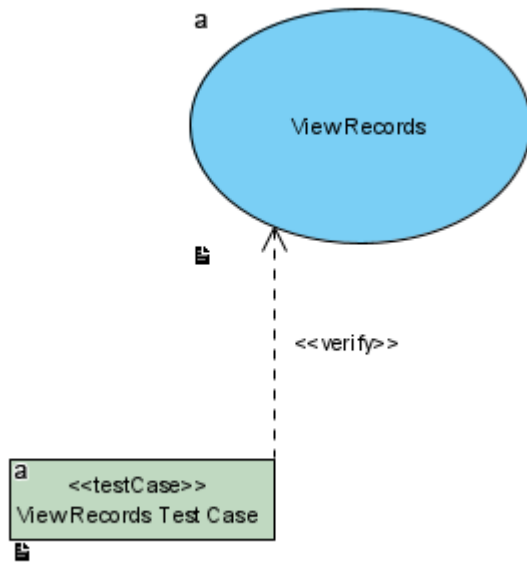
FA3: Artist's portfolio has 3 main test suites which are verification of image upload to the firebase, selection of the art to be displayed on the gallery and lastly ability to create the customizable portfolio.
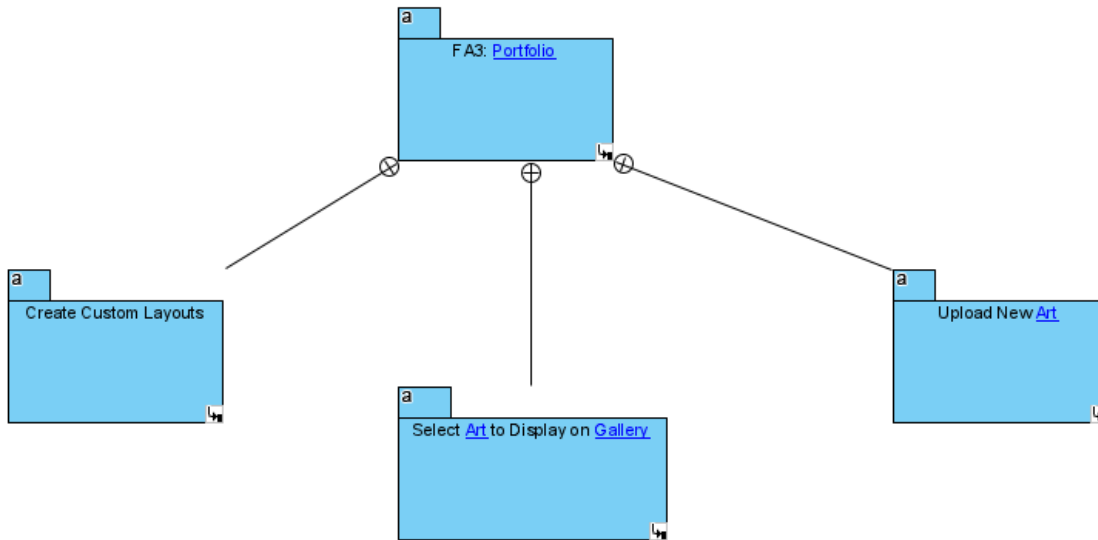
Create custom layouts test suit has not been implemented yet due to some limitations of the swift UI in terms of drag and drop + pitch to resize functionality. But in the future, once implemented users will be able to test given functionality by the simply dragging, dropping, and resizing images on the portfolio while the page grid should be able to handle proper positioning of art items on the screen.
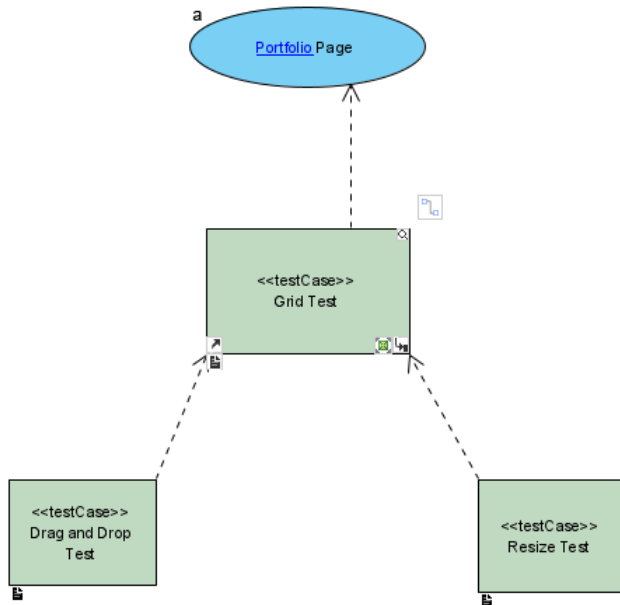
Select Art to Display on Gallery test suit have been successfully implemented and have been tested by tracking the changes of the image upload inside the firestore database. The changes are triggered by changing the state of the toggle button UI. After that when we upload the image to the database, we can see that the value of the showOnGallery property has been changed accordingly to the state.
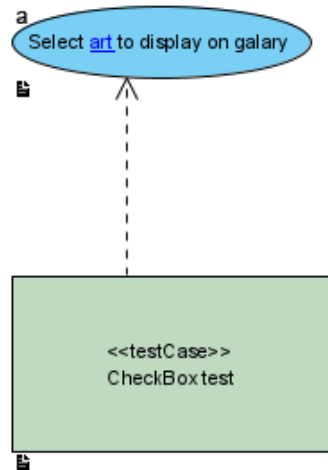
Last but not least, the upload art test suit has been implemented successfully and tested first by checking the database after the upload image button has been clicked. And second by verifying that the response from the database contains the last image loaded to the firestore.

VALIDATION RESULTS

The current project is almost complete. For our AR section, we just need to research how to merge Storyboards with Swift UI and our AR gallery would be complete. Currently we still have not completed the merging. In the Marketplace, user testimonials have asked for validations and alerts for events such as added an art to the cart, if they have successfully edited the details of the art or not, and search box validations. Additionally, the cart has encountered an issue with removing an item from the cart and this has not been fixed yet. Portfolios also need to have an alert and validation when uploading art to the portfolio. Other than these issues, all testing results are as expected.

CONCLUSION

Current platforms used by artists aren't tailored to their needs. Artists must adapt to these platforms and risk making their output seem unprofessional due to the nature of the applications. Artists lack the ability to customize how their art is perceived in a digital setting, which undermines their artistic expression, and their ability to convey their

intentions to their potential clientele. This problem is partly solved currently. The marketplace can host the art Artists upload in their portfolio. Artists can edit their art's details like the price, description, etc. Patrons can access the marketplace to see all sellable art and use the search function to isolate certain arts with search terms. The transaction with money still needs to be implemented and the cart system as well. Additionally, search using tags needs to be integrated as well.

By providing AR capabilities in the form of allowing users to get an idea what the art they're looking at will look in its intended environment, it is hoped that it will increase the likelihood of a purchase of that art. It can be difficult to visualize how a picture will look in one's house without purchasing it first. Allowing users to test a plethora of artwork out in their house will help them find one that suits them and therefore hopefully increase the chances they will purchase the art.

Portfolio Page is currently lacking some functionality such as customization feature due to some limitations of the swift UI. Additionally, some parts of the UI currently missing. For example, the artist's information should be seen on the portfolio home page. But on the other side, our platform has ability to load images to the database, display images stored on the database and provide the information about the artist's particular work.

Demo Link:

PROJECT SUITABILITY

The suitability of the solution to solve the problem is well under way. Our domain expert was impressed with the current progress of our application and only had some critiques about the UI design and some functional parts which we will develop in the future. The feasibility of the solution is normal as we only have encountered 2 roadblocks currently. The merging of AR that was programmed with Storyboards and Swift UI issue and the cart issue can be dealt with in our future work as we will have more time in the future. Our supporting advanced mobile computing area will also be implemented in the future. Other than that, we have easily fulfilled the Mobile Computing, Cloud Computing and primary advanced mobile computing requirements. We have researched our solution in depth and created detailed project requirements. We adhered to the Project Architecture and have constantly brough our Project Plan up to date. Finally, we exhaustedly tested our solution according to our testing plan to bring the project to its current result.

DOMAIN EXPERT EVALUATION

The domain expert was impressed with the state of the application so far. Artists can often be very non-technical, and they found the overall UI presentation somewhat lacking in intuitiveness. They recommended it be streamlined and made more user-friendly. There was a general complaint about the lack of style consistency between the different parts of the application. Artists have an eye for detail and for cohesion and they recommended that in the future efforts be made to have a consistent style to impress potential artist users and users in general.

In terms of features, they desired more functionality from the AR interface. To truly get an idea of how a picture would integrate into a room, there needs to be resizing options and sometimes the alignment is a bit off which can

throw off the user perception of the picture. Overall, they liked the AR concept and thought it could be a very useful feature for them to sell their work.

They generally liked the feature set presently offered but stressed the importance of custom commissions. Much of an artist's potential earnings come from the custom commissions from patrons. If the app is to truly facilitate artists looking to make money, this feature would be an essential addition.

USER TESTIMONIALS

Include any user testimonials you have received from stakeholders other than the domain experts. It is expected that the system will be demonstrated and used at a minimum as part of the validation stage of the project. Prepare a survey to be answered by users and/or testers and record the results of the survey in this section.

FUTURE WORK

Future work for the project includes the following:
- Custom Tab View
- Allow users to communicate with each other
- Remove art from marketplace when it is sold out
- Enable users to resize art to find a print size that is ideal for them
- Allow artists to create galleries for users to view the selected works

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