

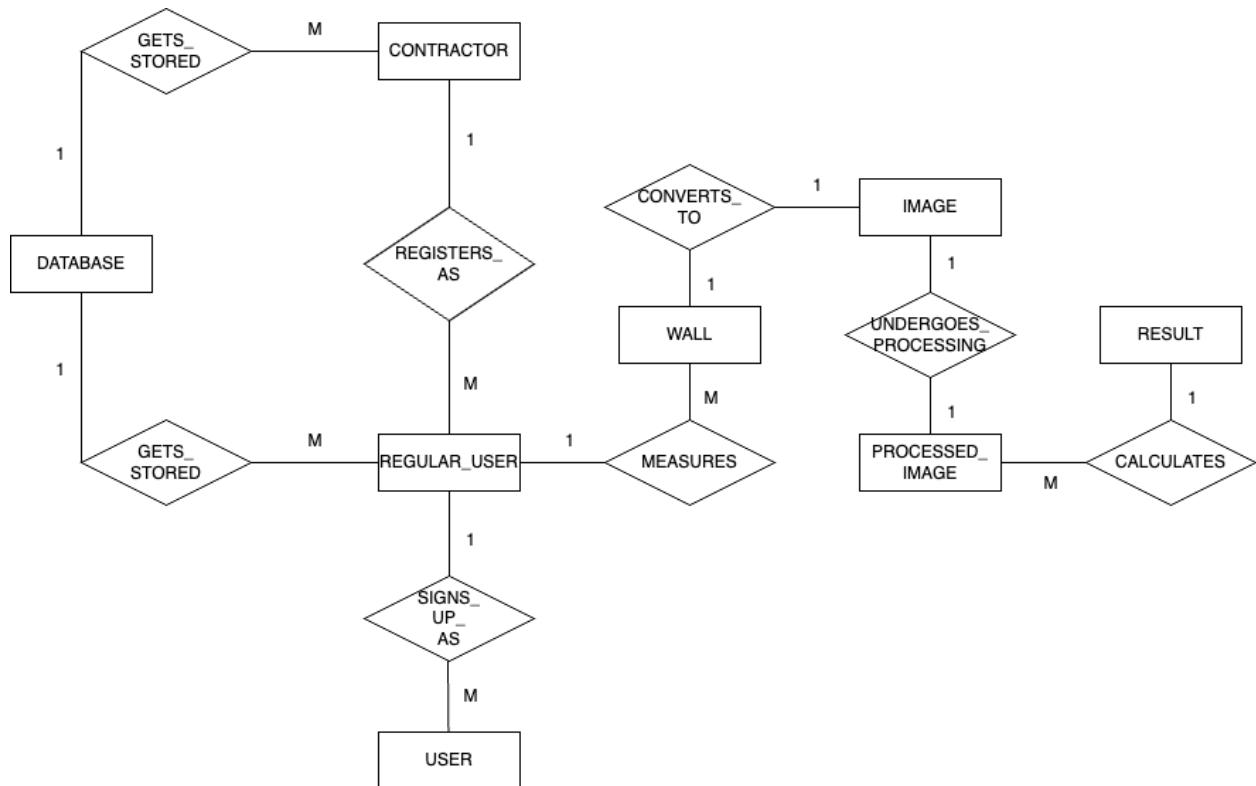
Assignment 2 (Design Questions Document)

COSC 4395.001

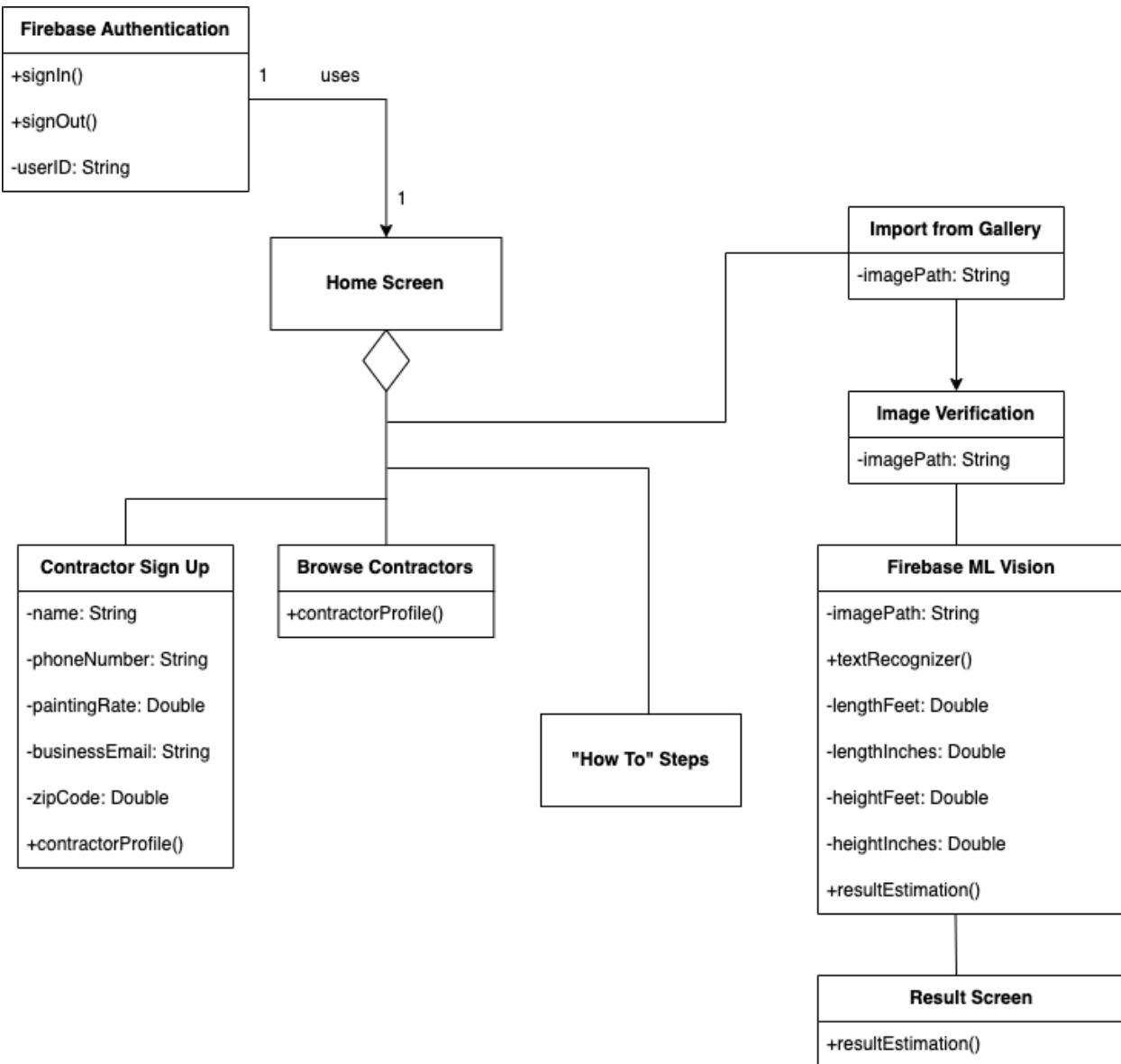
Group 1

CS: Produce a Software Design Document

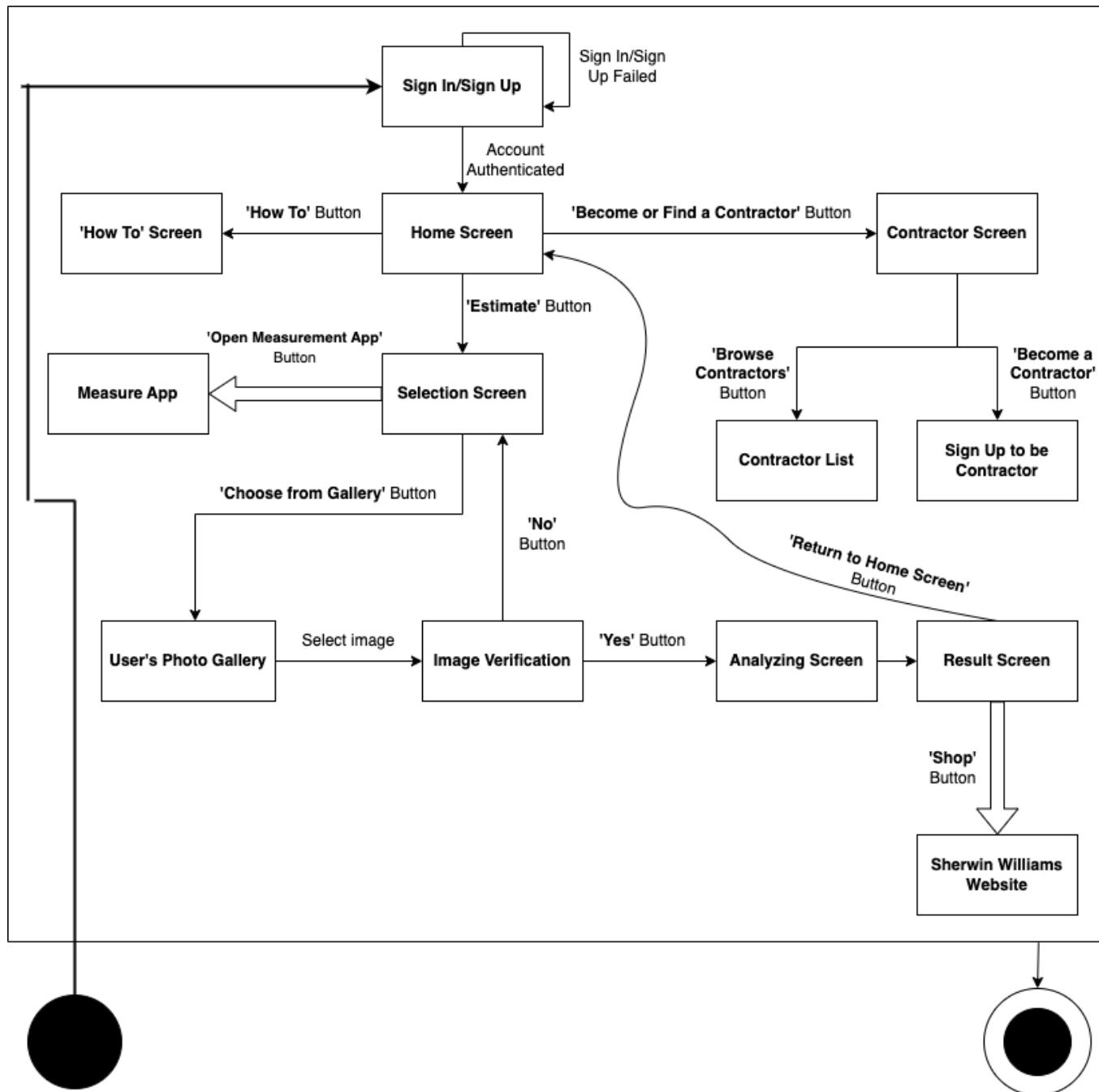
- Create a UML ER Diagram to illustrate the design of the underlying database.



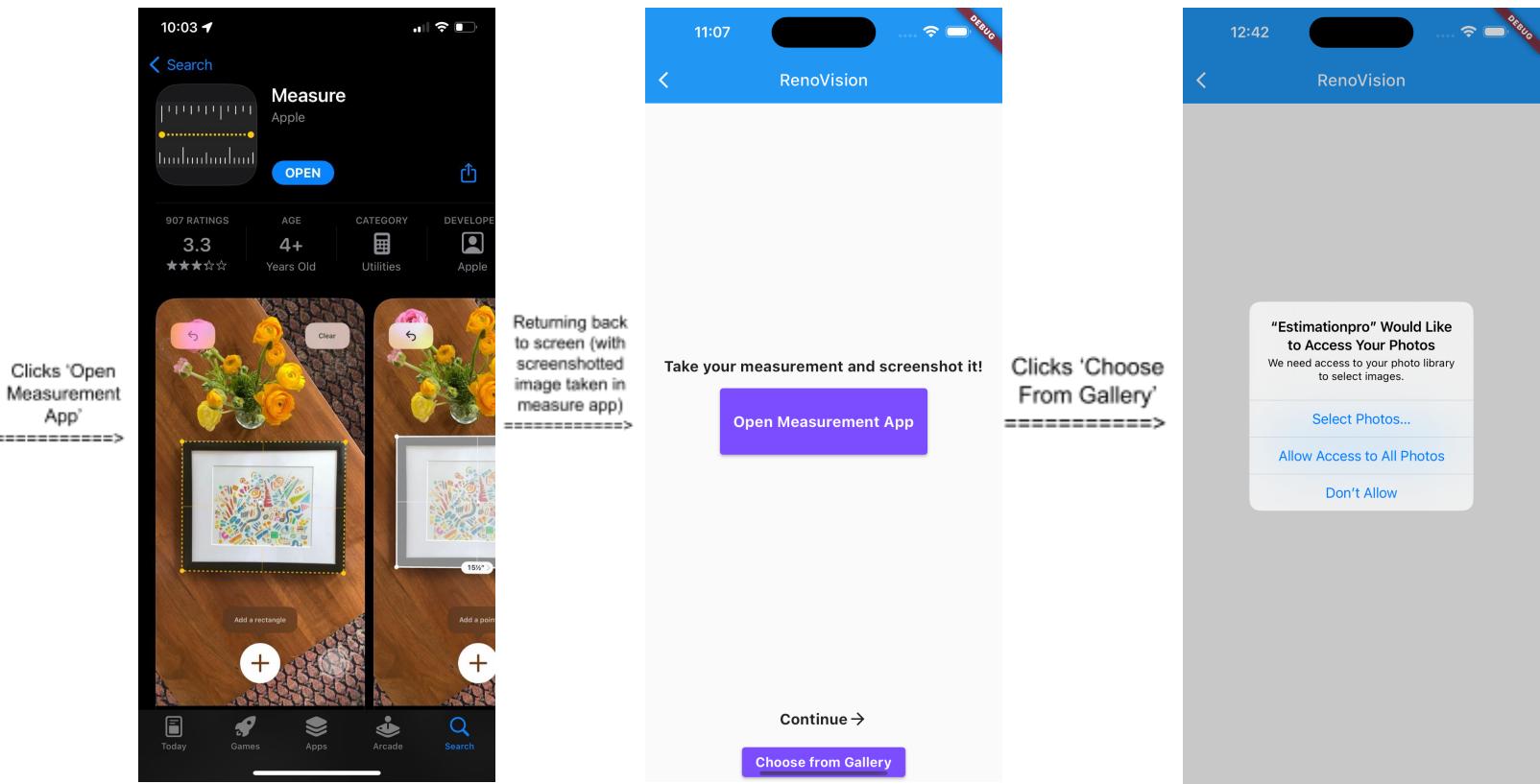
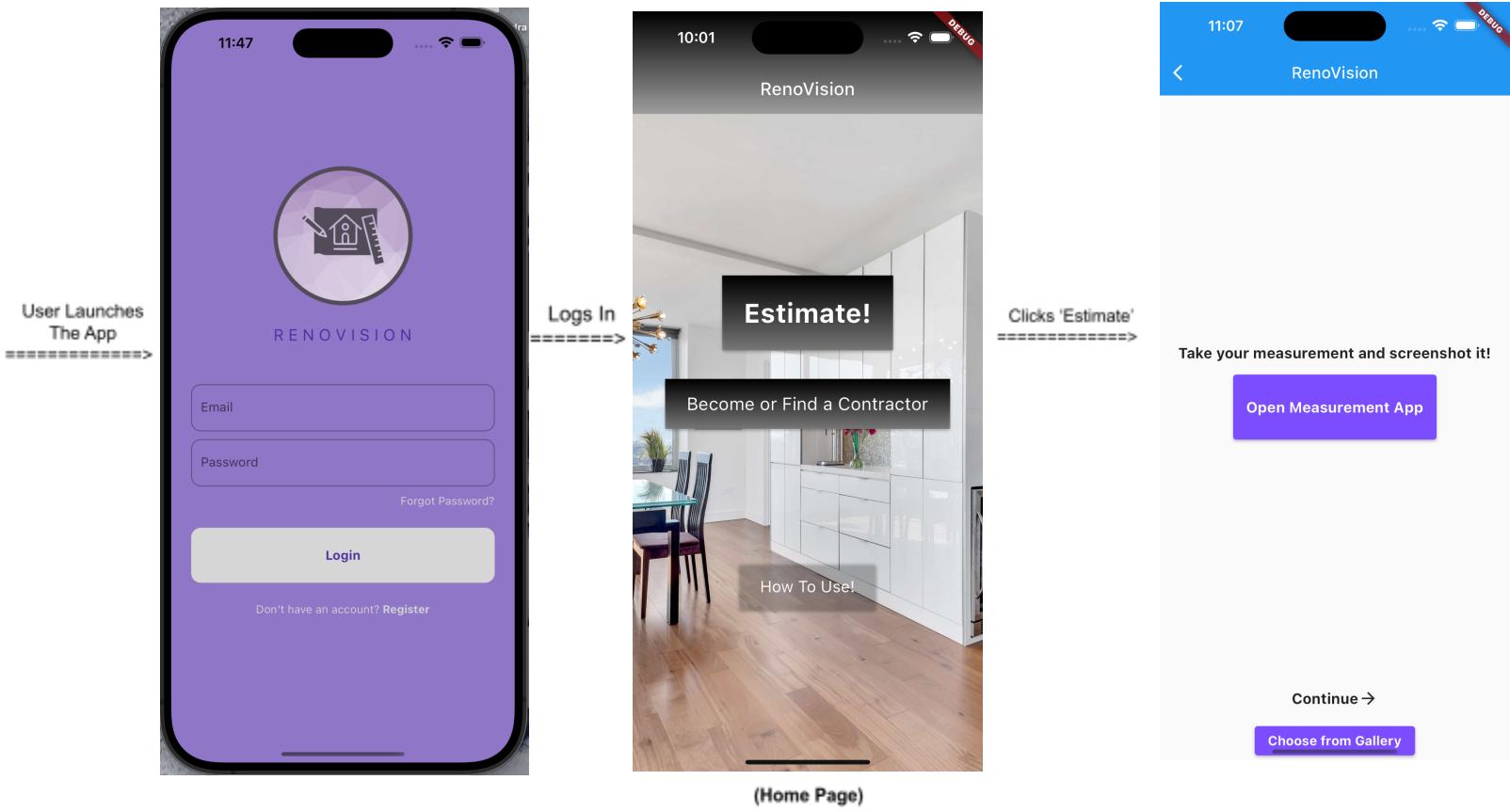
- (CS) Create a UML Class Diagram showing the static structure of the software modules.

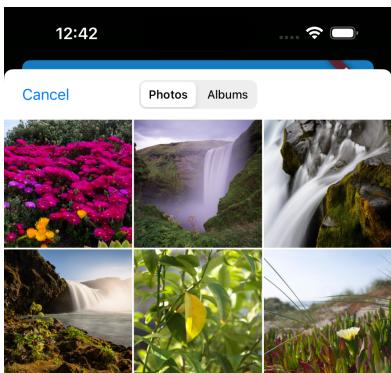


- Develop UML State Diagrams showing the different states of the software as it responds to events. (CS)

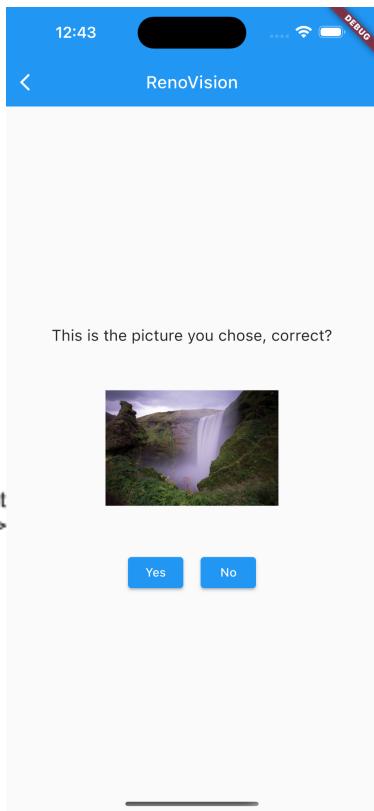


- Show the expected user interface. The screens must be generated through code or using drawing software. No hand drawn screens should be submitted. 0





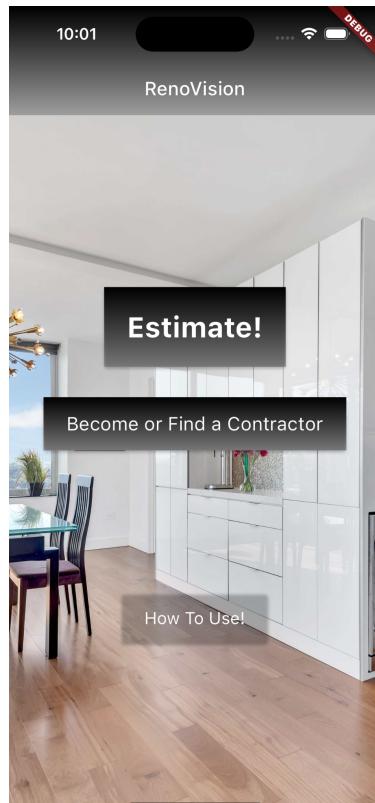
Chooses photo of measurement =====>



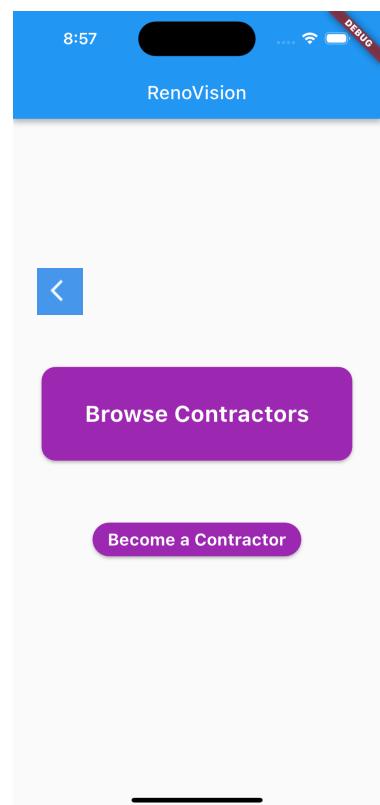
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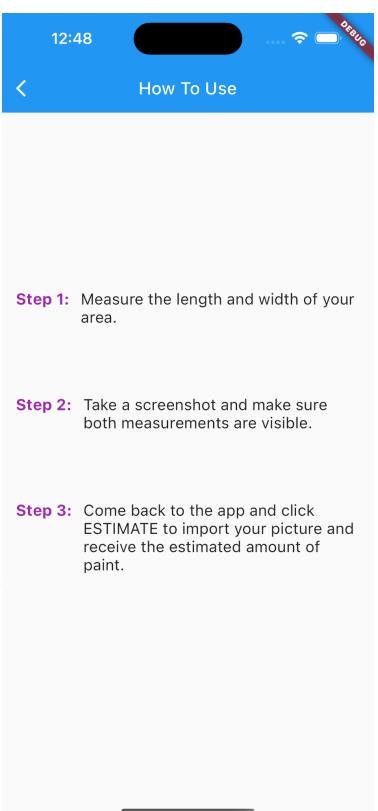
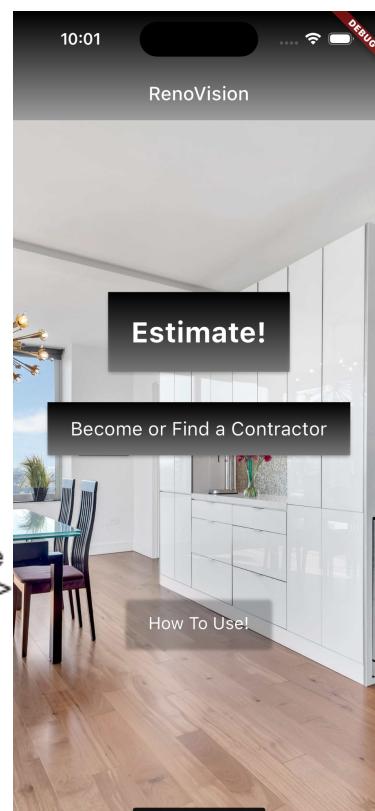
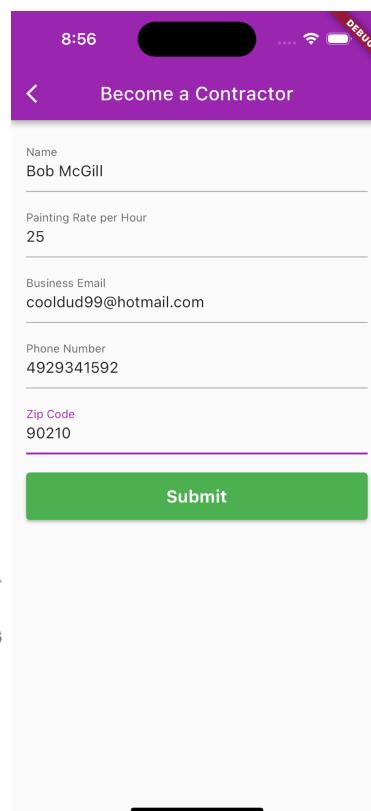
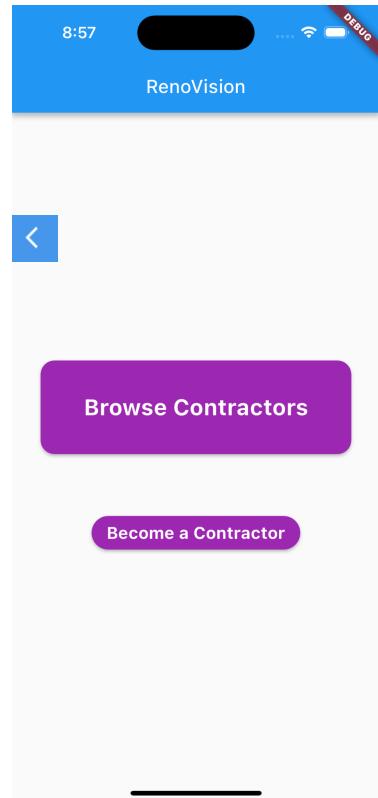
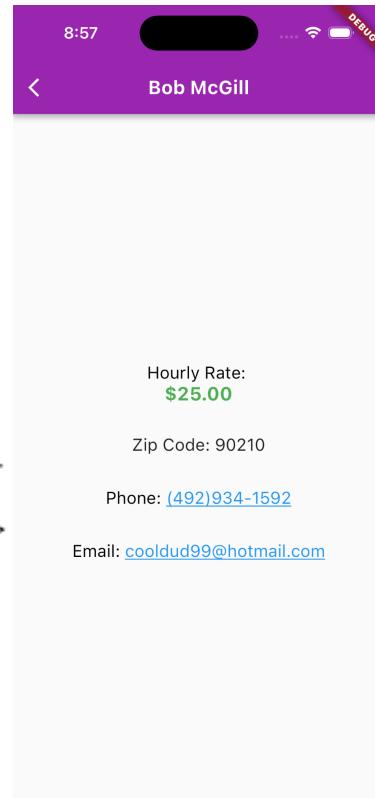
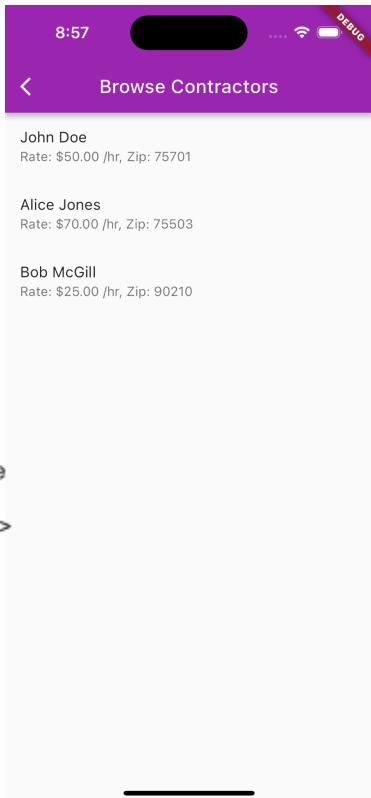


Clicks 'Back to Home Screen'
=====>
(Shop Paint just links to Sherwin Williams website)



Clicks 'Become or Find a Contractor'
=====>





CIS: Refine the Business Plan

Candidate System Solutions for RenoVision:

1. RenoVision Mobile App:

- **Description:** A mobile application, called RenoVision, which accurately measures wall areas and provides paint resource estimates. It has a user-friendly interface and is a great tool for people who only have a smartphone at hand.

- **Analysis:**

- **Strengths:**

- *Proven Operational Feasibility:* The RenoVision Mobile App is currently operational and has been used by homeowners and DIY enthusiasts. User feedback and data can inform further improvements.
 - *Low Development and Maintenance Costs:* Since the app is already developed, it benefits from lower development and maintenance costs, making it a cost-effective solution.
 - *Broad Market Appeal:* This solution addresses a wide consumer base, from homeowners to DIY enthusiasts, offering mass-market potential.

- **Weaknesses:**

- *Limited Features Compared to the Pro Edition:* The standard app may have limitations for professional contractors who require more advanced tools and features.
 - *Potential Limitations for Professional Contractors:* Professionals may find the app lacking the depth of features and support they need for complex projects.

2. RenoVision Pro Edition:

- **Description:** A premium version of the mobile app with advanced features and enhanced support for contractors and professionals. It includes features like advanced measurement tools, project management, and professional support.

- **Analysis:**
 - **Strengths:**
 - Targets a Niche Market: The Pro Edition caters to a specific niche of professional contractors and potentially offers specialized tools that meet their needs.
 - Higher Pricing Potential: With advanced features and support, the Pro Edition can be priced higher, potentially increasing revenue per user.
 - Advanced Features: The advanced features differentiate the Pro Edition from the standard app, making it a premium offering.
 - **Weaknesses:**
 - Requires Additional Development and Maintenance: Developing and maintaining the Pro Edition adds to the overall project cost and necessitates ongoing support.
 - Limited Market Appeal Compared to the Standard App: The Pro Edition targets a smaller market segment, limiting its potential reach.
 - Potential Resistance from Existing Users Due to Cost: Existing users of the free version may resist upgrading due to the increased cost.

3. Integration with E-Commerce:

- **Description:** Exploring the option to integrate RenoVision with e-commerce platforms for paint and renovation material purchases. Users can directly purchase the required materials from within the app.
- **Analysis:**
 - **Strengths:**
 - Potential for a New Revenue Stream: Integrating with e-commerce opens the possibility of generating revenue through affiliate marketing or sales commissions on materials purchased through the app.

- *Aligns with the Trend of Integrated Shopping:* Many mobile apps are incorporating integrated shopping experiences, enhancing user convenience and potentially increasing user engagement.
- **Weaknesses:**
 - *Requires Partnerships and Negotiations with E-Commerce Platforms:* The success of this solution depends on establishing partnerships and negotiations with e-commerce platforms, which can be complex and time-consuming.
 - *May Disrupt the User Experience If Not Well-Implemented:* Poorly integrated e-commerce features could disrupt the user experience or lead to user dissatisfaction.
 - *Success Depends on User Adoption and Purchasing Behavior:* This solution's success hinges on user adoption of the integrated shopping feature and their willingness to make purchases within the app.

4. ‘Manual’ Version:

- **Description:** In this version, the app would void any use of machine learning to gather input from the user’s screenshot of their measurements. The user can still import the photo in order to look at their measurements within the app (so they don’t have to keep switching back between photo album and our app) but they will just manually input their measurements into text fields and the system would estimate the value of materials needed upon the user clicking submit.
Furthermore, we would also not make the app just about paint estimates, but also give the users an option to choose flooring, roofing, and even fencing estimation buttons.

- **Analysis:**

- Strengths:

- **Enhanced User Control:** Users who prefer a more hands-on approach to measurement input can benefit from this version. They have greater control over the accuracy of the measurements they input.
 - **Diversified Use Cases:** By offering estimation for various materials such as flooring, roofing, and fencing, the app can cater to a wider audience and expand its potential user base.
 - **Reduced Dependency on Machine Learning:** This version may simplify the development process by reducing the reliance on machine learning algorithms and related technical complexities.

- Weaknesses:

- **Loss of Automation:** The app's level of automation is reduced in this version, which might not be as convenient as the machine learning-based approach.
 - **User Error Potential:** Manual input can introduce errors due to mistyped values or inaccuracies, which can affect the quality of material estimates.
 - **Shift in User Experience:** Users who were drawn to the app for its machine learning capabilities may find the transition to manual input less appealing.

Analysis and Recommendation:

RenoVision Mobile App:

- *Recommendation:* Given its proven operational feasibility, low cost, and broad market appeal, the RenoVision Mobile App should be the primary focus for further improvements and promotion. It should continue to evolve based on user feedback, potentially incorporating features that address some of the limitations for professional users.

RenoVision Pro Edition:

- *Recommendation:* While the Pro Edition offers advanced features and targets a niche market, it should be considered as a secondary focus. Pricing should be carefully determined to balance user adoption and revenue generation. Professional support and feature development are essential for its success.

Integration with E-Commerce:

- *Recommendation:* This option can be explored in parallel with the mobile app but should be approached cautiously. Success will depend on successful partnerships with e-commerce platforms, seamless integration, and user behavior analysis. It offers potential revenue opportunities but requires a well-planned and executed strategy.

“Manual” Version:

- *Recommendation:* Considering the 'Manual' Version's potential to cater to users who prefer hands-on measurement input and its capability to diversify the app's use cases, it is advisable to incorporate this version as part of the RenoVision Mobile App. However, this should be done in a thoughtful manner, ensuring it aligns with user preferences and doesn't compromise the overall user experience.

In all cases, regular monitoring of user feedback, market trends, and business goals is crucial to make informed decisions and ensure the chosen solution aligns with RenoVision's strategic direction.

Candidate System Matrix for RenoVision:

Characteristics:

Portion of the System:

- *Candidate 1 (Mobile App)*: This candidate represents the complete RenoVision system. It encompasses the core functionality of accurately measuring wall areas and providing paint resource estimates. Users interact with the app through their smartphones, capturing and analyzing data for their painting and renovation projects.
- *Candidate 2 (Pro Edition)*: The Pro Edition is an add-on to the core RenoVision system. It serves a niche market of professional contractors and enthusiasts who require advanced features and support. It complements the existing mobile app with specialized tools and capabilities.
- *Candidate 3 (Integration with E-Commerce)*: This candidate is focused on enhancing the user experience by integrating RenoVision with e-commerce platforms. It represents an extension to the system by enabling users to directly purchase paint and renovation materials through the app.
- *Candidate 4 (“Manual Version”)*: This candidate is a possibility due to the lessening of the load on the code as a whole. Implementation of machine learning is difficult, and even more so when the information about adopting it is so sparse online. With this version, users are still directed to the measure app and do their measurements but they will need to input their measurements into text fields within our app to get the material estimate they desire.

Benefits:

- *Candidate 1 (Mobile App)*: The benefits of the Mobile App include its proven operational feasibility, low development and maintenance costs, and a broad market appeal. Users find it user-friendly and accessible for home improvement projects.
- *Candidate 2 (Pro Edition)*: The Pro Edition targets a specific niche market of professional contractors, offering advanced features and specialized support. It has the potential for higher pricing, which can lead to increased revenue per user.
- *Candidate 3 (Integration with E-Commerce)*: Integrating with e-commerce platforms introduces the potential for a new revenue stream through affiliate marketing or sales commissions. It aligns with the trend of integrated shopping experiences in mobile apps, potentially enhancing user engagement.
- *Candidate 4 (“Manual Version”)*: The Manual Version places a strong emphasis on user control and simplicity in measurement input. Its key benefits lie in operational simplicity, as it streamlines the user experience with manual measurement input, making it particularly appealing to those who prefer a more traditional approach. Additionally, it offers cost-effective development by reducing reliance on complex machine learning, potentially lowering development and maintenance costs. By expanding its use cases to include flooring, roofing, and fencing estimation, this version broadens its market appeal, providing a versatile solution for users seeking estimates for various home improvement projects.

Software Needed:

- *Candidate 1 (Mobile App)*: Developing and maintaining the Mobile App requires mobile app development tools and a database management system. The existing software stack includes tools for measuring, data storage, and user interface.
- *Candidate 2 (Pro Edition)*: The Pro Edition shares the same software requirements as the Mobile App but may need additional server resources and support for specialized features.

- *Candidate 3 (Integration with E-Commerce)*: Integrating with e-commerce platforms involves working with e-commerce platform APIs, integration development resources, and security protocols. It requires coordination and collaboration with external systems.
- *Candidate 4 (“Manual Version”)*: Developing and maintaining the Manual Version involves a distinct set of software and resource requirements. Unlike the previous candidates, which heavily relied on machine learning and e-commerce integrations, this version simplifies the technology stack and focuses more on user input and the appeal of the GUI.

Input Devices:

- *Candidate 1 (Mobile App)*: Users primarily interact with the Mobile App through their smartphones. Input devices include the smartphone's camera for capturing wall area data and touchscreen input for app navigation.
- *Candidate 2 (Pro Edition)*: Like the Mobile App, the Pro Edition relies on smartphone input devices, such as the camera for capturing measurements and touchscreen input for control.
- *Candidate 3 (Integration with E-Commerce)*: Users continue to use their smartphones for input with this candidate, including capturing measurements with the camera and touchscreen input. Additional input mechanisms might be introduced to enhance the shopping experience like seamless purchases within the app through major paint brands.
- *Candidate 4 (“Manual Version”)*: The Manual Version maintains user interaction through smartphones, utilizing familiar input devices. Users will continue to capture measurements through the smartphone's camera, ensuring that the app remains accessible and easy to use. Additionally, touchscreen input is integral for manual measurement input and app navigation, preserving a user-friendly and intuitive experience while shifting the focus to manual data entry.

Output Devices:

- *Candidate 1 (Mobile App)*: The primary output device for the Mobile App is the smartphone's display. It presents measurement results, paint resource estimates, and user guidance.
- *Candidate 2 (Pro Edition)*: The Pro Edition also relies on the smartphone's display as the primary output device, showing advanced measurement data and professional project management information.
- *Candidate 3 (Integration with E-Commerce)*: This candidate involves the smartphone's display for presenting measurement results, but it also introduces output through the e-commerce platform's interface, where users can browse and purchase materials.
- *Candidate 4 (“Manual Version”)*: This version primarily utilizes the smartphone's display as the primary output device. It presents measurement results, material estimates, and user guidance directly on the smartphone screen. The focus remains on providing users with clear and accessible information for their home improvement projects while embracing manual measurement input.

This in-depth explanation of the characteristics in the Candidate System Matrix provides a clear understanding of how each candidate system solution aligns with the RenoVision project's goals and requirements. It helps stakeholders make informed decisions based on the unique strengths and considerations associated with each option.

Table 6-1: Candidate Systems Matrix:

Characteristics	Candidate 1 (Mobile App)	Candidate 2 (Pro Edition)	Candidate 3 (Integration with E-Commerce)
Portion of the System	Represents the complete RenoVision system, providing core functionality for measuring wall areas and estimating paint resources.	An add-on to the Mobile App, targeting professional contractors with advanced features and specialized support.	An extension to the core system, enabling users to directly purchase paint and renovation materials through e-commerce integration.

Benefits	<u>Proven operational feasibility:</u> The Mobile App has been successfully operational, ensuring that it works in practice. It is a reliable solution for homeowners and DIY enthusiasts.	<u>Niche market targeting professionals:</u> The Pro Edition focuses on specific niche professional contractors. This may result in a more dedicated user base with specific needs.	<u>Potential for a new revenue stream:</u> Integrating with e-commerce platforms creates the potential for new revenue streams through affiliate marketing or sales commissions.
	<u>Low cost:</u> Development and maintenance expenses are minimal, making it cost-effective for both users and developers.	<u>Higher pricing potential:</u> With advanced features and professional support, the Pro Edition can be priced higher, potentially leading to increased revenue per user.	<u>Aligns with the trend of integrated shopping:</u> Integration with e-commerce platforms aligns with the industry trend of offering integrated shopping experiences within mobile apps, enhancing user convenience and engagement.
	<u>Broad market appeal:</u> The Mobile App caters to a wide range of users, from homeowners to DIY enthusiasts, due to its user-friendly design.	<u>Advanced features:</u> The Pro Edition offers specialized tools and capabilities, meeting the needs of professional contractors.	

Software Needed	<p><u>Mobile app development tools</u> (e.g., IDEs, SDKs): The Mobile App requires the use of mobile app development tools and software to create and maintain the application.</p> <p><u>Database management system</u>: It relies on a database management system for data storage and retrieval.</p>	<p><u>Mobile app development tools</u>: Similar to the Mobile App, the Pro Edition needs mobile app development tools for development and maintenance.</p> <p><u>Additional server resources</u>: Specialized professional features may require additional server resources to support the advanced functionality.</p>	<p><u>E-commerce platform APIs</u>: Integration with e-commerce platforms requires access to their APIs for data exchange and transaction processing.</p> <p><u>Integration development resources and support</u>: This includes specialized development resources and support to ensure successful integration.</p> <p><u>Security protocols</u>: Security protocols are essential to safeguard user data and transactions within the integrated e-commerce platform.</p>
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Input Devices	<p><u>Smartphone camera for capturing wall area data:</u> The primary input device is the smartphone's camera, which captures data for measurement and estimation.</p> <p><u>Touchscreen input for app navigation:</u> Users interact with the Mobile App through touchscreen input for navigation and interaction.</p>	<p><u>Smartphone camera for measurements and data input:</u> The Pro Edition also relies on the smartphone's camera for capturing measurement data.</p> <p><u>Touchscreen input for control:</u> Users interact with the Pro Edition using touchscreen input for control and management.</p>	<p><u>Smartphone camera for measurements and data input:</u> The integration with e-commerce platforms maintains the use of the smartphone's camera as the primary input device for capturing data.</p> <p><u>Touchscreen input:</u> Touchscreen input remains the primary method for app interaction.</p> <p><u>Additional input mechanisms for e-commerce interaction:</u> In addition to the standard input devices, specific input methods for e-commerce transactions may be introduced to enhance</p>
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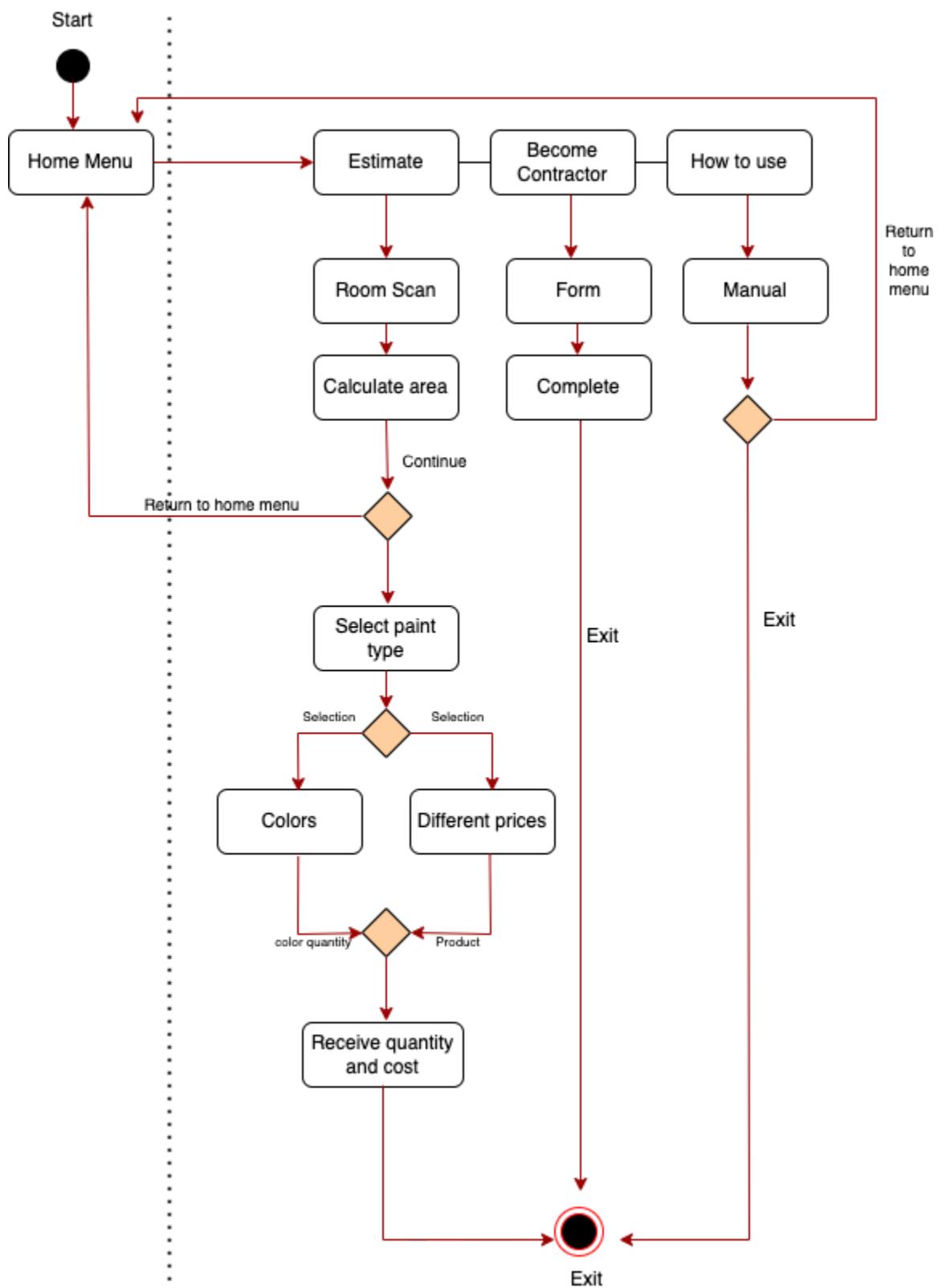
			the shopping experience.
Output Devices	<p><u>Smartphone display:</u> The primary output device for the Mobile App is the smartphone's display, where measurement results, paint resource estimates, and user guidance are presented.</p> <p><u>E-commerce platform interface:</u> In the case of Candidate 3, the e-commerce platform's interface serves as a secondary output, where users can browse and purchase materials directly.</p>	<p><u>Smartphone display:</u> The Pro Edition also utilizes the smartphone's display as the primary output device, showing advanced measurement data, professional project management information, and user support.</p>	

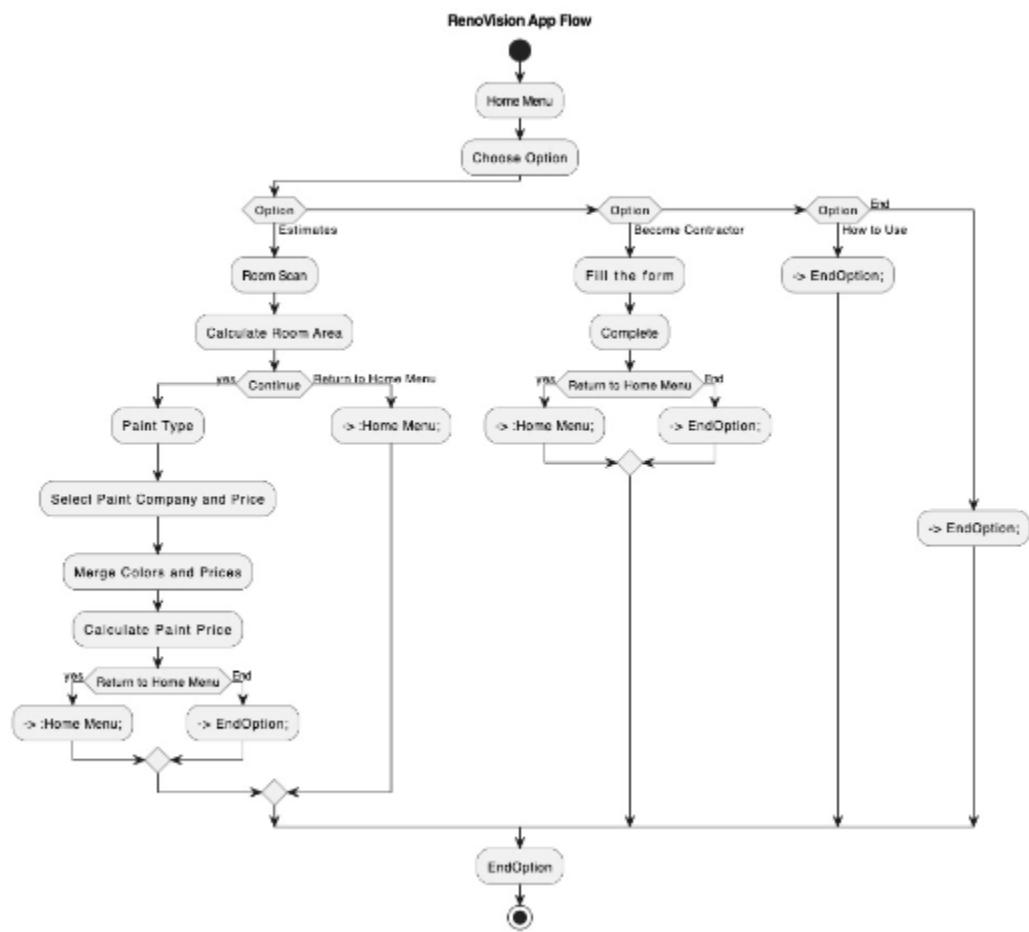
Table 6.1 cont... Candidate Systems Matrix:

(wouldn't fit nice in table so here is 4th backup solution by itself)

Candidate	Portion of the System	Benefits	Software Needed	Input Devices	Output Devices
#4 “Manual” Version	Combines all features previously listed minus the machine learning to capture text from image. Users will manually input measurements.	Enhanced user control, cost-effective development, better GUI, and diversified use cases.	User interface dev. tools, DBMS, estimation algorithms, cross-platform compatibility	Smartphone with a touchscreen, measure app, and working camera	Smartphone display

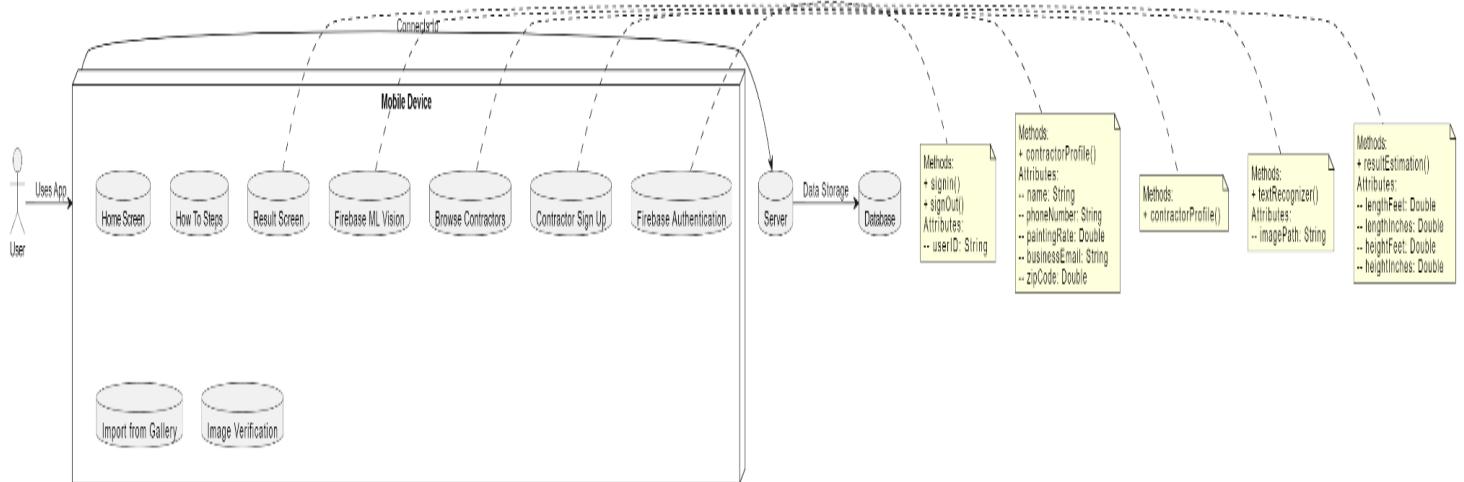
- Develop UML Activity Diagrams with swimlanes illustrating each of the different user functions described in the class project.





IT: Produce a Systems Design Document

- Create a UML Deployment Diagram illustrating the hardware and software components.



- Describe the technology (hardware and software) that will be used to implement the project. Explain the rationale for the hardware and software by comparing them to other technologies.

Hardware:

1. Mobile Device:

Rationale: The application was designed to be mobile-first, capitalizing on the smartphones. Mobile devices offer a combination of portability and functionality, and their built-in cameras are essential for the estimation features in "RenoVision".

Comparison with Desktop: Desktop computers, although powerful, lack the portability and the on-the-go accessibility that smartphones offer. Desktops typically don't come with built-in cameras, making features like paint estimation more difficult than needed.

Comparison with Tablets: Tablets offer a larger screen real estate, which might be beneficial for some applications. This would be a better option than carrying around a desktop, but they can be bulkier and less convenient to carry around than mobile phones. For an app like "RenoVision," which is meant to be on-site, mobile and convenient, a smartphone is more beneficial.

Software:

1. Flutter Framework:

Rationale: Flutter is known for its "write once, run anywhere" philosophy, allowing developers to maintain a single codebase for multiple platforms, which can reduce development costs and time.

Comparison with React Native: React Native is another popular cross-platform development framework. While React Native has a larger community, Flutter offers a more consistent and native performance due to its unique architecture and the Dart language. The widget-based approach of Flutter also makes UI development more intuitive.

Comparison with Native Development: Developing natively for Android (using Java or Kotlin) and for iOS (using Swift or Objective-C) would mean maintaining two separate

codebases. This can increase development time, costs, and potential inconsistencies between platforms.

2. Dart Programming Language:

Rationale: Dart, being Flutter's designated language, offers easy integration and a streamlined development process. It is efficient for both mobile and web applications and offers a great developer experience.

Comparison with JavaScript: JavaScript, especially when used with React Native, is another option for mobile app development. However, Dart was specifically designed with Flutter in mind, providing more seamless integration and optimized performance for Flutter apps.

3. Camera Package:

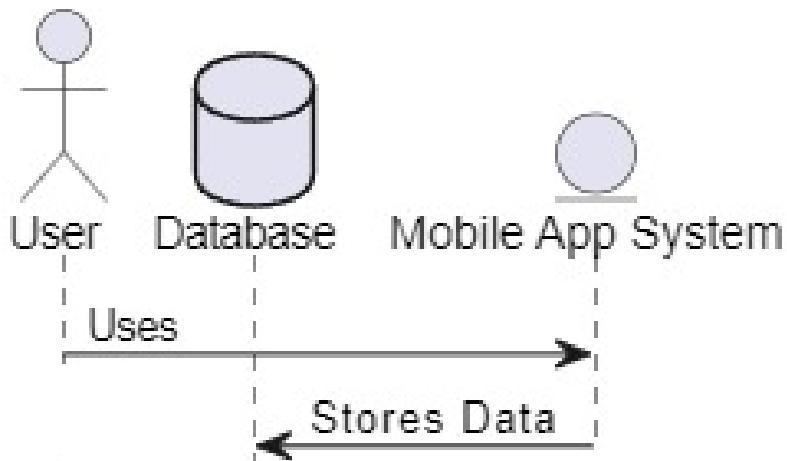
Rationale: This package was chosen to provide the camera functionality necessary for the paint estimation feature. It offers a straightforward way to access and use the device's camera within the Flutter app.

Comparison with Other Camera Plugins: There are alternative camera plugins available. The chosen package offers a good balance of features, ease of use, and community support. Some other plugins might offer additional functionalities but could be overkill for the app's requirements or might not be as well-maintained.

In summary, the choices in hardware and software for "RenoVision" were made based on the specific requirements of the app, the benefits of the chosen technologies, and their advantages over other available options.

- Create level 0 and level 1 Data Flow Diagrams illustrating the flow of data through the system.

Level 0 DFD



Level 1 DFD

