

# **Software Requirements Specification**

## **Automated House Planning and Visualization System for Real Estate Using Machine Learning**

Group APEXA

Name	Registration Number	Index Number
L. G. R. J. Lindapitiya	ICT/19/20/132	5066
R. M.V. P. B. Udagama	ICT/19/20/138	5071
B. M. C. B. K. Bandaranayake	ICT/19/20/016	4957
A. G. N. D. Kaluwelgoda	ICT/19/20/059	4997
T. M. M. M. B. Abeysinghe	ICT/19/20/002	4944

Supervised By:

Mr. K. H. A. Hettige

**Faculty of Applied Sciences  
Rajarata University of Sri Lanka  
2019/2020 Batch**

# 1. Project Scope

## 1.1. Project Aim

- The primary aim of this project is to develop a web application that automatically generates both house floor plans for regular and irregular land shapes as well as for angled lands with the use of user inputs and 3D house views in response to the 2D floor plan.

## 1.2. Project objective

1. To develop an algorithm that automatically generates flat or angled floor plans other than square and rectangular shapes for homes based on user-provided inputs, including room dimensions and clear image of the survey plan.
2. To implement a feature that produces 3D views of the house automatically, allowing users to visualize their designs.
3. To create a web application where people can design and see their dream homes.

## 1.3. Use case diagram

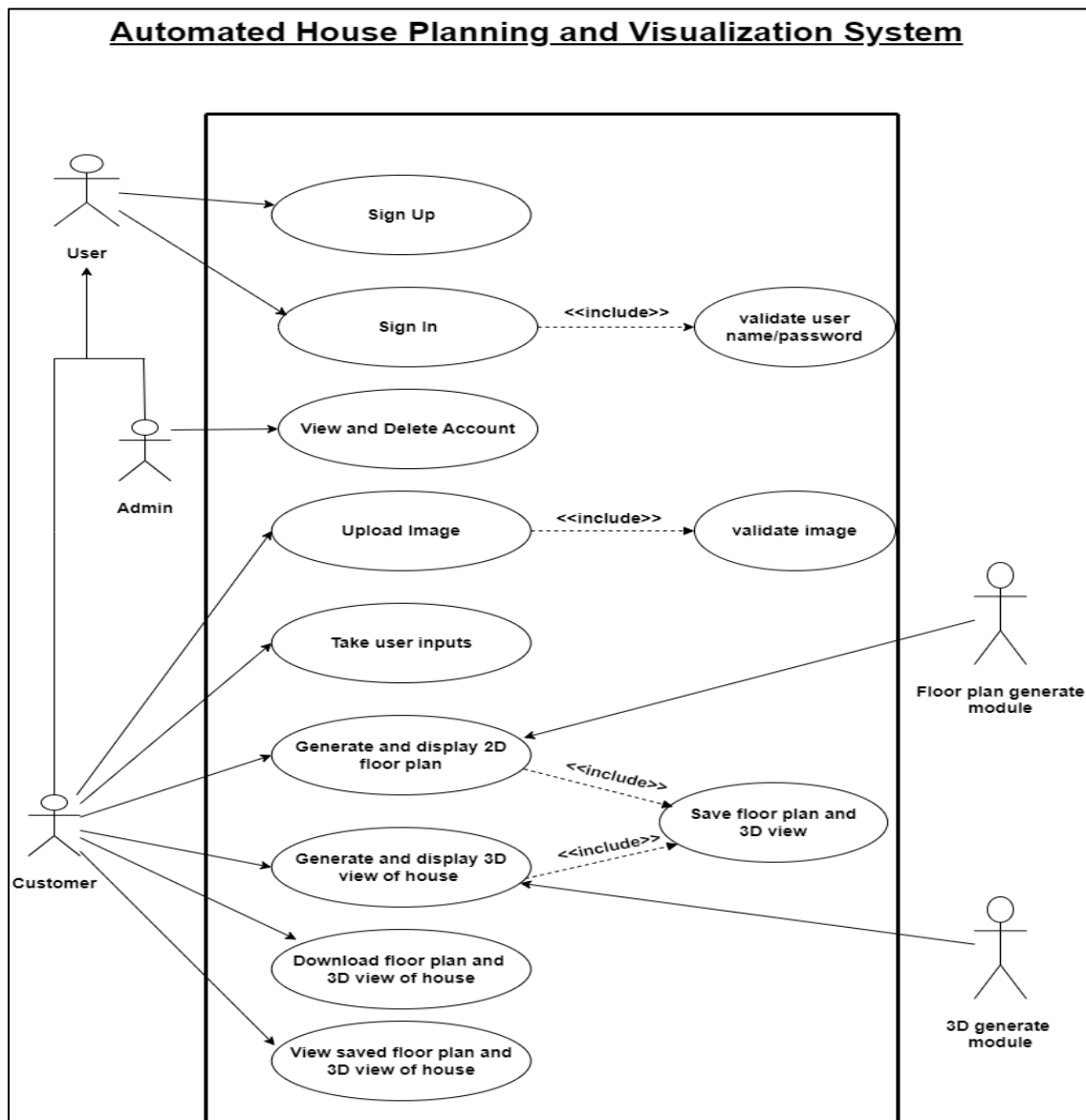


Figure 1: Use case diagram

## 1.4. Actors and use cases

### 1.4.1. Actors

Table 1: Description about actors

Actor	Description
User	Represents users who can log in and create accounts
Admin	An administrative user with privileges to view and delete user accounts.
Customer	A regular user who interacts with various functionalities of the web application.
Floor plan generate module	Responsible for the generation of 2D floor plans based on input data.
3D Generate Module	Responsible for the generation of 3D views of the house based on 2D floor plans and additional inputs.

### 1.4.2. Use cases

Table 2: Description about use cases

Use Case	Description
1. Sign Up	Customer creates a new account by providing required information.
2. Sign In	Customer logs into the system by providing valid username and password.
○ Validate Username and Password	The system ensures the entered username and password are valid during sign-in.
3. View and Delete Account (Admin)	Admin views and has the ability to delete user accounts.
4. Upload Image	Customer uploads a clear image of the survey plan.
○ Validate Image	The system verifies the uploaded image to ensure it meets required standards.
5. Take User Inputs	Customer provides inputs such as the number of rooms and dimensions.
6. Generate and Display 2D Floor Plan	The system processes the input data, and the 2D Generate Module generates and displays a 2D floor plan to the customer.
7. Generate and Display 3D View of House	Based on the 2D floor plan and additional inputs, the 3D Generate Module generates and displays a 3D view of the house.
○ Save Floor Plan and 3D View of house	The system saves the generated 2D floor plan and 3D view for future reference.

8. Download Floor Plan and 3D View	Customer can download the saved floor plan and 3D view of the house.
9. View Saved Floor Plans and 3D View of houses	Customer can view previously saved floor plans and 3D views.

#### 1.4.3. Actor-Use Case Interactions

Table 3: Interaction of actors with use cases

<b>Actors</b> <b>Use Case name</b>	<b>Customer</b>	<b>Admin</b>	<b>Floor plan generate module</b>	<b>3D Module</b>	<b>Generate</b>
1. Sign up	√				
2. Sign in	√				
3. View and delete account		√			
4. Upload image	√				
5. Take user inputs	√				
6. Generate and display 2D floor plan			√		
7. Generate and display 3D view of house					√
8. Download floor plan and 3D view of house	√				
9. View saved floor plan and 3D view of house	√				

#### 1.4.4. Sub-use cases

Table 4: Description about sub use cases

<b>Sub-use Case</b>	<b>Description</b>	<b>Parent Use Case</b>
Verify User Accounts	Verify the authenticity of user accounts during login	Sign In
Validate Image	Validate the uploaded image for correctness	Upload Image
Save 2D and 3D Views	Save the generated 2D and 3D views	2D View Generation, 3D View Generation

## 1.5. Use case scenarios and alternative scenarios

### 1.5.1. Sign-up

Table 5: Sign up Scenario

Use case number	1
Use case name	Sign-up
Actors	User
Precondition	The application displays a welcome screen.
Scenario Description	<ol style="list-style-type: none"><li>1. The user selects the “Sign-up” option.<ol style="list-style-type: none"><li>1.A.1: The user selects the other options.</li></ol></li><li>2. The application displays a “Sign-up” form to enter details.</li><li>3. The user fills out the form and submits it.<ol style="list-style-type: none"><li>1.A.2: The user selects the "Cancel" option.</li><li>1.E.1: The user submits the form with empty fields.</li><li>1.E.2: The entered confirm password does not match.</li><li>1.E.3: The user email is already existing.</li></ol></li><li>4. The application redirects to the Welcome screen while sending notification “Your account has been activated successfully.” to the user.</li></ol>
Postcondition	The application displays the Welcome screen after displayed “Your account has been activated successfully”.
Business rules	<ol style="list-style-type: none"><li>1.User form includes email, password, confirm password, password hint.</li><li>2.Password should include at least eight characters and it should include at least one uppercase letter, lowercase letter, one numeral and one special character.</li></ol>

### 1.5.2. Sign-in

Table 6: Sign-In Scenario

Use case number	2
Use case name	Sign-in
Actors	User
Precondition	The user must have a registered account.
Scenario Description	<ol style="list-style-type: none"><li>1.The user select the “Sign-in” option.<ol style="list-style-type: none"><li>2.A.1: The user selects “Forget password” option.</li></ol></li><li>2. The application display the login form to enter the email and password.</li><li>3. The user enter their email and password in the respective fields and select the “Login” option.<ol style="list-style-type: none"><li>1.E.1: The user submits the form with empty fields.</li><li>2.E.2: Incorrect email and password.</li></ol></li><li>4. The application validates the details and redirects to the home page.</li></ol>
Postcondition	The application displays the home page.
Business Rules	<ol style="list-style-type: none"><li>1.Login form includes email and password.</li><li>2.Allow user to enter password maximum three times.</li></ol>

### 1.5.3. View and Delete account

Table 7: View and Delete account

Use case number	3
Use case name	View and Delete account
Actors	Admin
Precondition	<p>Admin must have logged in to the system.</p> <p>Application displays the admin page.</p> <p>Admin must have the user email.</p>
Scenario Description	<ol style="list-style-type: none"><li>1. Application displays view and delete options.<ol style="list-style-type: none"><li>3.A.1: Admin select cancel option.</li></ol></li><li>2. Admin selects view and delete option.</li><li>3. Admin searches the user account entering user’s email.</li></ol>

	3.E.1: Invalid user email 4. Deletes user account using delete account options. 5. System displays the “Deleted successful” notification.
Postcondition	System displays the admin page with log out option

#### 1.5.4. Upload Image

Table 8: Upload Image Scenario

Use case number	4
Use case name	Upload Image
Actors	User
Precondition	User must log in home page.
Scenario Description	1. The user selects the “Upload Image” option. 2. The application display an Upload Image section to enter the image of survey plan. 4.A.1: The User select the “Cancel” option. 3. The application opens a new file explorer window. 4.The user selects a suitable image file from their device. 4.A.2: User selects Clear option. 5. Image is uploaded to the web application. 4.E.1: User uploads unsupported file format. 4.E.2: User uploads an oversized file. 6. User submits the uploaded image. 4.A.3: The User selects the “Cancel” options. 7. The system validate the image. 4.A.4: The User select the “Cancel” option. 4.E.3: Uploaded image was unclear.
Postcondition	The application displays the User Inputs upload session.
Business rules	The user must click the Upload Image option. The web application only supports JPEG, JPG and PNG file format. Maximum image size should be less than 10Mb.

#### 1.5.5. Take User Inputs

Table 9: Take user input scenario

Use case number	5
Use case name	Take User Inputs
Actors	User
Precondition	User must be in the input session.
Scenario Description	<ol style="list-style-type: none"><li>1. The user selects the Enter Details option. 5.A.1: The user selects the cancel options.</li><li>2. The application displays User Inputs form to enter details.</li><li>3. The user fill out the form and submit it. 5.A.2: The user selects clear option.</li><li>4. The application check errors. 5.E.1: The user submits the form with empty fields.</li><li>5. The user clicks Generate option.</li></ol>
Postcondition	<p>The user must have submitted the inputs correctly.</p> <p>The user must be in the 2D Generation page.</p>
Business rules	User form includes number of rooms and their dimensions.

#### 1.5.6. Generate and Display floor plan

Table 10: Generate and Display floor plan Scenario

Use case number	6
Use case name	Generate and Display floor plan
Pre-condition	<p>The input details should be valid enough to generate floor plan.</p> <p>The user must have logged into the system.</p>
Scenario description	<ol style="list-style-type: none"><li>1.The user selects generate options to generate 2D floor plan. 6.A.1: The user selects the cancel generate option.</li><li>2.Displays generated 2D floor plans. 6.E.1: Cannot generate floorplans.</li><li>3.The user selects a floor plan for preview. 6.A.2: Cancel selection and select another one.</li></ol>



Post condition	Save generated floor plans in user account
Business rules	Provides generated 2D floor plans to select a one floor plan.

### 1.5.7. Generate and Display 3D View of House

Table 11: Generate and display 3D module scenario

Use case number	7
Use case name	Generate and display 3D module
Actors	User
Precondition	Select one option from previously generated floor plans
Scenario Description	<p>1. User selects “Generate 3D view” option.</p> <p>7.A.1: User selects the “Cancel Generate 3D view” option.</p> <p>2. Display generated 3D view.</p> <p>7.E.1: Cannot generate 3D view.</p>
Post condition	Display download options for both generated floor plan and 3D view.

### 1.5.8. Download generated floor plan and 3D view

Table 12: Download generated floor plan and 3D view scenario

Use case number	8
Use case name	Download generated floor plan and 3D view.
Pre-condition	<p>System displays the download page.</p> <p>The 2D floor plan and 3D view of the house should have generated.</p>
Scenario description	<p>1.User selects to download generated 2D floor plan and 3D view.</p> <p>8.A.1: The user selects the cancel download option.</p>
Post condition	<p>Stores downloaded file in user hard disk.</p> <p>System displays the download page.</p>
Business rules	Allow user to download 2D floor plan and 3D view of the house 3 times.

### 1.5.9. View saved floor plan and 3D view of house

Table 13: View saved floor plan and 3D view of house scenario

Use case number	9
Use case name	View saved floor plan and 3D view of house
Pre-condition	User must log into the system. Home page displays the view saved project options
Scenario description	User selects the view saved project option. System displays the existing generated floor plan and 3D views.
Post condition	System stays in home page.

### 1.6. Alternative and Exceptional

Table 14: Sign-Up Alternative

Alternative number	1.A.1
Alternative name	The user selects the other options.
Pre-condition	The application displays a welcome screen.
Scenario description	User select the "Sign-in" option.
Post-condition	The application displays a "Sign-in" form to enter details.

Table 15: Sign-Up Alternative

Alternative number	1.A.2
Alternative name	The user selects the "Cancel" option.
Pre-condition	The application displays a "Sign-up" form to enter details.
Scenario description	The sign-up process will be cancelled.
Post-condition	The application returns to the home screen.

Table 16: Sign-In Alternative

Alternative number	2.A.1
Alternative name	The user selects “Forget password” option.
Pre-condition	User enter the email, password and submit.
Scenario description	<ol style="list-style-type: none"> <li>1. The user selects the “Forgot Password” option.</li> <li>2. The application redirects to “E mail verification” page.</li> <li>3. The application displays a form to enter the email, which the user used to register for the system.</li> <li>4. User enters the e mail.</li> <li>5. Application automatically send a link to reset the user’s password, via e mail.</li> <li>6. User clicks the link and it redirects to the “Reset Password” page.</li> <li>7. User can enter new password and save it.</li> </ol>
Post-condition	The application displays a “Sign-in” form to enter details.

Table 17: View and Delete account Alternatives

Alternative number	3.A.1
Alternative name	Admin select cancel option.
Precondition	System displays Cancel option.
Scenario Description	The admin selects cancel option.
Post condition	System displays the admin page.

Table 18: Upload Image Alternative

Alternative Number	4.A.1
Alternative Name	The User select the “Cancel” options.
Precondition	User must be in the Input image page.
Scenario Description	The user selects Cancel option, and image is not uploaded.
Postcondition	Return back to the home page.

Table 19: Upload Image Alternative

Alternative Number	4.A.2
Alternative Name	The User select the “Clear” options.
Precondition	User must select an image.
Scenario Description	The selected image is canceled instead of being opened.
Postcondition	Return back to the “Upload Image” section.

Table 20: Upload Image Alternative

Alternative Number	4.A.3
Alternative Name	The User select the “Cancel” options.
Precondition	User must upload an image.
Scenario Description	The submitting process will be cancelled.
Postcondition	Return back to the “Upload Image” section.

Table 21: Upload Image Alternative

Alternative Number	4.A.4
Alternative Name	The User select the “Cancel” options.
Precondition	User must submit an image.
Scenario Description	The validating process will be cancelled.
Postcondition	Return back to the “Upload Image” section.

Table 22: Take User Inputs Alternative

Alternative Number	5.A.1
Alternative Name	The User selects the cancel options.
Precondition	User must be in the input session.
Scenario Description	The input session process will be canceled.
Postcondition	The application returns to the home page.

Table 23: Take User Inputs Alternative

Alternative Number	5.A.2
Alternative Name	The user selects clear option.
Precondition	The user input field must be filled.
Scenario Description	Entered fields are cleared.
Postcondition	The application returns to the input field.

Table 24: Generate and Display floor plan Alternative

Alternative number	6.A.1
Alternative name	The user selects the cancel generate floor plan option.
Precondition	Display generate or Cancel option
Scenario Description	User select cancel option.
Post condition	Displays the input page

Table 25: Generate and Display floor plan Alternative

Alternative number	6.A.2
Alternative name	Cancel selection and select another one.
Precondition	The user must have selected one of the generated floor plans.
Scenario Description	User cancel the selected floor plan. System displays other generated floor plans.
Post condition	System displays the generated floor plan.
Business rules	Displays 2 remaining options.

Table 26: Generate and display 3D module Alternative

Alternative number	7.A.1
Alternative name	User selects the “Cancel Generate 3D view” option.
Precondition	User selects “Generate 3D view” option
Scenario Description	3D view generating will be cancelled.
Post condition	The application returns to the home page.

Table 27: Download generated floor plan and 3D view scenario

Alternative number	8.A.1
Alternative name	The user selects the cancel download option.
Precondition	Display download or Cancel option.
Scenario Description	User select cancel option.
Post condition	System displays the 3D generation page.

Table 28: Sign-Up Exceptional

Exceptional number	1.E.1
Exceptional name	The user submits the form with empty fields.
Pre-condition	User fill the register form and submit.
Scenario description	If user doesn't fill the required field, the system displays an error message "You should fill out the required fields." and prompts the required fields.
Post-condition	The application displays an error message "Please fill in all required fields."

Table 29: Sign-Up Exceptional

Exceptional number	1.E.2
Exceptional name	The entered confirm password does not match.
Pre-condition	The user submits the sign-up form.
Scenario description	<ol style="list-style-type: none"> <li>1. The user fills out the sign-up form and provides a password and a confirmed password.</li> <li>2. However, the entered confirmed password does not match the password entered earlier.</li> </ol>
Post-condition	The application displays an error message "The entered password does not match."

Table 30: Sign-Up Exceptional

Exceptional number	1.E.3
Exceptional name	The user email is already existing.
Pre-condition	The user submits the forms.
Scenario description	If there is already an account with the entered email address, the system displays an error message “This email address is already existed and Please try different one” and clear the email field.
Post-condition	The user submits the forms.

Table 31: Sign-In Exceptional

Exceptional number	2.E.2
Exceptional name	Incorrect email and password.
Pre-condition	User should enter the email, password and submit the form.
Scenario description	If the user enters an incorrect email or password, the system displays an error message “Re-enter the email and password” and clear the input fields.
Post-condition	The user submits the forms.

Table 32: View and Delete account Exceptional

Exceptional number	3.E.1
Exceptional name	Invalid user email
Precondition	Admin must enter the correct email
Scenario Description	The system displays an error message if the admin enters an incorrect email of the user.
Post condition	System displays the admin page.

Table 33: Upload Image Exceptional

Exception Number	4.E.1
Exception Name	User uploads unsupported file format.
Precondition	The user has selected the image file from their storage device.
Scenario Description	The system detects that the selected image file has an unsupported file format and display an error message “+Invalid file format”.
Postcondition	The system displays an error message.

Table 34: Upload Image Exceptional

Exception Number	4.E.2
Exception Name	User uploads an oversized file.
Precondition	The user has selected the image file from their storage device.
Scenario Description	The system detects that the selected image file has an oversized file and display an error message “Image file was oversized”.
Postcondition	The system displays an error message

Table 35: Upload Image Exceptional

Exception Number	4.E.3
Exception Name	Uploaded image was unclear.
Precondition	The user has selected the image file from their storage device.
Scenario Description	The system detects that the selected image file has an unclear file and display an error message “Image file was unclear”.
Postcondition	The system displays an error message

Table 36: Take User Inputs Exceptional

Exception Number	5.E.1
Exception Name	The user submits the form with empty fields.
Precondition	The user submits the form with empty fields.
Scenario Description	If user does not field or fields, the system displays an error message “You should fill out the required field.” And prompts the required field.
Postcondition	The application displays an error message.



Table 37: Generate and Display floor plan Exceptional

Exceptional number	6.E.1
Exceptional name	Cannot generate floor plan
Precondition	User must have a powerful internet connection.
Scenario Description	The system displays an error message if the user has a network connection problem.
Post condition	The system displays the 2D generation page.
Business rules	Internet speed should be at least 10 Mbps.

Table 38: Generate and display 3D module Exceptional

Exception number	7.E.1
Exception name	Cannot generate 3D view.
Precondition	User selects “Generate 3D view” option.
Scenario Description	3D view generating will be cancelled.
Post condition	The application returns to the generate 3D section.

## 1.7. Activity diagram

### 1.7.1. Sign Up

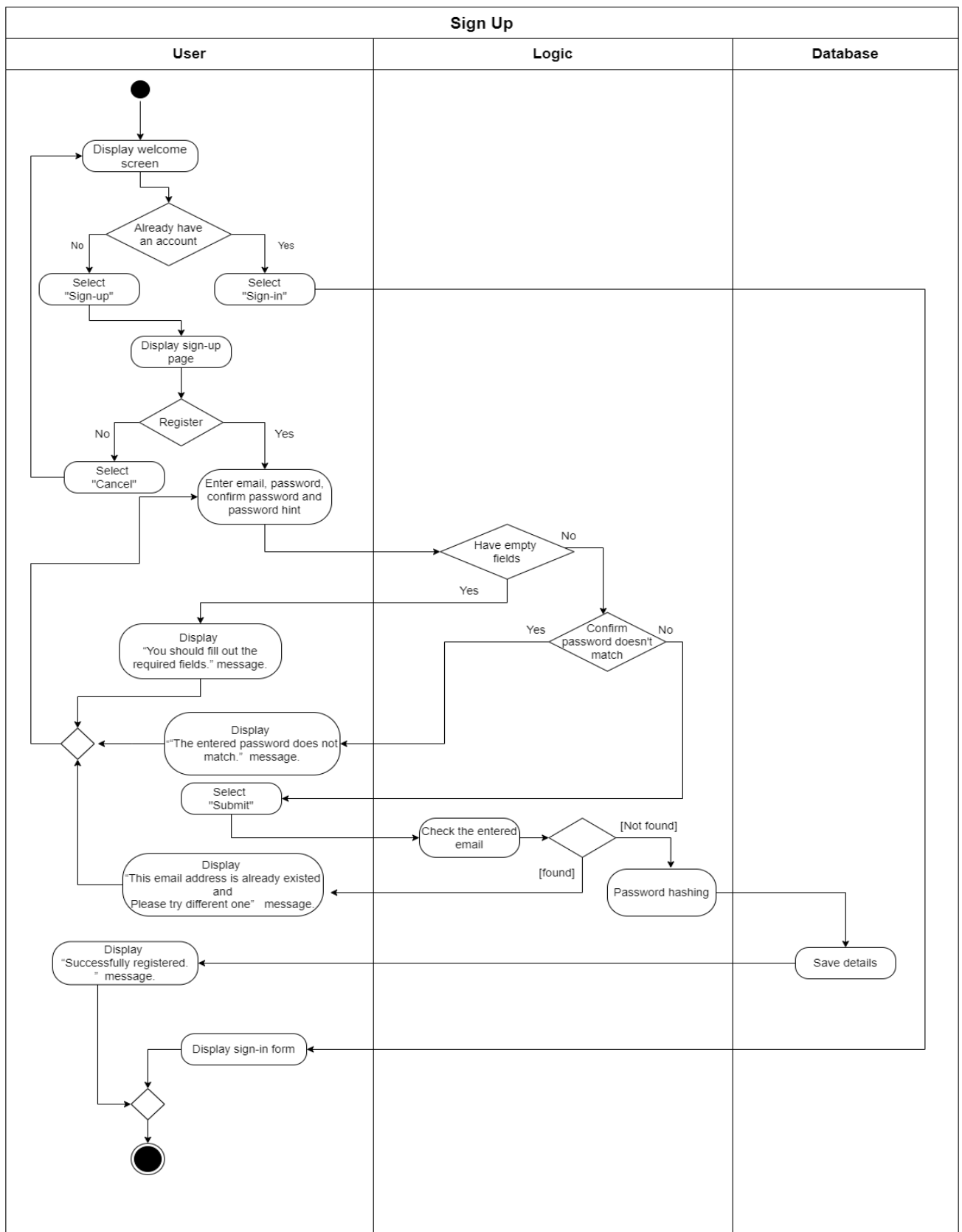


Figure 2: Activity diagram for Sign-Up

### 1.7.2. Sign In

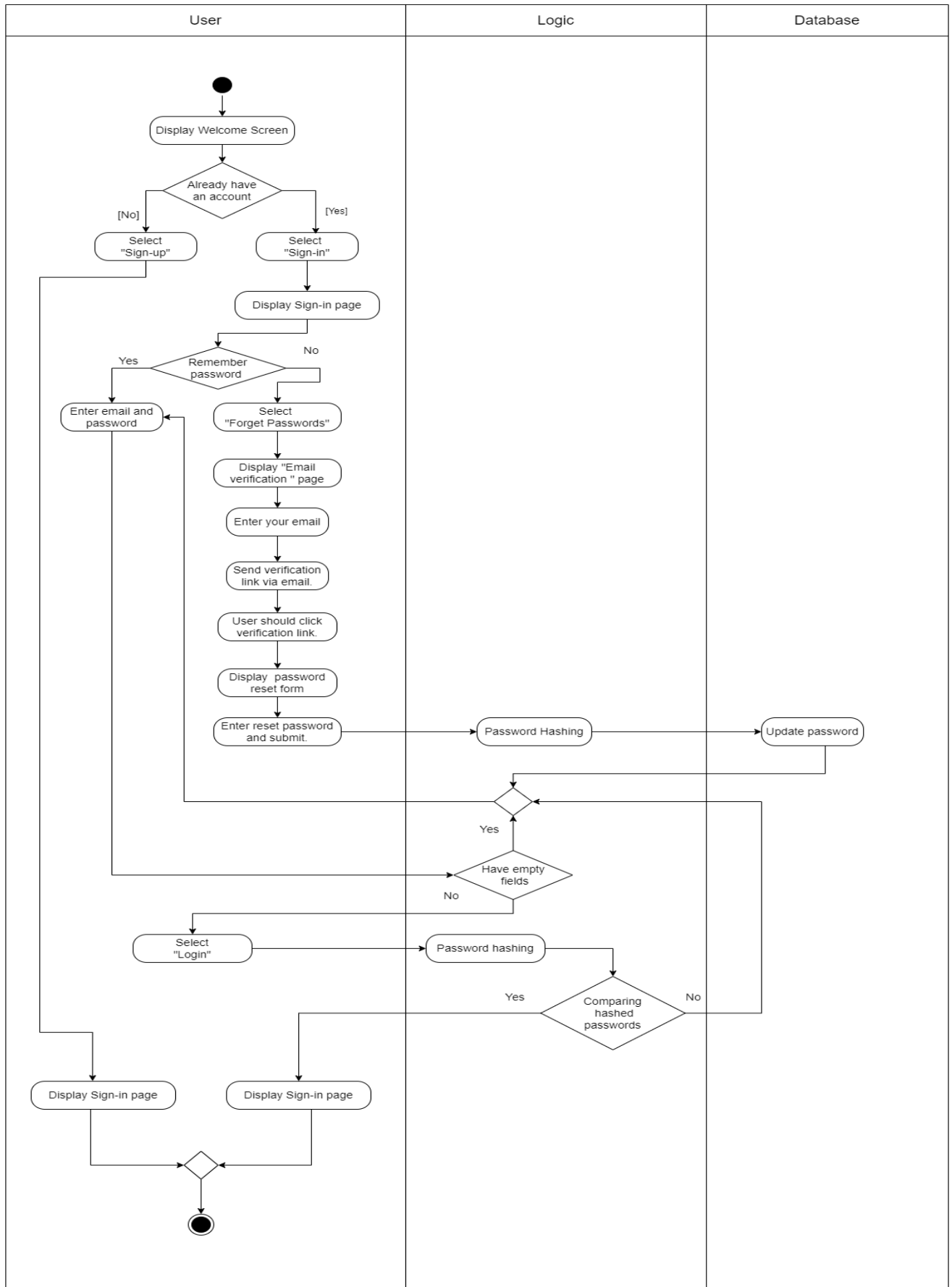


Figure 3: Activity diagram for Sign-In

### 1.7.3. View and Delete Account

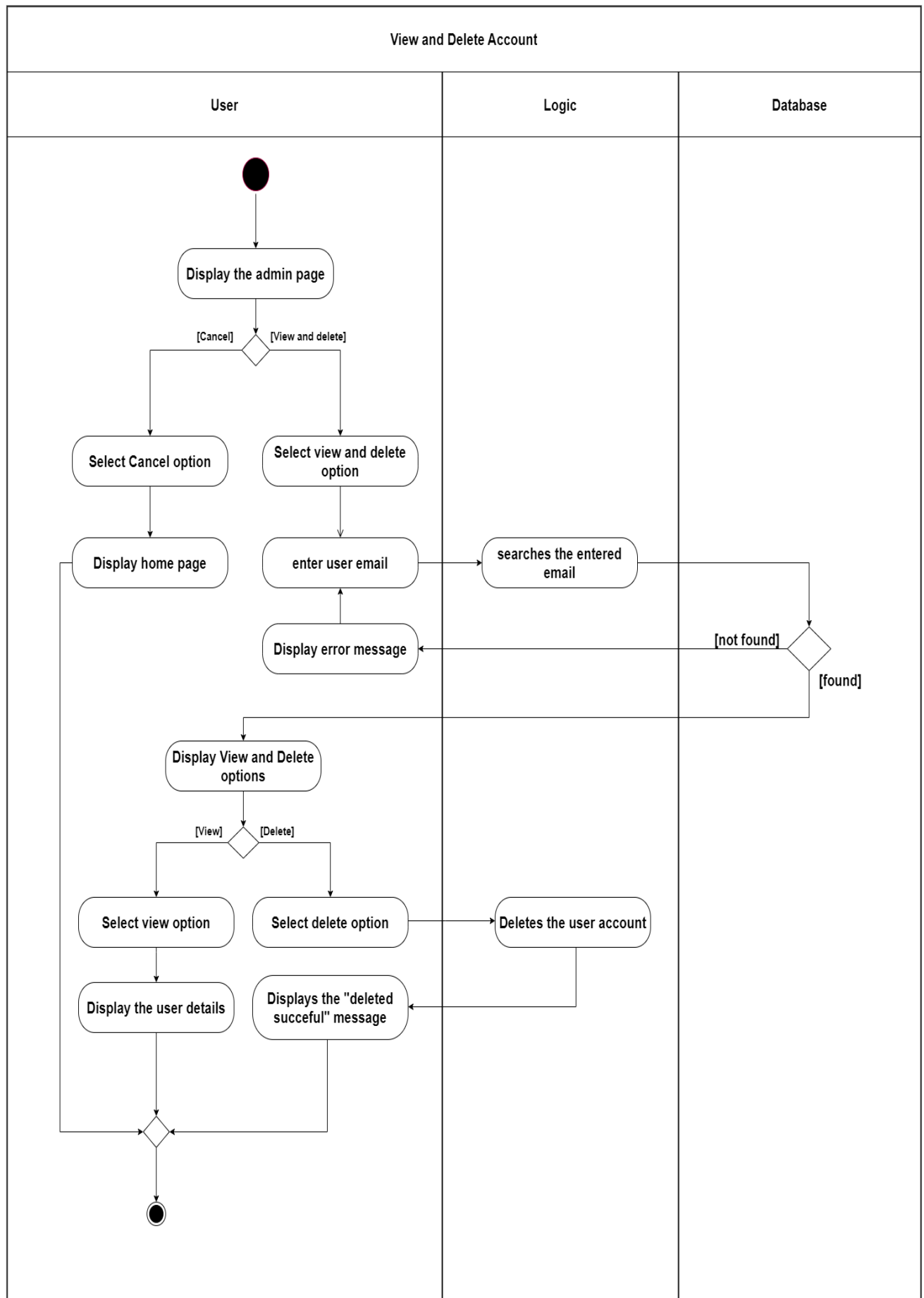


Figure 4: Activity diagram for View and Delete Account

### 1.7.4. Upload Image

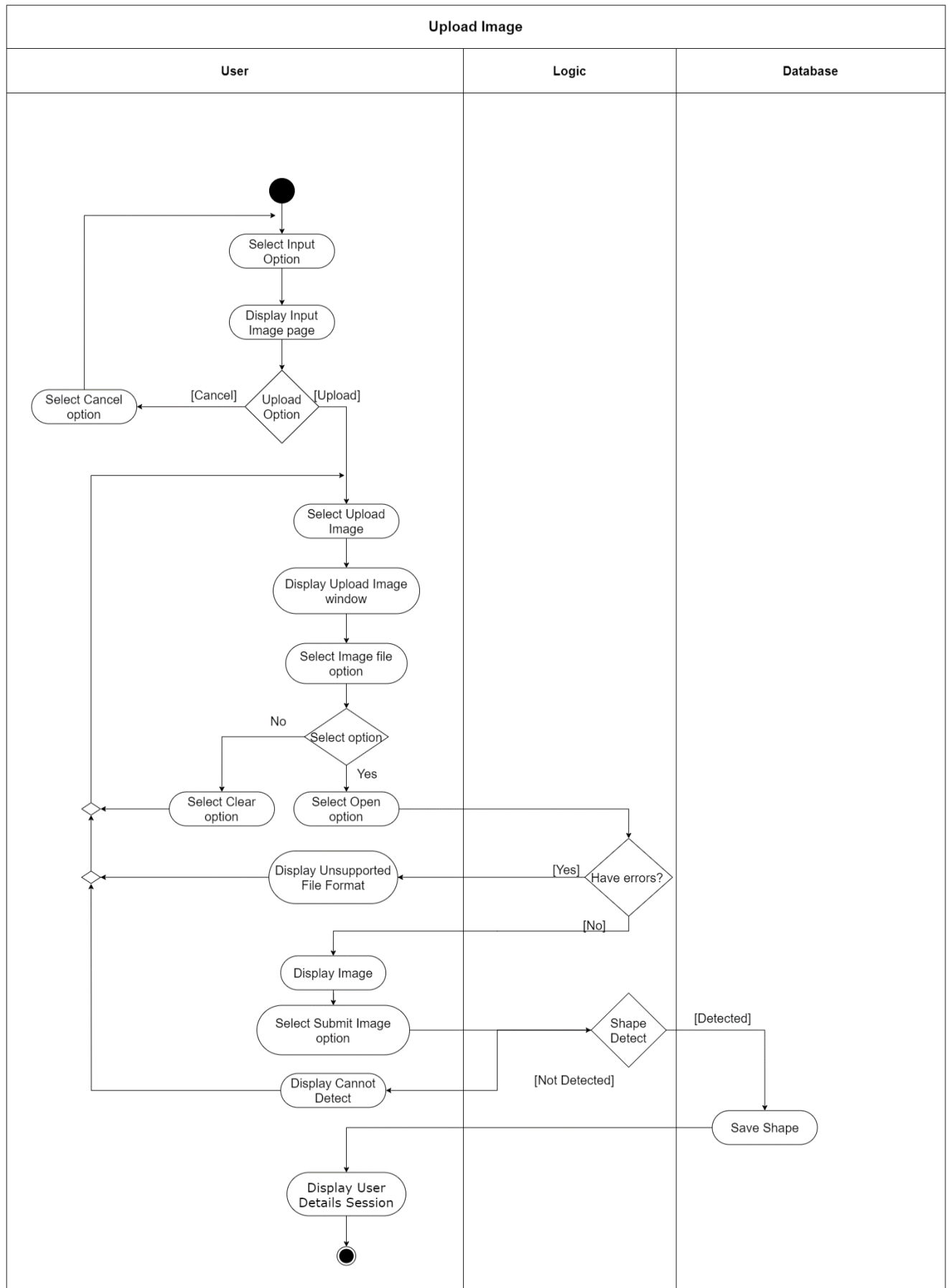


Figure 5: Activity diagram for upload image

### 1.7.5. Take User Inputs

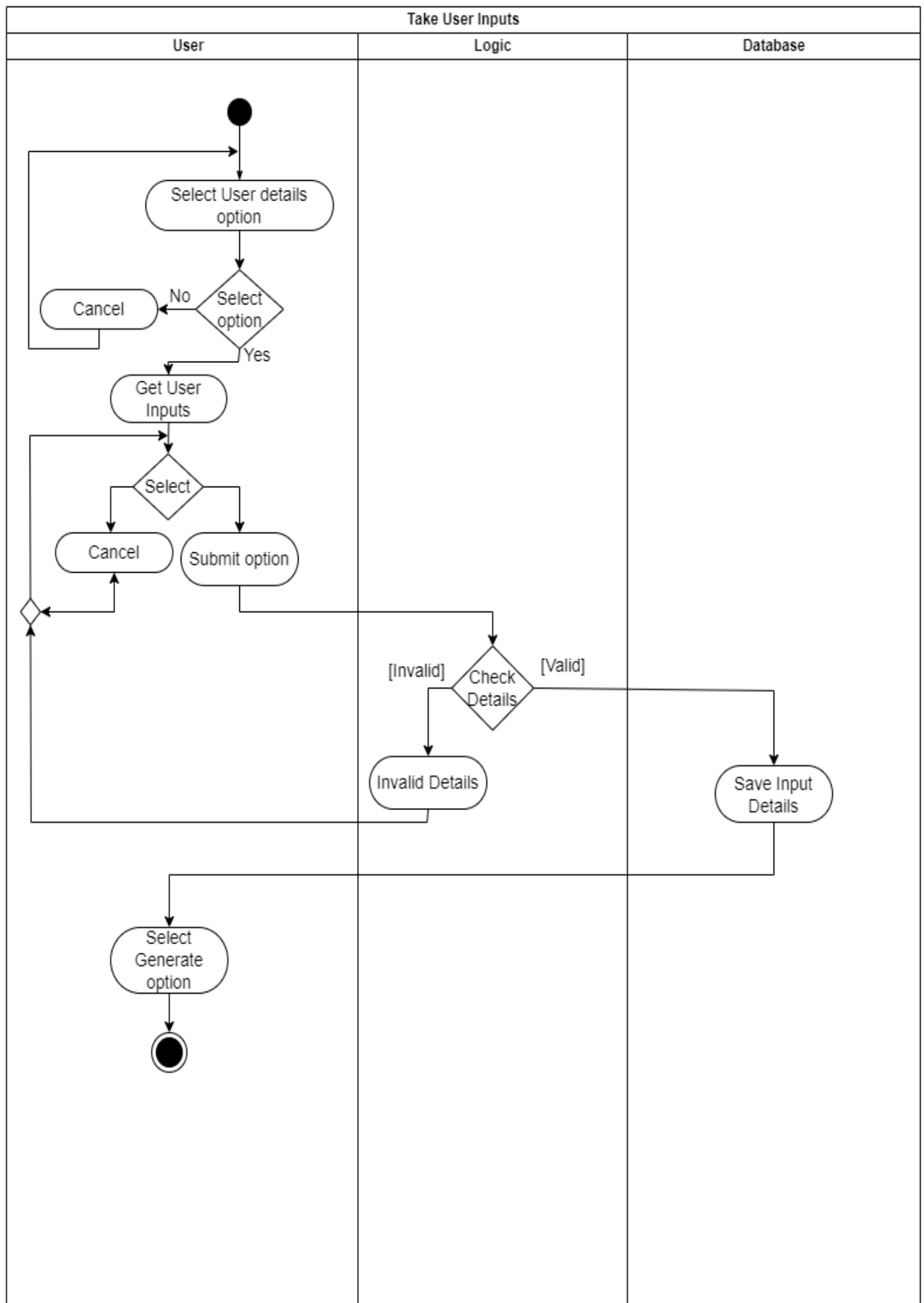


Figure 6: Activity diagram for Take user input

### 1.7.6. Generate and Display 2D Floor Plan

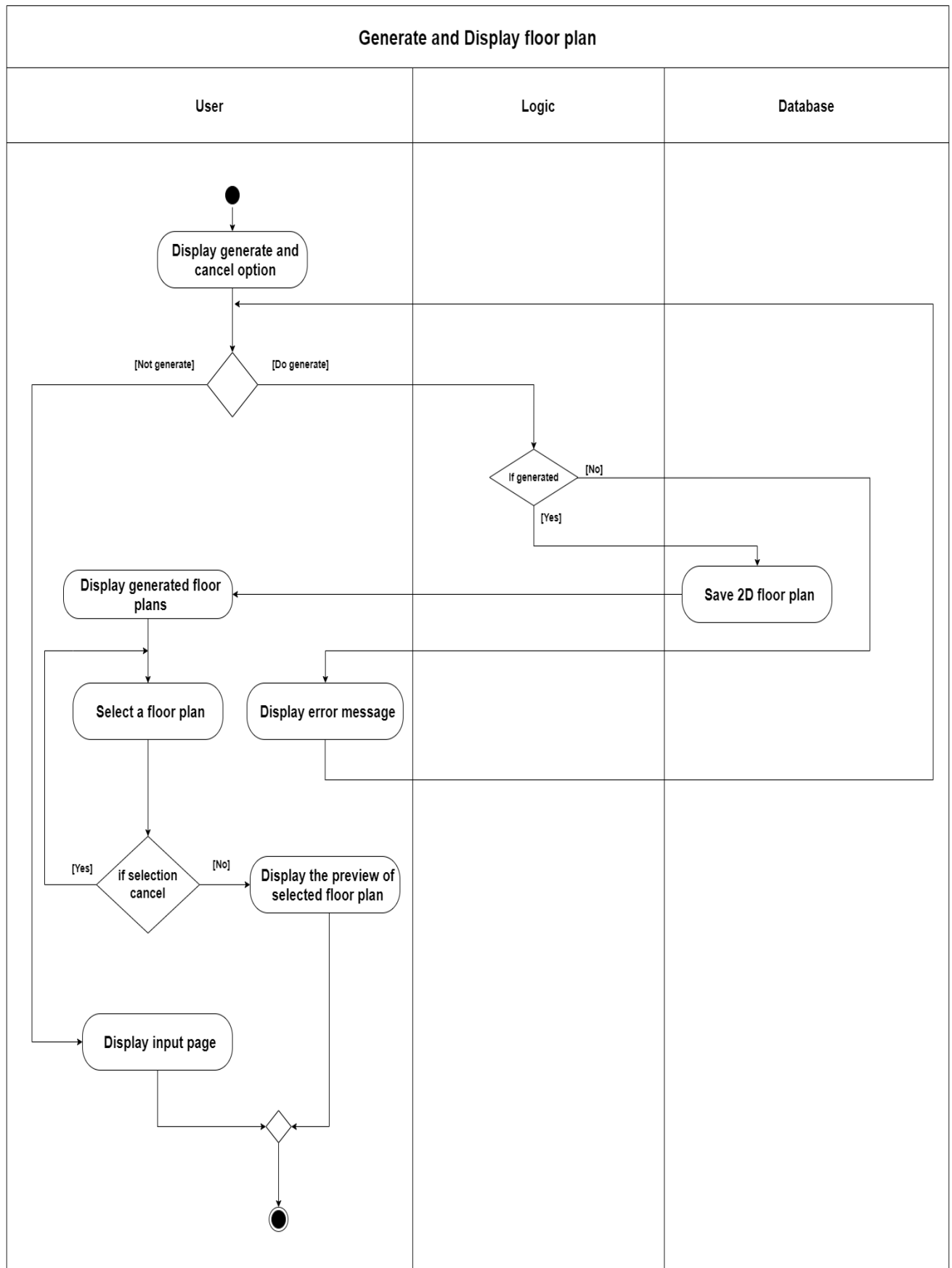


Figure 7: Activity diagram for generate 2D floor plan

### 1.7.7. Generate and Display 3D View of House

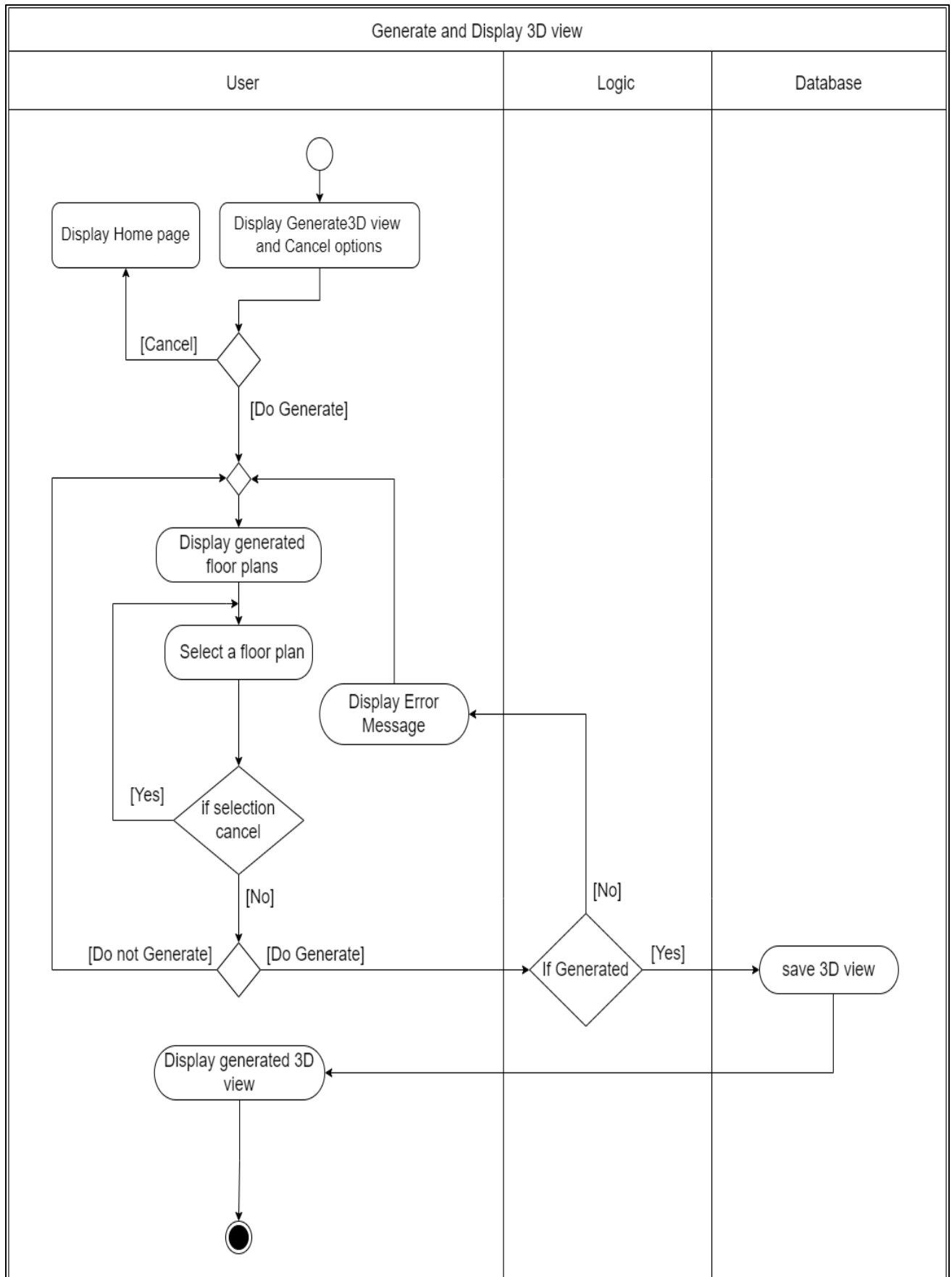


Figure 7: Activity diagram for generate 3D View



### 1.7.8. Download Floor Plan and 3D View

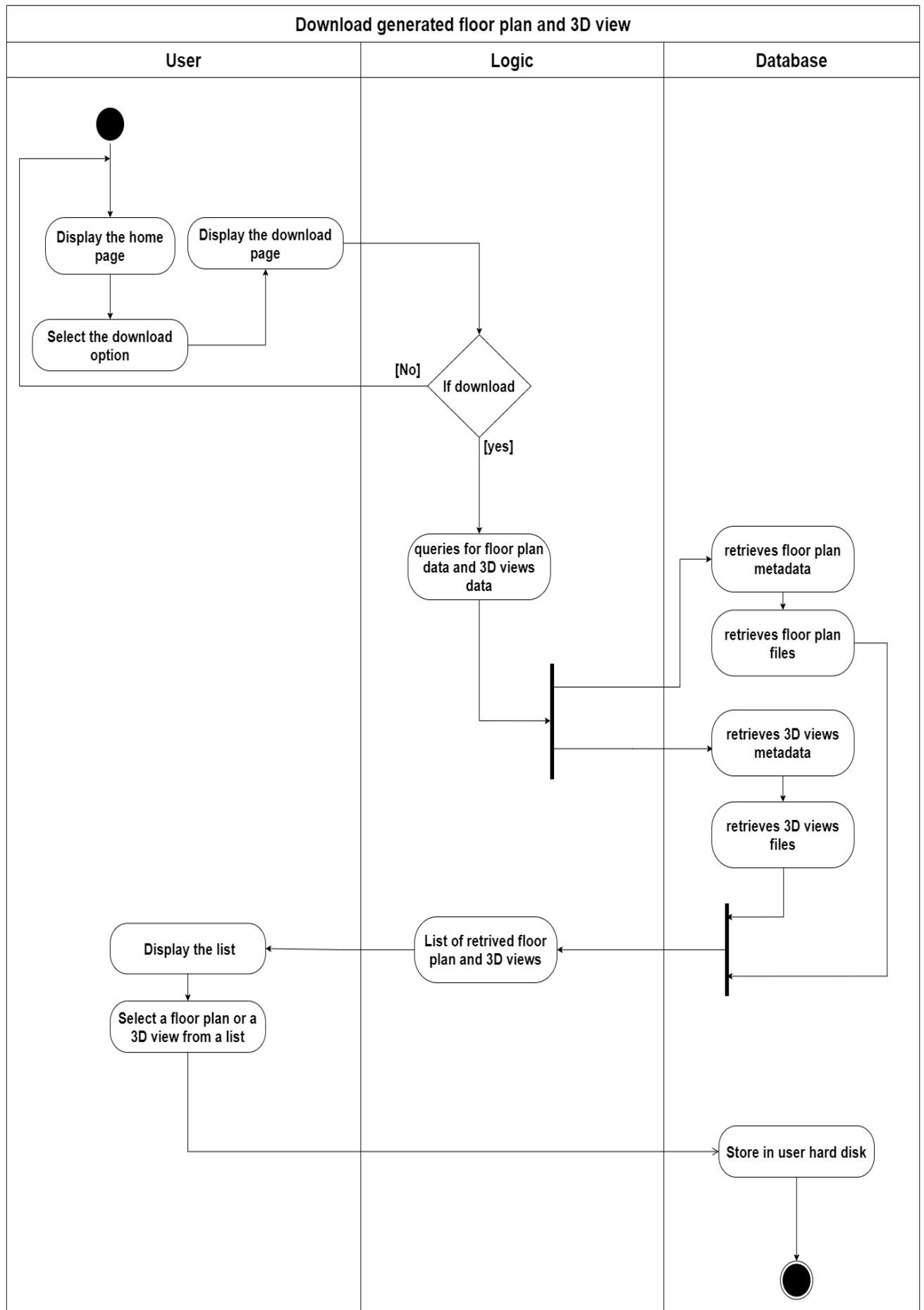


Figure 8: Activity diagram for download floor plan and 3D views

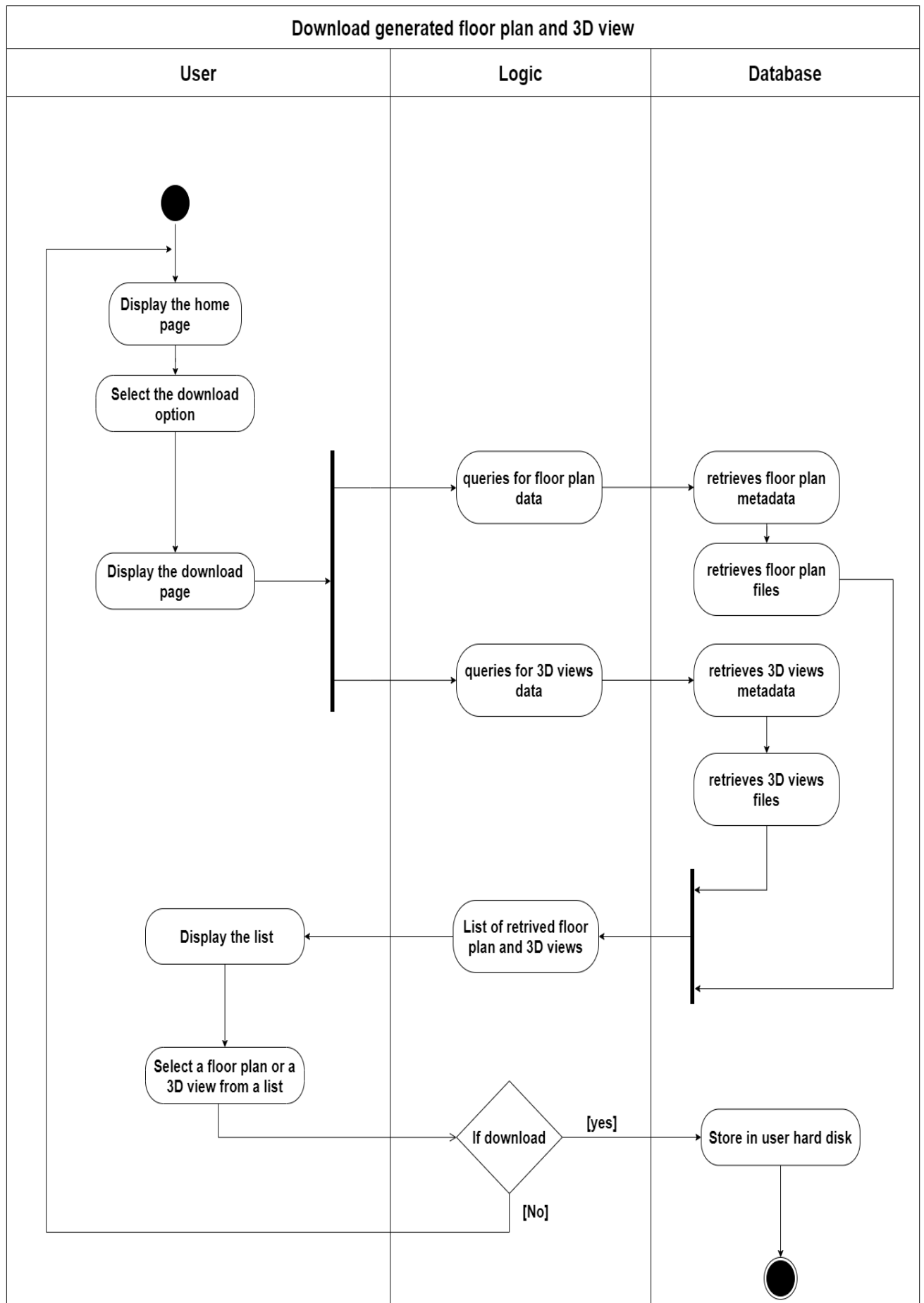


Figure 9: Activity diagram for download floor plan and 3D views

### 1.7.9. View Saved Floor Plans and 3D View of houses

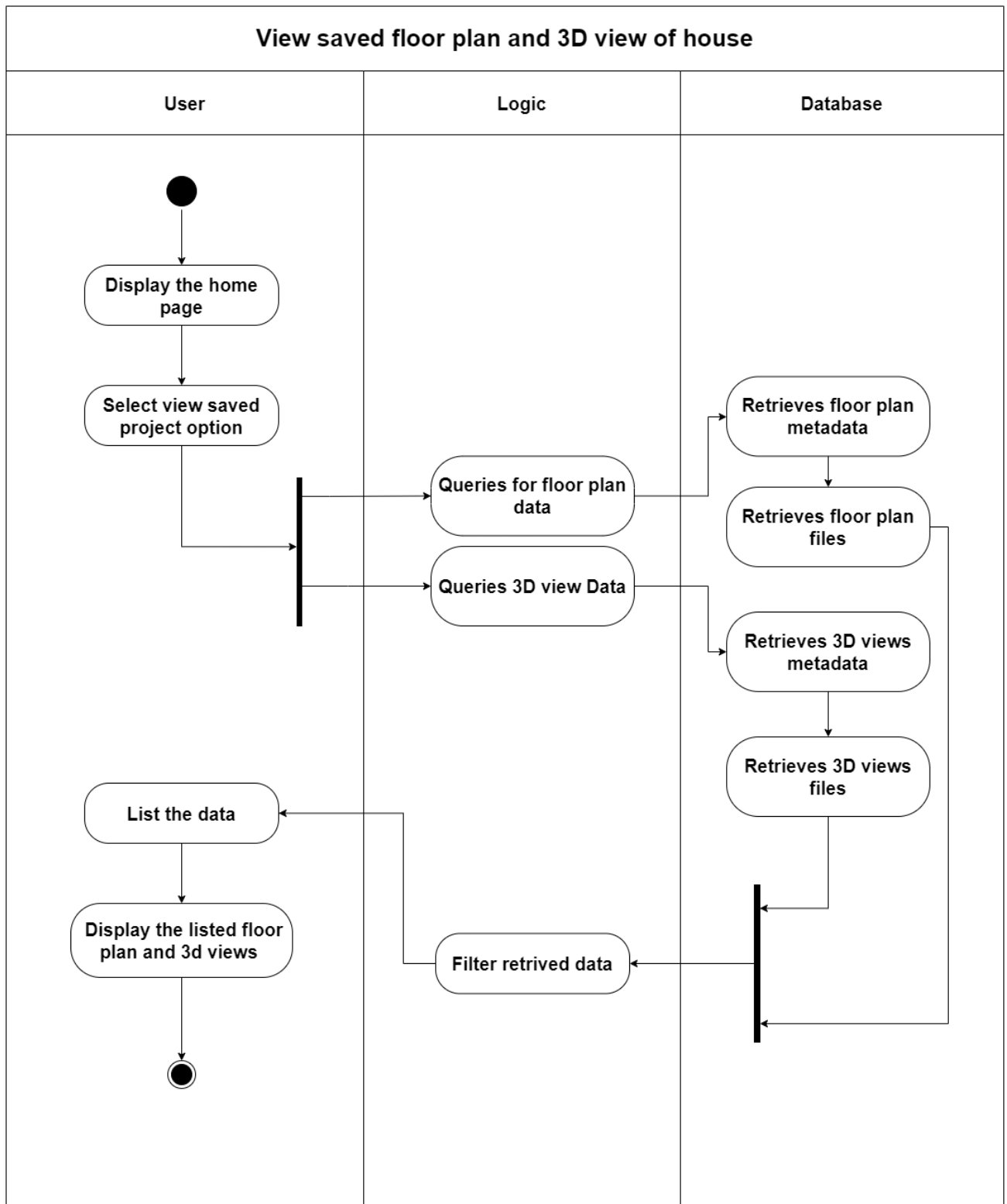


Figure 10: Activity diagram for view saved floor plan and 3D views

## 2. Functional requirements

Table 39 - Validate Registration Inputs

Functional Requirement Number	1
Name of the Functional Requirement	Validate registration inputs and display registration success
Short Description	System validates the user registration inputs and after validation system display success message.
Inputs	Email, Password, Confirm Password, Password Hint
Process	<p>If the user submits the registration form with an empty field, the system identifies the form has empty fields. The system checks if the email address is already entered. The system will display an error message if it is inserted before. Then the system checks do the password has a minimum of 8 characters. If it is not system will generate an error message. If it is, the system will compare the password and the confirmed password and also get the password hint. If all these are input correctly system will generate the “registration successful” message.</p> <p>Finally, system stores user details in the database.</p>
Output	Error message, success message
Business Rules / other considerations	Password should include at least eight characters and it should include at least one uppercase letter, lowercase letter, one numeral and one special character.

Table 40 - Verify user email and password

Functional Requirement Number	2
Name of the Functional Requirement	Verify user email and password
Short Description	System verifies user email and password for login.
Inputs	Email, Password
Process	<p>The system compares the user input email with the email stored in the database. The input password is then converted to a hash value and compared with the hashed password stored in the database. If it does not match, the system will generate an error message. If it compares, the system generates a success message.</p>

Output	Error message or success message Display homepage
Business Rules / other consideration	Username, Password, and Password hint should match registered data

Table 41- Forgot password

Functional Requirement Number	3
Name of the Functional Requirement	Forgot password
Short Description	If user forgot the password, they have "forgot password" option to reset the password
Inputs	User Email
Process	When the user selects the "forgot password" option, then the system displays the Email verification page to enter the email. after that, the system sends the verification link through email. Users can reset passwords using that email.
Output	Updated database with the new password

Table 42: Display User Accounts

Functional Requirement Number	4
Name of the Functional Requirement	Display User Accounts
Short Description	System displays a list of user accounts to the admin.
Inputs	User email
Process	Admin gives the user email to the system and the system searches the account details by using the given email. after that, the system displays the user account to the admin
Output	Display user accounts.

Table 43: Delete User Accounts

Functional Requirement Number	5
Name of the Functional Requirement	Delete User Accounts
Short Description	Deleting account that have not been used for more than one year.
Inputs	User email
Process	Admin gives the user email to the system and the system searches the account details by using the given email. After that, admin deletes the searched user account.
Output	System generate “Delete Successfully” message.

Table 44: Upload survey plan image

Functional Requirement Number	6
Name of the Functional Requirement	Upload survey plan image
Short Description	The land shape is identified by the system
Inputs	Image file
Process	User input the survey plan image to the system using upload image section and system will identify the land shape by uploaded image. Then the system stores the land shape in the database.
Output	Identified land shape
Business Rules / other consideration	Support JPEG and PNG image formats.

Table 45: Calculate Land Area

Functional Requirement Number	7
Name of the Functional Requirement	Calculate Land Area
Short Description	System calculates the area of the land based on user inputs.
Inputs	Number of rooms, dimensions, Number of floors

Process	System calculates the area of a single room by dividing the total area by the number of rooms. Then, determine the dimensions like width and length based on the shape of each room.
Output	Calculated area
Business Rules / other considerations	Verify input data in meters.

Table 46: Generate 2D Floor Plan

Functional Requirement Number	8
Name of the Functional Requirement	Generate 2D Floor Plan
Short Description	System generates a 2D floor plan based on the detected land shape.
Inputs	Survey plan image
Process	System starts generate 2D floor plan based on the detected land shape. After that system will store the generated floor plans and display them in the web interface.
Output	2D floor plans

Table 47: Generate 3D House View

Functional Requirement Number	9
Name of the Functional Requirement	Generate 3D House View
Short Description	System generates a 3D view based on the generated 2D floor plan.
Inputs	2D floor plan.
Process	System generates the 3D view of house based on the user selected floor plan. After completing 3D view generation, it stores in the database and display it to the user.
Output	3D view of house.

Table 48: Automatically save 2D floor plans and 3D views of house

Functional Requirement Number	10
Name of the Functional Requirement	Automatically save 2D floor plans and 3D views of house
Short Description	System automatically saves the generated 2D floor plan and 3D view.
Inputs	2D floor plan, 3D views of house
Process	System will automatically save the 2D Floor Plans and 3D views in the database with timestamp after generating them.
Output	The system displays “Saved successfully” message.
Business Rules / other considerations	Generated 2D floor plan and 3D view.

Table 49: Browse user 2D floor plan and 3D views from the database

Functional Requirement Number	11
Name of the Functional Requirement	Browse user 2D floor plan and 3D views from the database
Short Description	System navigates to the database to retrieve relevant user data.
Inputs	User email
Process	System sends requests to browse 2D floor plans and 3D views from the database using user’s email
Output	The list of browsed 2D floor plans and 3D views



Table 50: Download floor plans and 3D view of house

Functional Requirement Number	12
Name of the Functional Requirement	Download floor plans and 3D view of house
Short Description	Users download displayed 2D floor plan and 3D view.
Inputs	2D floor plan, 3D views of house, Download option
Process	When user selects download option, system will display the list of browsed 2D floor plans and 3D views of house. User can select one of them and download it.
Output	Downloaded file
Business Rules / other considerations	System had been generated 2D floor plan and 3D view of the house.

### 3. Non-functional Requirements

Non-functional requirements define the aspects of a system that are not related to specific behaviors or features but instead describe the overall qualities or characteristics of the system. \

#### 3.1. Product Requirements

Table 51: Product Requirement

Number	Non-Functional Requirement	Measurement Criterion
1	Performance	The system should be able to store a minimum of 100,000 user-generated 2D floor plans and 3D views in the database. The database storage allocation for user-generated content should not exceed 1 TB.
2	Scalability	Handling larger file sizes, especially for GLTF/GLB files with standard-resolution textures (1024x1024 to 2048x2048 pixels).
3	Interoperability	The system must compatible with major web browsers (Chrome version 122 or higher, Microsoft Edge version 121 or higher, Opera version 107 or higher) and mobile devices (iOS version 14 or higher, Android version 10 or higher).
4	Usability	The user interface should be optimized for a display resolution of 1920x1080 pixels. The System Usability Scale (SUS) score should be at least 10 in user testing.

### 3.2. Organizational Requirements

Table 52: Organizational Requirement

Number	Non-Functional Requirement	Measurement Criterion
1	Documentation	Ensure compliance with the IEEE guidelines, as well as Rajarata University's Faculty of Applied Sciences, Department of Computing Learning Management System Software Requirement Specification Submission guidelines for subject code ICT3411, released on January 30, 2024, at 7:31 a.m., when documenting.
2	Standard	The system should comply with ISO 27001 standards for information security management, ensuring the protection of user data and privacy.
3	Security	Make sure to use a strong hashing method to keep password secure.

### 3.3. External Requirements

Table 53: External Requirement

Number	Non-Functional Requirement	Measurement Criterion
1	Privacy Requirements	<ul style="list-style-type: none"><li>The system should comply with GDPR regulations, ensuring the protection of user privacy and data rights in accordance with EU standards.</li><li>User data should be stored and processed in compliance with relevant data protection laws, with a data breach notification time frame of 72 hours.</li></ul>
2	Safety Requirement	<ul style="list-style-type: none"><li>The web application should not include any features or content that pose a safety risk to users, ensuring a safe and secure user experience.</li></ul>

## 4. Data Design

### 4.1. ER diagram

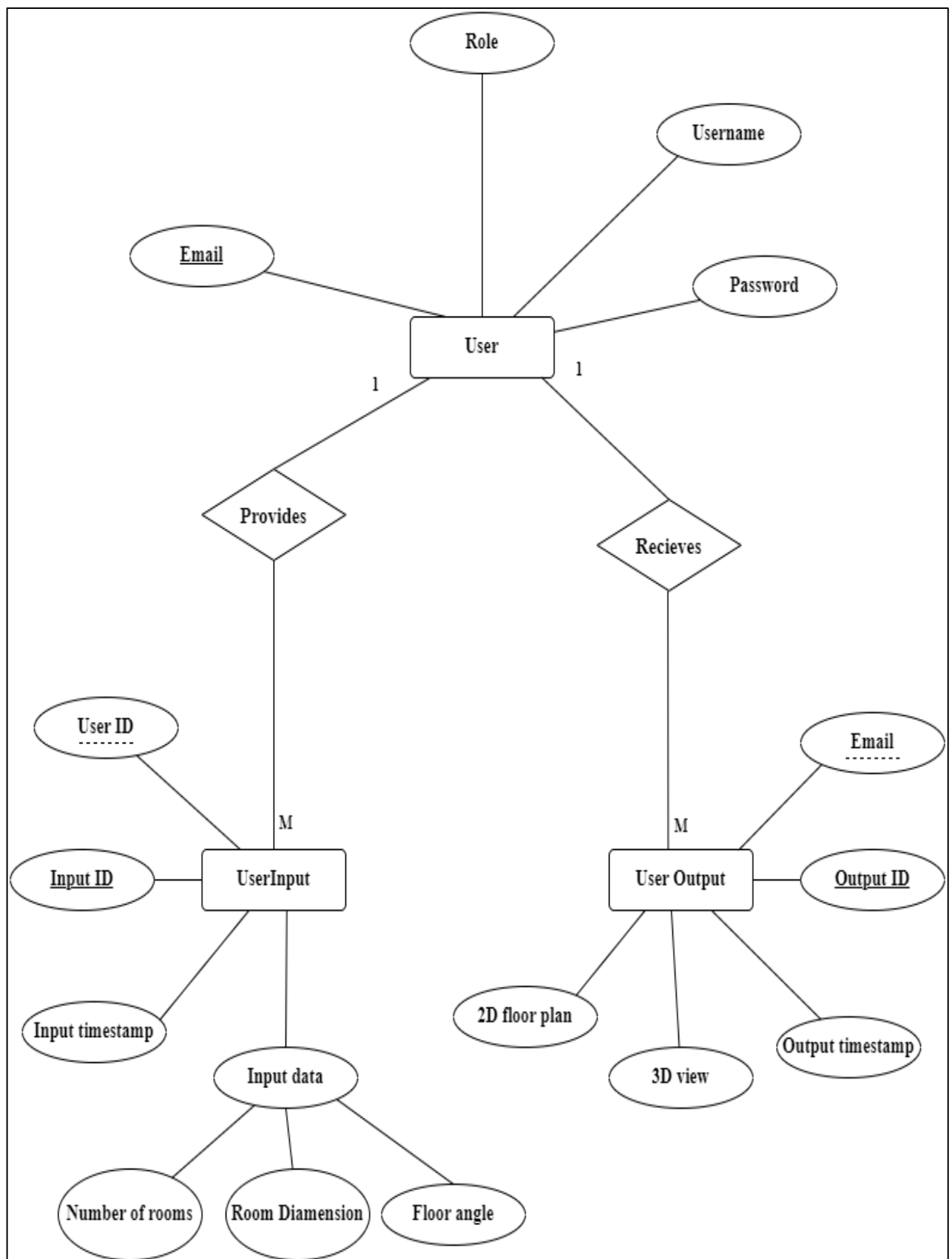







Figure 11: ER diagram

## 4.2. ER description

- The ER diagram depicts a database model with three entities: User, UserInput, and UserOutput. The User entity represents individuals with attributes such as User ID, email, role, username, and password. Email stands as the primary key. UserInput captures data provided by users, linked to the User entity via a one to many relationship, with attributes including inputID, input timestamp, and input data detailing room information. InputID is denoted as the primary key whereas the UserID stands as the partial key. InputData attribute has two composite attributes namely Number\_of\_rooms, Room\_dimension and Floor\_angle. UserOutput records the results delivered to users, also connected to the User entity in a one-to-many relationship, featuring attributes like outputID, output timestamp, and a 3D view. Here OutputID is the primary key and Email stands as the partial key. This model enables tracking user interactions, input data, and corresponding outputs, facilitating efficient management and analysis of user-generated content.

## 5. Approval

Signature of the team members:

Registration Number	Index Number	Name	Signature
ICT/19/20/132	5066	L. G. R. J. Lindapitiya	
ICT/19/20/138	5071	R. M.V. P. B. Udagama	
ICT/19/20/016	4957	B. M. C. B. K. Bandaranayake	
ICT/19/20/059	4997	A. G. N. D. Kaluwelgoda	
ICT/19/20/002	4944	T. M. M. M. B. Abeysinghe	

Date: 20.10.2023

- Recommendation of the supervisor(s)

Name: K. H. A. Hettige

Department/Organization: Department of Computing

Signature: .....

