

Team 2



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1. Introduction

IntergenHome is an application that matches elderly landlords with students seeking affordable housing, offering reduced rent in exchange for light caregiving or companionship (IntergenHome, 2024). The application offers a platform that connects students with property listings and matches elderly landlords with suitable housemates. By tailoring recommendations to personal preferences, it enhances students' chances of finding affordable housing and helps to address the housing crisis in the Netherlands.

This report presents definitions, assumptions and requirements from Assignment 2, Software Requirements Specification (SRS), and builds upon these requirements for the development of two diagrams based on Unified Modelling Language (UML). For the structural model, the class diagram has been prescribed and will be presented in Section 2. This diagram will build upon Functional Requirements [FR1], [FR2], [FR3], [FR4] and [FR6]. For the behavioural model, the activity diagram has been selected and will be presented in Section 3. This diagram builds upon [FR5].

1.1. Functional Requirements

ID	User's Interface	ID	Admin's Interface
General			
FR1	Create user account	FRX	Create admin account
FR2	Create user profile	FRX	Login admin account
FRX	Login user account	FRX	Adjust admin account settings
FRX	Adjust user account settings	FRX	Browse admin dashboard
FRX	Adjust user profile	FRX	Receive payment
FRX	Logout user account	FRX	Logout admin account
FRX	Delete account	FRX	Receive real-time notification
Functional			
FR3	View recommended property listings	FRX	Access to user data
FRX	View landlord profiles	FRX	Manage personalized feedback system
FRX	Rate the property	FRX	Manage users' matching algorithm
FR4	List property information		
FRX	View recommended student profiles		
FRX	View student profiles		
FRX	Search property listings		
FRX	Search students		
FRX	Pay commission fee		
FR5	Choose a subscription plan		

FR6	Message the landlord		
FRX	Message the student		
FRX	Cancel premium subscription plan		

Table 1. Functional requirements

1.2 Definition

ID	Definition	Description
D1	System	The InterGenHome business application.
D2	Student verification	The process of verifying whether the user is a student or not by asking them to verify their student email.
D3	Bank authentication page	A secure web interface where users [U2] verify their identity by entering credentials such as login information or security codes to authorise access to their bank account or complete a financial transaction.
D4	Landlord verification	The process of verifying whether the user is a house owner and above 60 years old.
D5	Matching system	The matching system is an algorithm that compares user preferences, such as location, price, and property type, to generate and rank personalized recommendations for landlords and students based on a calculated matching score.
D6	Room type	Types of room include studio apartments, shared rooms, private rooms in shared houses, and self-contained apartments
D7	Proof of property ownership	A legalized purchase property agreement that is typically provided by an official deed (akte van levering) issued by a notary and registered with the Dutch Land Registry (Kadaster).
D8	Property listing	A rental offer containing essential information such as rental price, room size, room type [D6], location, and a thumbnail image. Each property listing is distinct.
D9	Recommendation page	A personalized overview of recommended property listings[D8] for students [D5] and recommended student profiles [D24] for landlords [U2.2].
D10	Free subscription plan	A basic subscription free of charge, with access to basic features[D25] of the system [D1]
D11	Premium subscription plan	A subscription with a monthly fee, with access to additional features in the system [D1]
D12	Personal bank account	Bank account of the user[U2]

D13	List of supported banks	ABN AMBRO, ASN Bank, bunq, ING, Knab, Rabobank, RegioBank, Revolut, SNS, Svenska Handelsbanken, Triodos Bank, and Van Lanschot (iDEAL, 2021)
D14	Developers	People who design, develop and test the system[D1].
D15	Updates	Updated version of the system[D1] after fixing bugs or adding new features.
D16	System uptime	The time that the system [D1] is fully functional and available for the users [U2]
D17	System downtime	The time that the system [D1] is not fully functional and not available for the users[U2]
D18	Terms and conditions	A legal document that outlines the rules, guidelines, and agreements that users must accept to use the home-sharing application. It includes user rights and responsibilities, liability limitations, privacy policies, and other important legal and operational information.
D19	Sensitive information	Personal information relates to an individual that can be identified and is therefore protected under regulations such as the GDPR.
D20	User experience	The overall satisfaction and ease with which a user[U2] interacts with a product or a system, encompassing usability, design, and emotional response.
D21	Mobile operating system	Software platforms on which the system[D1] operates.
D22	Matching score	The score is a numerical value derived from comparing a user's[U2] preferences with available options, which the algorithm uses to rank and recommend the best property listings[D8] and student profiles [D24].
D23	Customisable features	Options in the interface that allow users[U2] to personalise settings to fit their preferences.
D24	Student profile	A brief personal description including the student's name, contact information, university affiliation, and housing preferences to help match them with suitable rental properties.
D25	Basic features	Features that the system [D1] offers the students [D5] involve creating student profiles [D24], and viewing the property listings [D8]
D26	User data	The collection of personal profile and account information provided by the user [U2] during the registration process and profile creation. This includes but is not limited to, the user's name, email address, phone number, date of birth, user type (student or landlord), profile picture, personal description, preferences, and any other information the user provides to the system.
D27	Personal description	Additional information in text format that the user[U2] uses to describe themselves

D28	Spoken languages	The languages that the user [U2] uses to communicate.
D29	Rating score	A quantitative score ranging from 1 to 7 indicates the user experience [D20]
D30	User account	A profile created by the user [U2] primarily for authentication and access control.
D31	User account data	Information that contains the user's[U2] name, email address, date of birth, phone number, and user type.
D32	User profile	A personalized profile created by the user [U2] that contains detailed information.
D33	User profile data	Information contains profile picture, preferences, language spoken [D28]
D34	Premium features	Additional features the system[D1]offers the students [D5] when they opt for the premium subscription [D12], that involves messaging the landlords.
D35	Educational institution's domain	A web domain often associated with accredited academic organizations, featuring specific extensions like .edu

Table 2. Definitions

1.3. User Classes

ID	User	Description
U1	Admin	An IntergenHome's employee [U1] who knows exactly how the application works, maintains the application, and fixes any malfunctions.
U2	User	A person who downloaded the system [D1] and uses the system [D1].
U2.1	Student	<p>A user [U2] who completed the account registration and student verification process [D2], and uses the system[D1]to look for houses.</p> <p>Note: This term is used in requirements that apply only to students and their interactions within the system [D1]</p>
U2.2	Landlord	<p>A user [U2] who completed the account registration and the landlord verification process [D4], and uses the system to rent out their houses.</p> <p>Note: This term is used in requirements that apply only to landlords and their interactions within the system [D1].</p>

Table 3. User classes

1.4. Additional Changes

To enhance the completeness of the class diagram, requirement FR1.11 has been added. In the previous document (SRS), the requirement only mentioned that users [U2] could create individual accounts but did not specify that the system [D1] must assign a unique userID to each account. This

functional requirement is essential for supporting key features such as the messaging system and the creation of landlord [U2.2] and student [U2.1] accounts. In addition, functional requirement FR4.3 has also been included, as it is crucial for the matching system [D5]. Additionally, FR6.4 and FR6.5 have been added to complete the messaging system's functionality.

The functional requirement FR5, which covers choosing a subscription plan, has been refined to outline a more detailed process. Specifically, FR5.2.2.2 has been added to address the scenario where a student does not choose a bank to link. Similarly, FR5.2.2.4 outlines the interaction when bank authentication fails. Finally, FR5.2.2.7 has been included to handle the cancellation of the linking process if the student does not accept the system's authorization request. Requirements displayed in gray are excluded from the diagrams, while those in blue have been added to the original SRS and implemented in the diagrams, reflecting additional features or functionality. Moreover, the user class has been divided into two subclasses—student [U2.1] and landlord [U2.2]—for better clarity.

2. Class Diagram

2.1. Applied Functional Requirements

FR1 User's Interface - Create User Account

FR1.1 The system [D1] shall enable the user [U2] to create a user account [D30].

FR1.2 If the user [U2] creates a user account[D30], the system [D1] shall require the user [U2] to provide input of the following personal data:

FR1.2.1 First name

FR1.2.2 Last name

FR1.2.3 Email address (to be used as username)

FR1.2.4 Phone number

FR1.2.5 Password

FR1.2.6 User type (student or landlord)

FR1.2.7 Date of birth

FR1.3 If the user has entered all the user account data [D31], the system [D1] shall save the user account data [D31] to the user data [D26].

FR1.3.1 The system [D1] shall notify the user [U2] that accepting the terms and conditions is mandatory.

FR1.3.2 The system [D1] shall redirect the user [U2] to [FR1.2] if any required data is missing.

FR1.4 The system [D1] shall validate the email address format.

FR1.4.1 If the email address is not in the format of “abc@email.com”, the system [D1] shall notify the user [U2].

FR1.4.1.1 The system [D1] shall require the user [U2] to enter the email address again.

FR1.5 The system [D1] shall validate that the email address is not already associated with an existing account.

FR1.5.1 If the email address is already in use, the system [D1] shall notify the user [U2].

FR1.5.1.1 The system [D1] shall require the user [U2] to enter a different email address.

FR1.6 If the user [U2] selects “Student”[U2.1] as the user type, the system [D1] shall require student verification [D2]:

FR1.6.1 The system [D1] shall require the user [U2] to enter their student email address.

FR1.6.2 The system [D1] shall validate that the entered email address contains an educational institution's domain [D35].

FR1.6.3 If the email address is valid, the system [D1] shall send a verification link to the provided student email address.

FR1.6.4 If the email address is not valid, the system [D1] shall notify the user [U2].

FR1.6.4.1 The system [D1] shall redirect the user [U2] to [FR1.6.1].

FR1.7 If the user [U2] selects “Landlord” [U2.2] as the user type, the system [D1] shall require landlord verification [D4]:

FR1.7.1 The system [D1] shall require the user [U2] to upload the proof of property ownership [D7].

FR1.8 The system [D1] shall require the user [U2] to accept the terms and conditions [D18].

FR1.8.1 If the user [U2] accepts the terms and conditions [D18], the system [D1] shall save the user account data [D31].

FR1.8.1.1 The system [D1] shall display the user account [D30].

FR1.8.2 If the user [U2] does not accept the terms and conditions [D18], the system [D1] shall notify the user [U2] that this is mandatory

FR1.8.2.1 The system [D1] shall redirect the user [U2] to [FR1.8].

FR1.9 The system [D1] shall create the user account [D30] and save the user data [D26].

FR1.10 The system [D1] shall redirect the user [U2] to the profile creation page [FR2].

FR1.11 The system[D1] shall assign a unique user ID to every user account [D30].

Rationale: Creating a user account [D30] is essential for the functionality of the home-sharing system [D1]. It allows the system [D1] to distinguish between different users [U2], maintain user-specific data [D26], and provide personalized services. The distinction between student [U2.1] and landlord [U2.2] accounts is crucial for the matching process and ensures appropriate verification for each user type.

Source: InterGenHome Business Case (2024)

Author: Felix Masselter

Priority: High [P1]

Dependency: [FR2], [FR3], [FR4], [FR5]

History: 4/10/2024 (first draft), 5/10/2024 (revision 1), 7/10/2024 (final)

FR2 User's Interface - Create User Profile

FR2.1 The system [D1] shall enable the user [U2] to create a user profile[D32].

FR2.2 The system [D1] shall require the user [U2] to provide the following additional information:

FR2.2.1 Location (city and country)

FR2.3 The system [D1] shall enable the user [U2] to optionally provide the following information:

FR2.3.1 Profile picture

FR2.3.2 Preferences (smoking habits, pet preferences)

FR2.3.3 Spoken languages [D28]

FR2.4 The system [D1] shall allow the user [U2] to upload a picture for the user profile[D32].

FR2.5 The system [D1] shall allow the user [U2] to enter a personal description [D27] of up to 500 characters.

FR2.6 The system [D1] shall save the user profile [D32] to the user data [D26].

FR2.7 The system [D1] shall redirect the user [U2] to their user profile page after the user [U2] has entered their user profile data[D33].

Rationale: User profile [D32] creation is a critical component of the home-sharing system [D1]. It allows users [U2] to provide detailed information about themselves, their preferences, and their living situations. This information is essential for the system [D1] to effectively pair students [U2.1] with landlords[U2.2]. A comprehensive user profile [D32] enhances the user experience [D20] by allowing for more accurate matches and facilitating better communication between potential housemates.

Source: InterGenHome Business Case (2024)

Author: Felix Masselter

Priority: High [P1]

Dependency: [FR1]

History: 4/10/2024 (first draft), 7/10/2024 (final)

FR3 User's Interface - View Recommended Property Listings

FR3.1 If the student [D5] has completed the student verification [D2], the system [D1] shall enable the student [U2.1] to view the property listings [D8] on the recommendation page [D9].

FR3.2 The system [D1] shall display recommended and available property listings [D8] to the student [U2.1].

FR3.2.1 The system [D1] shall update the order of property listings [D8] based on the matching score [D22] for each property, with the higher-scoring properties appearing in a higher position on the recommendation page [D9].

FR3.2.2 The system [D1] shall display the following information for each listing:

FR3.2.2.1 Rental price per month

FR3.2.2.2 Room size

FR3.2.2.3 Room type [D6]

FR3.2.2.4 Location

FR3.2.2.5 Thumbnail picture of the room

FR3.3 If the student [U2.1] selects a property listing [D8], the system [D1] shall display the property information [FR4.1.1] of the selected property.

Rationale: Allowing verified student users [D5] to view property listings [D8] ensures the platform's integrity by restricting access to users [U2]. This enhances the user experience [D20] by providing relevant, tailored listings, reducing fraud, and facilitating efficient decision-making. It encourages engagement and improves the overall effectiveness of the system [D1].

Source: IntergenHome Business Case (2024)

Author: Thy Cao

Priority: High [P1]

Dependency: [FR4], [NFR1], [NFR2],

History: 03/10/2024 (first draft), 4/10/2024 (revision 1), 5/10/2024 (revision 2), 7/10/2024 (final)

FR4 User's Interface - List Property Information

FR4.1 The system [D1] shall allow the landlord [U2.2] to create property listings [D8].

FR4.1.1 If the landlord [U2.2] has completed the landlord verification [D4], the system [D1] shall require the landlord [U2.2] to provide input of the following information:

FR4.1.1.1 Property location:

FR4.1.1.1.1 Country

FR4.1.1.1.2 City

FR4.1.1.1.3 Street name

FR4.1.1.1.4 House number

FR4.1.1.1.5 Postcode

FR4.1.1.2 Property size

FR4.1.1.3 Room type [D6]

FR4.1.1.4 Listing caption

FR4.1.1.5 Additional property description

FR4.1.1.6 Rental price per month

FR4.1.1.7 Images and videos of the property

FR4.1.2 If the landlord [U2.2] has entered all property information [FR4.1.1], the system [D1] shall save all property information [FR4.1.1] to property listing [D8].

FR4.1.2.1 The system shall display the property listing [D8].

FR4.1.3 If the landlord [U2.2] has not entered all required property information, the system [D1] must notify the landlord [U2.2] that not all property information [FR4.1.1] has been entered.

FR4.1.3.1 The system shall redirect the landlord to [FR4.1.1].

FR4.2 The system [D1] shall allow the landlord [U2.2] to modify their property information [FR4.1.1].

FR4.3 The system shall assign an ID to every property listing [D8].

Rationale: The system [D1] must allow landlords [U2.2] to create and modify property information [D8]. The functionality to list new property information is the data source for displaying recommended property listings [D8], and the foundation for charging commission from the landlord [U2.2]. The functionality to modify existing property information [D8] can reduce data redundancy on the platform and prevent duplicate listings, which not only improves the overall user experience [D20] for both landlords [U2.2] and students [U2.1] but also helps maintain data accuracy and integrity. Additionally, the functionality to modify existing property information [D8] can encourage landlords [U2.2] to keep listings up-to-date, ensuring that students [U2.1] have access to the most accurate and relevant information.

Source: InterGenHome Business Case (2024)

Author: Dan Gong

Priority: High [P1]

Dependency: [FR3][NFR2]

History: 03/10/2024 (first draft), 4/10/2024 (second draft), 7/10/2024 (final)

FR6 User's Interface - Message the Landlord

FR6.1 If the student [U2.1] has a premium subscription plan [D11], the system [D1] shall enable the student [D5] to message the landlord [U2.2].

FR6.2 The system [D1] shall notify the student [U2.1] if there is a message from the landlord [U2.2].

FR6.3 If the student [U2.1] has a free subscription plan [D10], the system [D1] shall not enable the student [D5] to message the landlord [U2.2].

FR 6.3.1 The system [D1] shall enable the student [U2.1] to view the message from the landlord [U2.2].

FR6.4 The system [D1] shall allow the users [D2] to delete the message.

Rationale: The messaging and notification feature is a critical component of the system [D1]. It is a premium feature [D11] designed to ensure a smooth user experience [D20] and interactions, improving platform engagement. By differentiating between premium and free subscription plans [D10], [D11], the platform incentivizes users [U2] to upgrade to a premium plan [D11], granting them the ability to actively communicate with landlords [U2.2]. Notifications play a key role in ensuring users [D5] stay informed of important messages.

Source: InterGenHome Business Case (2024)

Author: Baichuan Ji

Priority: High [P1]

Dependency: [FR5]

History: 02/10/2024 (first draft), 4/10/2024 (second draft), 5/10/2024 (third draft), 7/10/2024 (final)

2.2. Class Diagram Description

The functional requirements in the class diagram are: FR1 User's Interface - Create User Account, FR2 User's Interface - Create User Profile, FR3 User's Interface - View Recommended Property Listings, FR4 User's Interface - List Property Information, FR6 User's Interface - Message the Landlord. The diagram presents the core functionalities of the system.

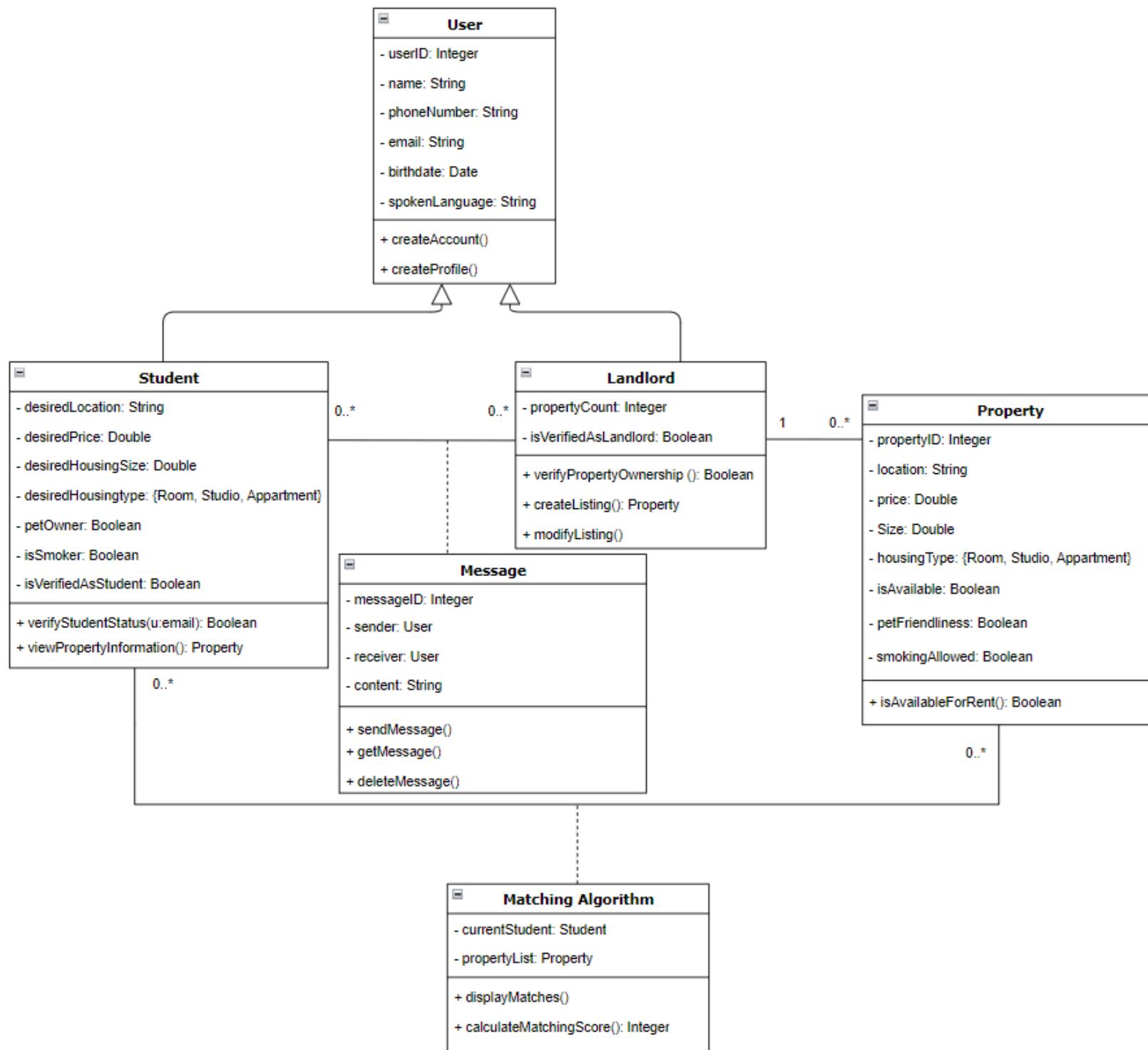
The system is designed to accommodate two types of users: landlords and students. All users are required to create accounts, providing personal information including name, email, date of birth, and phone number. Post-account creation, users can personalize their profiles with a profile picture, preferences, and spoken languages. Verification is mandatory for both landlords and students. Landlords must confirm property ownership, while students need to verify their student status.

Upon successful verification, landlords can list their properties, providing essential details such as location, rental price, and room type. Additionally, the landlords can set specific preferences for the potential housemate, such as whether smoking and pets are allowed. Verified students will be able to access recommended property listings. The system generates a match score for each property based on the student's preferences and ranks the listings accordingly on the student's homepage. If a student identifies a suitable property, they can communicate with the landlord through the integrated messaging system to negotiate terms and finalize the rental agreement.

2.3. Class Diagram Assumption

ID	Assumptions
A1	There is only a specific desired price that students [U2.1] are willing to pay for a property so there is no price range students can select.
A2	Users [U2] submit accurate and truthful personal information.
A3	Users [U2] are willing to share their information with IntergenHome.
A4	Students [U2.1] and Landlords [U2.2] are strictly limited to sending text-based messages only.

Table 4. Assumptions of Class Diagram



3. Activity Diagram

3.1. Applied Functional Requirement

FR5 User's Interface - Choose a Subscription Plan

FR5.1 The system [D1] shall allow the student [D5] to select between a free subscription plan [D10] and a premium subscription plan [D11].

FR5.2 The system [D1] shall allow the student [D5] to choose between the following two options:

FR5.2.1 If the student [D5] chooses to keep the free subscription plan [D10], the system [D1] shall enable the student's access to basic features [D25].

FR5.2.1.1 The system shall not enable the student [D5] to access premium features [D34].

FR5.2.2 If the student [D5] chooses to subscribe to a premium subscription plan [D11], the system [D1] shall request the student [D5] to link their personal bank account [D12] with the student's account.

FR5.2.2.1 The system [D1] shall allow the student [D5] to select their bank from a list of supported banks [D13] or select not to link their personal bank account.

FR5.2.2.2 If the student [D5] does not select a bank to link [D12], the system shall redirect the student to the page to choose the subscription plan.

FR5.2.2.3 If the student [D5] selects their bank, the system [D1] shall redirect the student [D5] to their bank's authentication page [D3] to complete the linking process.

FR5.2.2.4 If the authentication process fails, the system shall [D1] redirect the student to choose another bank.

FR5.2.2.5 If the authentication process is successful, the system [D1] shall request the student [D5] to authorize the system [D1] to perform the following actions:

FR5.2.2.5.1 Store the student's [D5] personal bank account details [D12]:

FR5.2.2.5.1.1 Bank account number (IBAN)

FR5.2.2.5.1.2 Account holder name

FR5.2.2.5.1.3 Bank name

FR5.2.2.3.2 Automatically debit the monthly subscription fee from the student's [D5] personal bank account [D12].

FR5.2.2.6 If the student [D5] accepts the authorizations, the system [D1] shall redirect the student [D5] to the student profile page [D26] with access to the premium features [D34].

FR5.2.2.7 If the student [D5] does not accept either of the authorizations, the system [D1] shall cancel the linking process.

3.2. Activity Diagram Rationale

The activity diagram is selected to represent FR5 User's Interface - Choosing the Subscription Plan because it provides a clear flow of decisions and actions the user [U2] will take when choosing between subscription plans. The diagram effectively illustrates the conditional behaviour that occurs when a student [U2.1] selects either a free subscription plan [D10] or a premium subscription plan [D11], making it easy to follow the different scenarios.

While a sequence diagram could show the interactions between the system [D1] and the student [U2.1], an activity diagram is more appropriate because it captures the parallel decisions and actions, such as the choice between subscription plans and the associated steps for linking a bank account [D12] for premium subscriptions. Additionally, the activity diagram highlights how different conditions lead to different outcomes, such as the successful linking of a bank account [D12] or the cancellation of the subscription process. This ensures that the process is well-structured and easy for both developers and stakeholders to understand.

3.3. Activity Diagram Description

The activity diagram for InterGenHome's functional requirements FR5 User's Interface - Choosing the Subscription Plan illustrates the process a student [U2.1] follows when selecting a subscription plan within the application. This feature is critical for distinguishing between users [U2] who wish to access basic features [D25] under the free plan [D10] and those who prefer the additional benefits of the premium plan [D11], which includes advanced functionality like direct messaging with landlords [U2.2].

The diagram starts with the student [U2.1] logging into the InterGenHome platform and navigating to the subscription options. Here, they are presented with a choice between two subscription models: the Free subscription plan [D10] and the Premium subscription plan [D11]. Once the student [U2.1] selects a subscription plan, the system [D1] processes their choice. If the student [U2.1] opts for the Free subscription plan [D10], the system [D1] immediately grants access to basic features [D25]. These features include browsing properties, accessing landlord profiles [U2.2], and interacting with the recommendation system [D22] that matches students [U2.1] with available properties based on preferences like location, price, and type of housing. However, they are restricted from using premium features [D34] like messaging, which requires an upgrade to the premium plan [D11].

If the student [U2.1] selects the Premium subscription plan [D11], the process becomes more detailed and involves several steps to ensure secure payment and account setup. The system [D1] prompts the student [U2.1] to link their personal bank account [D12] to authorize the monthly premium fee. This step requires the student [U2.1] to choose their bank [D13] from a pre-populated list of supported banks. Upon selecting their bank [D13], the InterGenHome system [D1] redirects the student [U2.1] to the bank's secure authentication page [D3]. This step is crucial for ensuring that personal banking information is handled safely and complies with privacy regulations such as GDPR.

After the student [U2.1] successfully authenticates with their bank [D13], they are asked to authorize the system [D1] to perform certain actions. These include storing their bank account details [D12], such as the IBAN, account holder name, and bank name [D13], and setting up an automatic debit for the subscription fee. If the student [U2.1] authorizes these actions, the system [D1] finalizes the subscription process by linking their bank account [D12] to their InterGenHome account [D30]. From that point, the student [U2.1] is granted full access to all premium features [D34], including the ability to message landlords [U2.2], a feature designed to streamline communication and help students [U2.1] find housing more efficiently.

However, if the student [U2.1] does not authorize the link to their bank account [D12] or rejects any of the required permissions, the system [D1] will cancel the premium subscription process. In this case, the student [U2.1] is redirected back to the subscription selection screen, where they can either reattempt the premium setup or revert to the free subscription plan [D10].

3.4. Activity Diagram Assumptions

ID	Assumptions
A1	Users [U2] have smartphones to download the application.
A5	The system [D1] can handle the authentication from the bank and manage users [U1] at the same time.

Table 5. Assumptions of Activity Diagram

3.5. Activity Diagram

