CS353 - Database Systems Term Project

Project Name: WeRent

Group No: 16

Project Proposal

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Introduction

In today's world, given the convenience of relocation, the need for rental accommodations like rooms and flats has arisen. However, the renting process may be demanding as customers need to go over many property visits to find a suitable place. Conversely, people willing to rent out their properties will have to deal with finding customers and advertising. To be able to easen this process, we propose a flat/room rental system application development. The flat/room rental system will be a web-based application that will serve both property owners and customers. The application will provide a platform where customers can browse and book for available flats, and property owners can present their flats or rooms with their properties.

This proposal is to give a general idea about the flat/room rental system, its functionalities, how and why a database system is required, limitations, and an entity-relationship diagram. With this system, we aim to provide an inventive solution to the difficulties that customers and hosts have to deal with.

Description of the System

WeRent is a room/flat rental application that allows customers to book individual rooms or flats. The rooms/flats that are on the application are posted by other users. Customers can put their properties for rent by switching to the host mode of the application. Customers that put their places on the application are called hosts. The host must input information of the rented place, such as approximate location, pictures, a description, size of the property, check-in procedure, room information, amenities provided, type of the place, guest limit, type of guests, price, cancellation cost, and accessibility features. The host must also specify if the rental can be booked directly from the application or if the host would like to review who wants to book the place. Hosts must also specify the language/s they speak so that customers have the language information. Hosts can be upgraded to a Superhost by the application automatically, which is a status that shows the host is reliable and has good ratings. Hosts may cancel bookings if they would like to. After the cancellation, the money will be returned to the customer's online balance.

A customer will be able to either search the name of a rental or filter through the postings. The filtering will include properties such as the price range, the type of place, room,

bathroom, and bedroom count, property type, superhost and *WeRent* plus options, whether pets are allowed or not, and host language options. *The WeRentplus* option shows if the place for rental has been checked by the admin and is approved. Moreover, customers will be able to wish-list flats/rooms for future reference. The customer will be able to view additional pictures and information about the posting once the customer clicks on a posting. The customer will be able to view reviews of previous customers that have stayed at the location and see their ratings of the place based on different categories such as cleanliness, communication, check-in, accuracy, location, and value. Information such as safety and property and cancellation policy will be given on the page. The customers must add the name and the surname of the guests that will stay with them, if a guest will be staying, as long as the number of guests does not exceed what the rental allows. Customers must also specify if any pets accommodate the stay. Moreover, customers may also visit the profile of a host. The profile of a host includes brief information about the host, all reviews of the host, and postings. Customers may report fake rentals or abusive behavior on the application, which would be received by the admin.

If the customer would like to rent a place, the customer must indicate the dates of the stay and how many people will be staying. Kids, pets, and infants can also be added as guests. The payment will be made over the application and cancellation costs and policy will be shared with the customer. Additionally, customers can view a calendar which shows the duration of all of their stays. Moreover, customers can also see all the dates that a posting is booked on the calendar. Besides, customers can access an interactive map that allows the customer to click on a location on the map, and rooms/flat postings that are closest to the region will be listed on the screen. Furthermore, popular and touristic places that are close to the clicked region will be listed on the screen. Customers can also view the most popular rental properties or trustworthy hosts within a region. A customer can also select additional options such as daily cleaning service and transfer service when booking the place.

After a customer's stay at their rented location has ended, the customer can leave a review about his/her experience by rating the place and the host on their cleanliness, communication, check-in, accuracy, safety, location, and value as well as leaving a written review. The host may also leave a review for the person who had rented her/his property on the same criteria. Lastly, the customer who has filled out a rating or/and a review may choose to leave it anonymous. The review will be shown on the rated person's page with the name of the reviewer covered. The reviews may be shared publicly if the customer/host who has filled

in the review wishes to do so. Hosts may reply to reviews left on their pages with a comment. Each user can see their past transactions, money withdrawals, and money deposits, cancellation fee transactions, and returned payments. Users will make their payments through the application. Returning the fee of a booking cancellation will be reflected on the customer's balance.

Additionally, the admin will be able to view all customer reportings made on the page and either reject or confirm them. The user who has made the reporting will receive feedback on the report's status. Moreover, the admin may remove a customer/host, and also start a maintenance mode within the application. Fake postings can also be deleted by the admin. The admin can also view system reports for finding popular places in different regions and different categories that are generated by the system.

The application also has an option that allows earthquake victims to rent properties for free. Earthquake victims can prove their status by uploading an official E-Government file on the application. Also, earthquake victims who are renting their property will be given a special badge that shows the customers of their status. In doing so, customers may choose to purposefully rent a room/flat from them. Also, customers can find places that are open for couch surfing as well. Hosts will be notified through the application when a customer has reserved their rental. Customers will be able to see whenever their wish-listed location gets emptied out on the wish-listed postings page. The hosts will get an email from the application whenever a customer has rented or canceled a booking. Moreover, customers and hosts must be registered to the application to put up rentals or to book places.

Furthermore, customers will be sent an online customer satisfaction survey after their reservation date has ended. The survey will be optional to fill out and customers will be also asked to add any new landmarks in close proximity to the location that they did not see on the rental map. After entering information, the landmark information will be sent to the admin. The admin is responsible for checking the validity of the landmark and can reject or approve the landmark to be added to the list of landmarks on the website.

Creativity and Database Usage

Innovative features have been added to *WeRent* to add to its creativity component. The application supports the usage of adding custom locations on the map of a posting. The user may visit the map later on and view the added locations on the map. The added locations

will be kept as a separate entity in the database. In addition to adding locations on the map, users can also click on a map and the nearby flats/rooms for rent will be listed on the page. Furthermore, the user will also be able to view popular and touristic places, which is continually added to the application based on customer feedback. Users will be able to suggest adding a new landmark after they had stayed at their rentals through a survey, which will be optional to fill out. The added landmark by the customer will be sent to the admin for review and making changes. If the admin accepts the landmark to be added to the official landmark lists, then the landmark will be added to the list of landmarks that other users can see if they click on a nearby location on the map. 2 new entities (see *Survey* and *Landmarks* entities in the E/R diagram) will be added to the database to keep track of both the survey and the landmark information.

One new feature is wish-listing locations for future use. Users can wish-list a rental posting and view the list of all their wish-listed postings on the page. The wish-listed postings can be filtered through in different ways such as oldest, newest, most wish-listed, highest-rated, etc. Users can report other users or postings on the application for fraud, inappropriate behavior, etc. These reports will be sent to the admin for reviewing purposes. The admin may choose to delete a posting or a user in such cases. The reportings will be contained in a new entity, *Report*, as well. Moreover, one other new feature is that the application provides earthquake victims to find flats/rooms to stay for free after they upload their official E-Government Entitlement of the Disaster Victim PDF. After uploading the document, earthquake victims will be shown properties that are free for them to stay. The E-Government Entitlement of the Disaster Victim PDF will be kept in a new entity called *E-Government File*. Additionally, customers who would like to couchsurf can find such postings on the application in addition to regular rental postings.

The booking application system requires several complex data retrieval and manipulation operations such as booking and creating rentals, writing reviews, approving booking requests, map actions, and interaction between users; thus, creating the need for a database management system. The intended function of this database application is to manage query requests, data input, updates, and deletions. The database is needed to keep track of every information about postings, hosts, transactions, customers, admins, and to keep statistics about the website and the users. There will be statistical reports generated by the application by using the stored information about hosts and postings. Moreover, users can

filter among postings with specific settings set such as most popular postings, region, highest rated host, superhosts, etc, which requires modular database architecture.

Functional Requirements

Requirements for Unregistered Users:

- All users can browse all rooms/flats through the map.
- Users can filter rooms/flats according to their preferences such as its city, province, number of beds etc.
- Users can browse through types, such as a room or an entire flat.
- Users can view information of the room/flat in detail.
- Users can view the host's information such as name, surname, gender, preferred language and whether he/she is a superhost and/or an earthquake victim.
- Users can browse superhosts and rooms/flats in a specific region.
- Users can view landmarks about the region they clicked on a map, such as museums, attractions, shopping areas, beaches etc.

Requirements for Registered Users:

- Registered users may change from/to hosting/booking mode in the system.
- Registered users may add a profile photo to their profile.

Requirements for Customers:

- Customers can register to the system by inputting their name, surname, email, password, telephone number, gender and date of birth.
- Customers can log into the system by their email and password.
- When customers forget their password, they click on the "Forgot Password" button, and a link which asks the user to set a new password is sent.
- Customers are able to rent a room/flat by specifying guest information such as number of guests, guest types, and renting duration with exact start, and end date.
- Customers are able to see their balance and transaction history.
- If the rental is labeled for the earthquake victims, they can rent it for free after uploading their E-Government Entitlement of the Disaster Victim PDF.
- Couch surfing flats/rooms are free of charge for all customers.

- Customers are able to cancel their reservation before a specific time of their arrival, with or without a fee, which will be decided by the host.
- Customers can fill in a customer satisfaction survey after their stay and also recommend a landmark to be added to as a popular place if it is not already in popular places.
- Customers can rate their hosts and their room/flat in detail by factors on their corresponding criteria such as cleaning, safety, value, location, check-in, accuracy and communication.
- Customers may add the specific room/flat to their "Wishlist" section.
- Customers can access the phone number of the host and the exact location of the rented room/flat at most 3 days before the reserved stay for safety purposes.
- Hosts can access the phone number of the customers who rented their house at most 3 days before the reserved stay.

Requirements for Hosts:

- Hosts must register by their name, surname, email, password, phone number, date of birth, region of residency, job, gender, language(s) they speak, their IBAN and by uploading a profile picture.
- Hosts can log into the system by their email and their password.
- When hosts forget their password, they click on the "Forgot Password" button and a link which asks the user to set a new password is sent.
- Hosts are able to set a new rental room/flat by specifying its exact type (room or flat) and their corresponding features. These features may include but are not limited to: number of rooms, sea view, wi-fi availability, daily cleaning service, transfer service etc.
- Hosts are able to see their past transaction history and the balance under their account.
- Hosts are able to cancel reservations if they wish.
- Hosts are able to set the daily price for the room/flat, extra features to add, dates to rent in the calendar and detailed information about the place.
- Hosts are able to set a cancellation policy for their place.
- Hosts are able to set "free accommodation" for their room/flat for the ones who suffered from the earthquake.
- Hosts are able to comment to the reviews that are made for them/their rentals.

- Hosts are able to rate and review about the customers who stayed in their rentals.

Requirements for Admins:

- Admins are able to log into the system by their email and a password, which are provided by the IT team.
- Admins are able to see technical reports about the website, such as number of rent postings, number of hosts, popular properties in a specific region and customers etc.
- Admins are able to add/delete users from the system.
- Admins receive the reports made by users about other users or posts. The admin will evaluate the reportings and may remove a user or a post.
- Admins will receive the landmarks added by the customers and review them. Admins may add the landmarks to the application if he/she finds it appropriate.
- Admins are able shut down the system for maintenance.

Non-Functional Requirements

Usability

Users of the website must be able to filter among available room/flat rental listings, view them and make reservations on the listings. Also, users should be provided an option to switch between 'customer mode' (for booking or renting purposes) and 'hosting mode' (which enables them to rent out their room/flat(s) by creating listings). Since the website includes various functionalities dedicated to different user types, it should be usable, that is, it must provide an interface that is easy to comprehend and utilize. To enhance usability, a user should be provided different interfaces when switched between the customer mode and the hosting mode. By the same token, a separate view must be implemented for the use of admin. Overall, the website must contain a distinct UI for each functionality and the interfaces must be separated for increased usability. Additionally, smaller components of the UI should be dynamic and eye-catching while preserving their simplicity and practicality.

Similarly, the system should be bug-free in order to be usable. This is because some of the key features of the website include making payments and room/flat reservations, which

are processes that must be handled carefully. Any errors/bugs could potentially lead to undesired outcomes, thus, should be eliminated to obtain better usability. The usability of the system will be measured by how often users submit wrong documents and make false reservations. The error rate is expected to be less than 10% for the usability requirement.

Scalability

Scalability of the system is one of the most important aspects. *WeRent* will be a small-medium website where at least 1000 users will be able to use the system at the same time. The website will function at such capacity, making the website handle at least 10000 transaction requests simultaneously. This stems from the system's application domain in which there are a lot of data transactions, with a number correlational to number of requests and users, required between the entities of the system. For example, at a time instance, more than one customer might demand to become a tenant of a particular host's properties and later proceed with payment. Even such a process requires multiple requests to be handled simultaneously, in a fashion which should prevent any loss of information or malfunctioning of the system. To briefly summarize, the essential features of the room/flat rental website might trigger hundreds of backend actions in a short amount of time, that is at most 10 ms, and these must be dealt with appropriately in order to achieve a scalable and stable system.

Reliability

Registered users, who are authorized to access some different features of the website, like booking or renting out a property, will have their emails, phone numbers, passwords (login credentials), and other information stored on the system. Such storage should be made in the database in a reliable and secure manner. Any kind of data leak in the system is unacceptable. To achieve this goal, every password and credit card information for every different registered user should be stored in an encrypted form. Other than security measures, accurate data communication between the layers of the system is also crucial for reliability. Any type of data transaction must be handled in 99% accuracy in order to prevent loss of information, crashes and malfunctioning of the system. The data will be kept in a secondary database to ensure data loss recovery. The system must perform with no error 95% of the total time to keep up with reliability standards. Overall, precautions regarding the security of user information and the accuracy of data operations might lead to enhanced user experience and safety; and, consequently, increased reliability. It is also important to realize that these factors result in improved usability.

Maintainability

As the development process continues, the system's components may change, require modifications and/or bug fixes. Additionally, requirements might change as well. All of the mentioned would require adjustments to the source code during (and possibly after) the development of the website. It is crucial to understand that such adjustments are rather certain than possible, as this is a complex system with potentially a large number, that is at least 1000 of users and thus functionalities. All things considered, a highly maintainable system is necessary. For that purpose, the development process should be carried out on a systematic basis.

In the source code, redundancy should be avoided. Common code pieces should be implemented as methods or libraries that enable reusability. All needed features should be declared and used. Commentation should be consistent in order to make the code understandable and to achieve time-efficient development, bug-fixing and modification processes.

In terms of database maintainability, requirement analysis for the entities and the relationships of the system should be conducted carefully. Any contradictions in the database design must be eliminated in the early stages of the project. During the test runs, the database should be used in a way that loss of crucial information and unnecessary allocations are prevented.

Overall, the maintainability action must take at most 10 minutes to abide by the website standards. Any kind of system failure of more than 10 minutes is unacceptable.

Extensibility

During (or after) the development process, updates or addition of new features might be necessary. Thus, the system must be built in such a way that enables easy addition of new features. Also, it should be suitable for modification of existing ones. Any extension or modification should not create a conflict with the previous versions of the system. The new systems should still be compatible with 2015 and up versions of Chrome, Safari, Brave, Firefox. Any change in the database system should not cause the website to crash or modify unintended data. Creating an abstract layer over the database system will enable to change the database models without having to modify all of the source code.

Limitations

There are some limitations in the booking application so that it becomes consistent throughout the entire project and they are listed as follows.

- Only registered users will be able to rent or host a room/flat. Unregistered users will only be able to search and browse the rentals.
- Users have to enter their name, surname, date of birth, email, password, gender, and telephone number for registering.
- Users have to be at least 18 years old to be able to register to the system.
- Registered users will only be able to give ratings and write reviews to the rental and the host after they have stayed in that rental.
- Hosts can only give reviews to the users after the users have stayed in the rental.
- Only registered users will be able to put a room/flat on a wishlist.
- Only registered users will be able to report other users/hosts/rentals.
- Registered users must specify the number and type (child, pet, adult) of people that will stay in the rental and the dates that they will be accommodating in the rental.
- Registered users can only rent the room/flat if the rental is available in the chosen time slot, the number of people that will accommodate in the rental is less than or equal to the capacity of the rental, and the host approves the rent request.
- Registered users can only see the exact location of the rental and phone number of the host at most 3 days before the day of the reserved stay.
- To be able to benefit from earthquake features of the system, users must upload a legal E-Government Entitlement of the Disaster Victim PDF to prove they are earthquake victims.
- In order to put up a place for rental, registered users should also register as a host.
- Registered users have to specify the languages that they can speak, their region of residency, their job, their IBAN and put up a profile picture to be able to register as a host.
- Hosts must specify the capacity and price of the property, available time slots, amenities of the rent (such as wifi, free parking spots, security cameras etc.), check-in procedure, put up pictures and write a description about the property.
- Only admins must approve to add or delete a rental from the system.
- Only admins will be able to view and confirm/reject customer reports.
- Only the admins can remove a customer/host.

- Only admins can shut down the system.
- Only admins will be able to view statistical reports about hosts and rentals.
- Admins have to approve the landmarks that the user put in the survey for it to be added as a landmark to the system.
- Customers must provide their credit card information to be able to use payment services.
- If a customer wants to pay from his/her balance, the balance should be bigger or equal to the payment fee.
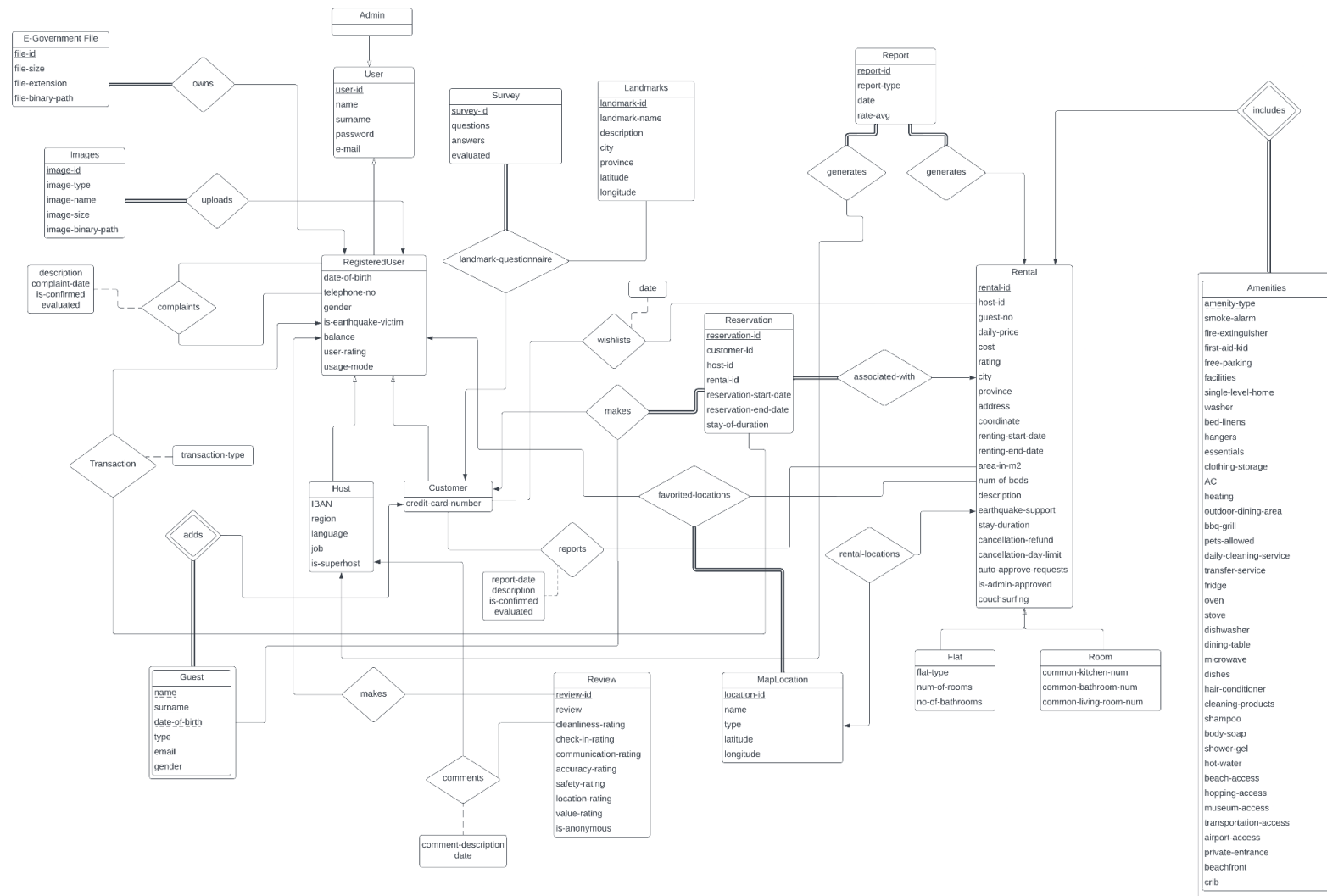
ER Diagram

Figure 1: *Entity/Relationship diagram of the WeRent System* [1]

References

[1]   A. Silberschatz, H. F. Korth, and S. Sudarshan, *Database system concepts*. New York, NY: McGraw-Hill, 2020.