UNIVERSITÄT SIEGEN

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Master Thesis

Faculty III - Institute of Business Informatics and New Media, University of Siegen

Digital Transformation in Student Living: A Design Case Study on Overcoming Dormitory Challenges

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[redacted]

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List of Abbreviations

UI	User Interface
UX	User Experience
HCI	Human-Computer Interaction
IA	Information Architechture
RUP	Rational Unified Process
MADLC	Mobile Application Development Life Cycle
SUS	System Usability Scale
MVC	Model-View-Controller
UCD	User-Centered Design

Abstract

This study was administered to students living in the various hostels of Student Union Siegen (Studierendenwerk). It explores the possibility of digitizing all the Studierendenwerk dormitory's services. The primary purpose of this study is to identify the most critical factors that affect students' lives in the dormitory in three phases, from applying to moving into the dormitory and to staying there. The objective of this research is to tackle all the problems and provide a solution that is both efficient and effective. A mixed-method approach was used to conduct user research on the research question, including qualitative research methods like one-on-one interviews with 10 participants and quantitative research surveys with 42 responses. This methodology focused on understanding students' pain points and challenges when living in dormitories. Based on the findings, a personalized app was developed for the audience. The design process follows the iterative design process followed by usability testing. This research also aims to provide a way to enhance the effectiveness of the Studierendenwerk administration and develop a hypothetical management-related solution. Results from user testing of the mobile application for the students indicated improvements in communication, ease of access, and efficiency compared to traditional methods of communication and management that are done via emails or calls. Participants reported increased satisfaction and a sense of control due to the app's presence and immediate responses. This study contributes to students and the dorm administration, addressing their problems and easing their work in the dormitory.

Keywords: Student dormitory, dormitory application, dormitory management system

1 Introduction

A dormitory is a place where a group of students come together from various locations, and their common goal is to gain knowledge from their institutes. Students living in dormitories come from diverse countries, and their cultures and languages differ from one another. A dormitory is also considered the primary residence of students when they go abroad to pursue their education. The area is of utmost importance for students as it is where they dedicate most of their time after spending time at the institution. At times, the student dorms take on the role of the student's home, reflecting their home environment (11). This new lifestyle allows students to learn how to live independently, adapt to other residents and roommates, and share space and utilities with each other. They also learn to live independently and compromise with their housemates (12). Living in a dormitory can be a vibrant and diverse experience for students. Although dormitory living may be enjoyable, it presents other problems, including communication difficulties and disputes arising from shared household responsibilities (13).

According to research, hostel students are more likely to exhibit empathy, altruistic conduct, and emotional stability (14). Ali in his research, stated that dormitory life has a very unique impact on the lives of the students, and it makes students socially and behaviorally different (15). Later, Muizz and Hassanain (2016) conducted research demonstrating that student housing is directly related to students' overall personal growth, well-being, social relationships, and academic success. A comfortable dormitory atmosphere is essential for students' well-being (16). Regarding all the problems students might face living in the dormitory, a study by Bekurs shows that good hostel conditions can positively impact student life (17).

This thesis examines the challenges encountered by students residing in the Studierendenwerk Dormitory in Siegen. Studierendenwerk is a dormitory service provider catering to the needs of students. They provide other services such as culinary, student financing, and more. Currently, there are 11 dorms, each consisting of various complexes (18). Each dormitory has many types of rooms. These dormitories are structured differently, some provide single rooms with 20 people sharing a communal kitchen; there are also doublette rooms, which are similar to small apartments with two rooms and a shared kitchen and bathroom. There are also WGs, which are divided into three and four shared rooms. Studierendenwerk currently oversees a collective of 970 students residing in their dormitory accommodations and managing nearly a thousand students in the dormitories can be extremely challenging. There are a lot of things that need to be taken care of, like new registrations, room allocation, creating contracts, and managing existing tenants and their complaints and requests. It is necessary to address this efficiently and smoothly.

1.1 Problem Statement

Besides the fact that Studierendenwerk Siegen dormitory has state-of-the-art facilities and serves competent customer service, communication limitations still disrupt a seamless living experience for the residents. This thesis used a combination of qualitative and quantitative approaches to tackle the challenges encountered by students living in the Studierendenwerk dormitory in Siegen. These study approaches helped identify a few challenges like old-fashioned email techniques establishing a slow and unresponsive channel of information. Sending any requests to the administrators and getting a delayed response is something that happens alot because of the existing system. A centralized and efficient system is needed to maintain the students' experience and ensure the satisfaction of dormitory living. This reveals the necessity for an apartment management application that fills the communication gap and provides a more time-efficient way. To guarantee cooperation and communication among students and administrators, fast communication channels must be available.It should function as a significant central hub for accessing information and seeking help about dormitory amenities. Additionally, a proficient administration system is important to promptly receiving the student enquiries. An application of this kind might potentially assist Studierendenwerk Siegen in fostering a deeper feeling of community and enhancing the convenience of daily living for its members. Hence, the main problem statement for this thesis subject is focused on the need for a centralized system through which students can contact the dormitory authorities or efficiently access their details or other services offered by the dormitory. As a result, this thesis aims to handle all management and resident-related difficulties digitally.

1.2 Objective

This master's thesis aims to comprehensively investigate students' experiences in three phases of dormitory living. These three phases are

Phase 1: Challenges that students face while applying for rooms while sitting in their home country.

Phase 2: Challenges that students face after they reach the dormitory and start moving in.

Phase 3: Challenges that students face while living in dorms, focusing on the issues they encounter during their stay.

By researching the lives of the students and gaining insight into their living experiences, the objective is to devise a digital solution that is customized to address the diverse range and requirements of students, taking into account their difficulties, issues, and areas of difficulty, which would improve the residents' experience and ensure a seamless and joyful stay in the dormitory. This thesis also aims to delve into the challenges the authorities face in managing students. By addressing the challenges of both parties, this thesis aims to provide a solution for both Studierendenwerk authorities to handle all management and resident-related difficulties

digitally to make their tasks easier and enhance their overall experience.

1.3 Research Question

The research question for this thesis is:

"How can a centralized and digital management tool for student dormitories improve the user experience for residents and management satisfaction?"

By studying this research question, this thesis aims to explore the potential of a centralized and digital tool to enhance the residents' experience and overall satisfaction with the management and the dormitory. This thesis attempts to identify a technology solution that has the potential to significantly improve dormitory life and enhance the connection between residents and management staff.

1.4 Role of HCI

As Figure 1.1 illustrates, Human-Computer Interaction (HCI) is an interdisciplinary subject that encompasses several disciplines, including computer science, sociology, psychology, human factors, and cognitive science ((1). A thorough investigation was carried out to analyse the challenges encountered by the students. This included using various methodologies and leveraging the field of HCI, such as qualitative and quantitative research.

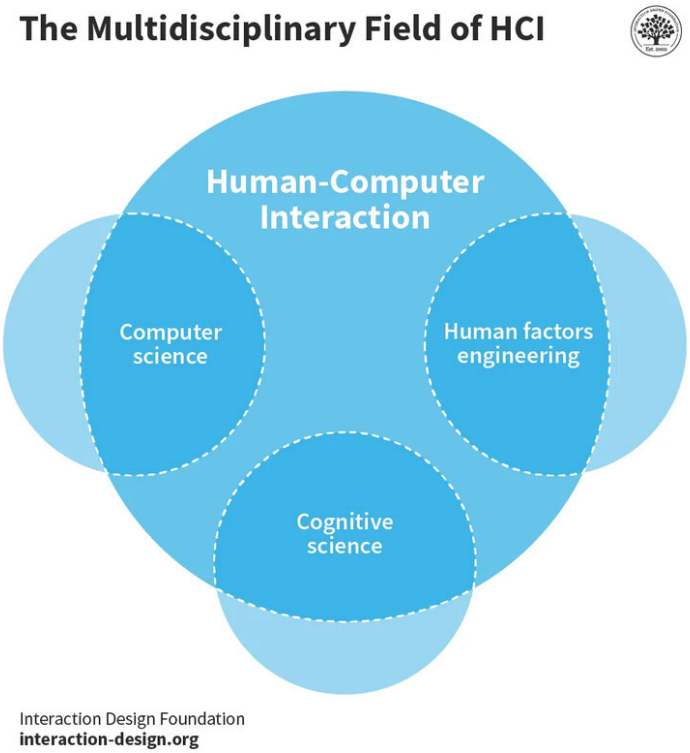


Figure 1.1: Multidisciplinary Field of HCI ((1)

As a result of the interdisciplinary nature and improvements in HCI, there are several procedures and methods for performing measurements and research in this field ((19). According to Lazar et al., when doing user research on interfaces and apps, there are several research methodologies available for users to choose from. However, the selection of research methodologies for a specific study is entirely dependent upon the setting and the problem the researcher aims to address. It is also determined by the objective of the research, time limitations, expertise, and other factors.

HCI is a research topic that focuses on studying the ways in which individuals engage with computer systems. When using these computer systems, the user engages with the user interface (20). An optimal user interface should include a high level of navigability and provide great user-friendliness. Usability, according to the ISO 9241 standard, is the measure of how effectively and efficiently a product may be used by certain users to achieve specific goals, while ensuring satisfaction, within a given context of use (20).

Recently, HCI has addressed several complex difficulties by imaginative and inventive solutions. As HCI is a specialized discipline within computer science that examines the experiences and viewpoints of non-expert users and how technology impacts their everyday lives its goal is to assist and support these people in their interactions with technology(21).

1.5 Scope

This thesis intends to design a user-friendly application for dormitory tenants and an effective and easy-to-use management solution for administrators. This thesis will also include research on comparable platforms and literature on designing an app and management systems for users. The insights and final design generated from this thesis may serve as a reference for dormitory administrators if they wish to develop the application. This solution can improve tenants' overall experience of living in a dormitory while making the administration's life easier. This thesis's final design could be a sturdy foundation for future implementation as it strives to develop an effective medium for everyone while keeping everyone's issues in mind.

1.6 Thesis Structure

This thesis is explored in a total of 8 chapters.

Chapter 1 introduces the dormitory and background information of the problem statement. It gives some insights into the Studierendenwerk. It gives in-depth insights into the lives of students living in the dorms and provides specific information about their everyday activities inside the hostel. The primary research inquiries have been introduced, and the extent to which the thesis may be included has been defined.

Chapter 2 examines the present status of research on support in dormitory management systems. This tries to determine which studies have been conducted earlier and what discoveries

have been produced about the research goal. According to current research, the relevance of research topics is argued based on research gaps that must be assessed. Furthermore, the results are utilized to develop the solution and create the interface idea without repeating errors previously studied.

Chapter 3 outlines the technique used in the research. It gives a deeper explanation of the design case study methodology and why it has been used.

Chapter 4 provides the findings or results of the research thesis. The document provides extensive details on the results obtained from both qualitative and quantitative assessments. It also includes user stories and a corresponding list of features.

Chapter 5 describes the execution of the design idea, which is derived from the findings of the literature review and the analysis of both quantitative and qualitative research. The chapter highlights the processes involved in conceptualizing and creating a concept, considering the relevant design principles.

Chapter 6 critically examines evaluation outcomes. Usability testing was performed with the students during this phase, and any difficulties they experienced while using the solution were addressed based on their comments.

Chapter 7 is on iteration, which involves revising the first the draft of design depending on received feedback. This chapter gives a comprehensive account of the previous implementation and reasons for the introduction of a new modification.

Chapter 8 examines the problems and challenges encountered during the design process, the possibilities for this solution, and a view of potential future research areas.

Chapter 9 discusses and summarizes the thesis outcomes.

2 Related Work

This chapter covers the essential research topics required to achieve the thesis's goal of designing an application concept for dormitory students and a management tool for dormitory administrators. First, the current state of the art in dormitory management systems is described. Following that, the appropriate systems already in the market and utilized by other Studierendenwerk in Germany are thoroughly detailed. A review of existing research aided in comprehending the present successful practices in the industry and their influence on users. Currently, Studierendenwerk Siegen lacks such systems and it would be beneficial to explore other dorms and their operational methods since they have been shown to have a favorable influence on students. As the University of Siegen is experiencing annual growth and now has a student body exceeding 15,000 in the winter semester 2023/2024(22). Many of these students also reside in Studierendenwerk. In the future, if Studierendenwerk chooses to expand its student dormitory offerings and accommodate a larger number of students, implementing solutions similar to those mentioned in the associated work may be beneficial in effectively managing a large student population.

2.1 Dormitory Management System for Students

With the growing population, the campus is faced with the task of effectively handling the growing number of students, which poses a tough and intricate management endeavour. The number of students at institutions is growing along with their increase a traditional manual management would be no longer enough to meet the demands of the situation. It becomes critical to use network information technology to manage the students (23). The major components of the College Students' Dormitory Management System are the foreground user interface and the background database. The construction of a front-end application program requires that the application program should be easy to use, have a friendly interface, and be simple to use (23). With the advancement of technology, the student dormitory management system has become essential for managing numerous students. Geng and Liu have identified six key roles of the student dormitory administration system: user authentication, management of student accommodations, management of visitor information, management of administrator information, and management of item repairs. Consequently, interface designs were created for user logins, student information management, visitor information management, administrator information management, and item repair management (24).

According to a study by Yang and Chen, they divided their designed system into two parts, administration and student user, to simplify management. In their system, the students can register themself, share feedback, view announcement, apply for leave, pay the rent, and more. Given the current state of student dormitory management, their system provides an effective medium

for increasing the efficiency in dormitory management and accomplishing logical management by transitioning from mobile phones to electronic, paperless management. Their study discovered three significant issues: data sharing cannot be done, data management content is insufficient, and there is a need for standard data information formats (25). Future dorm management systems will have a solid technological basis because of the technology that was developed to assist management systems.

Many studies exist for creating a web-based dormitory management system. One such study for SMA Terpadu Krida Nusantara focused on creating a web application for boarding schools where the management system was manual. The manual system caused an issue in calculating and managing student data. Consequently, a dormitory management system was developed using Rational Unified Process (RUP), which consisted of four distinct stages: inspiration, elaboration, building, and transition. The study provided a system in which the dormitory supervisor could store data on students based on student behavior, student counseling, student health conditions, and students' weekly excursions. The software could offer scan-in and scan-out amenities for students when they depart or arrive on campus. The system also provides the students' information to the parents of these students (26).

A research was undertaken at the University of Mosul, Iraq, to develop a web-based management system for university students' dorms. This was achieved by designing an Android application specifically designed for the dormitory administration system. Both the administration and students can use the system. For students, it provides a medium to communicate urgent maintenance or emergency medical assistance to the supervisor for which immediate response is required. Based upon the emergency, the supervisor can share the message with an appropriate staff member and provide them with the dormitory location information(27).

A study by Universitas Muhammadiyah Yogyakarta developed the UNIRES student dormitory system for two types of roles for staff and residents where staff included all the management teams of the dormitory along with technicians and caregivers of all dormitories and residents living in the dormitories. The system uses sign-in credentials connected to their university (28).

Another study at UiTM Shah Alam University of Malaysia created a mobile application, PNSCares, based on Android that will be used to lodge student complaints. The researchers used the Mobile Application Development Life Cycle (MADLC)) and System Usability Scale (SUS) to assess the efficacy of the application development process. With the application, the hostel manager could see the status of complaints in progress and new complaints. Students can enquire about any doubts or raise a complaint regarding dormitory management and check the status of the inquiry or complaint (29).

A study from Terna Engineering College in Navi Mumbai created a hostel management system. The system provides complaint lodging and cancel booking provisions for the students. Students can apply for the rooms based on their requirements by using filters that showrooms based on

different prices and air conditioning facilities. The application's primary purpose is for hostel management of all colleges to use the same applications to provide hostel rooms to college students based on room availability (30).

2.1.1 Studierendenwerk Rostock Wismar Student Portal

Studierendenwerk Rostock Wismar offers a student portal (Figure 2.1) for dormitory students to fill out applications for dormitory spaces, submit requests to the administration, and get a summary of their requests. Students may see their details, send messages to the dormitory authorities, submit relevant documentation for their stay, and cancel their contract using the same portal. This platform facilitates the process for students to submit various types of requests. Although this portal includes a broad variety of functions that students want, there is still potential for improvement in the application's User Experience (UX) and User Interface (UI).

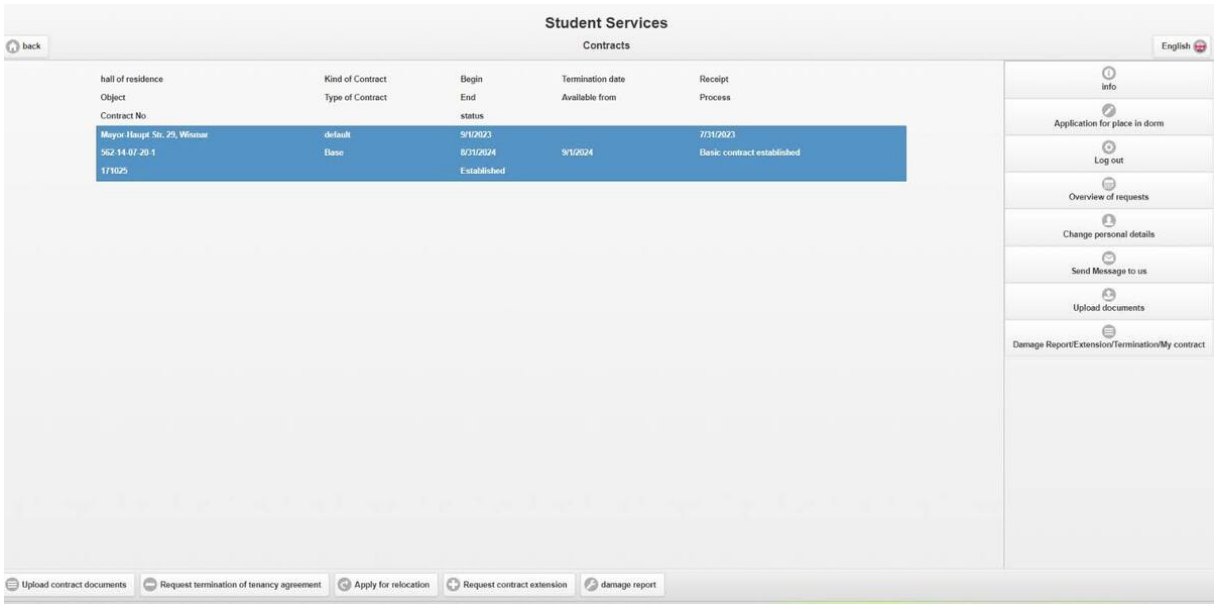


Figure 2.1: Studierendenwerk Rostock Wismar Student Portal

Through this portal, users can do various of things like:

- Upload contract documents
- Request termination of tenancy agreement
- Apply for relocation
- Request contract extension
- Damage report
- Application for place in dorm
- Overview of requests
- Change personal details
- Send message

Credits: A student residing in the dormitory shared the user interface screen of the portal. In addition, he expressed a favorable opinion of the website and said that it is more convenient to submit complaints or produce other types of requests via the system.

2.1.2 Studierendenwerk Stuttgart Application

The Studierendenwerk Stuttgart offers an app (Figure 2.2) with a range of services for students. The students can check the menu at Mensa, book laundry, book one-to-one consulting sessions, and more. This application allows students to conveniently access all dormitory amenities, saving them time while making all services readily accessible. Even though this app has many capabilities, the UX/UI may be improved significantly and should be updated. The application's language is German, which may be difficult for foreign students to comprehend. It should be user-friendly and use a common language for foreign students.

Figure 2.2: Studierendenwerk Stuttgart Application

Credits: Google Play Store screenshots of the app.

2.1.3 Studierendenwerk STWNO

The article from Studierendenwerk STWNO addresses the issue of limited washing facilities in a student housing complex accommodating 600 students and explains the solution used to resolve this problem. The Dr. Gessler-Straße residential complex in this dormitory has a high number of students, however, there are only 8 washing machines accessible for them. They created an application that allows students to check the availability of washing machines. Their method included using a contactless 3-axis compass sensor to monitor the power of each machine. This enables them to determine if the machine is currently in use or not. They conducted a test and received great feedback from the user (31).

2.2 Dormitory Management System for Dormitory Authorities

A research was done at Jilin University of Agricultural Science and Technology to develop and execute a college dormitory management system, with a specific emphasis on demand analysis, structure design, database design, and system implementation. It was developed using Model-View-Controller (MVC) architecture, OkHttp technology, and other technologies. The system provided the administrator with functionalities to maintain student information, student enrollment management, and student feedback management, where the administrator offered feedback on students and broadcasted announcements to the students. For students, the system provides leave management for students to apply for a leave payment module for payment of fees and other payment requirements (25).

The same study from Terna Engineering College also created an aggregation that helped manage bookings and rooms in the hostels and students. The system uses three roles: website admin, hostel admin, and students. The main focus of the study was to create a system that maintains student data digitally by avoiding missing information regarding hostel rooms and the students allotted to them (30).

In this chapter, we examined the existing literature and solutions related to dormitory administration with the aim of enhancing the dormitory experience. An analysis was conducted on several projects to comprehend the diverse methods and challenges encountered in different dorms. This chapter aimed to identify the measures adopted to enhance the living circumstances of student residents. The current study indicates that the focus is on developing digital solutions that target unique concerns for each individual dormitory. The key research gaps revealed in the study were the absence of a holistic approach and the prevalence of solutions that are too particular to one kind, lacking a complete all-in-one solution. There seems to be an absence of study on user interface and the art of crafting visually appealing designs that enhance usability on a platform. Unlike other specific applications explored in previous research, this master's thesis specifically examines the various challenges that students may encounter during their whole duration of living in a dormitory. These use cases concentrate on particular difficulties that are faced by the Student dormitory in Studierendenwerk Siegen, but this thesis seeks to address all the changes occurring throughout each dormitory living stage and follow a holistic approach to creating a solution.

3 Methodology

3.1 Design Case Study

Design Case Study methodology was used for this research project as it fits best for a practice-based project (2). When using design case study methodology, it is essential to recognize and learn more about the social aspects of the design space before designing any IT artifact. The designers should consider the existing social practices and IT infrastructure when creating any Information Technology artifact. The Professors at the University of Siegen developed a three-phase process for the design case study (Figure 3.1):

1. Pre-study
2. Design
3. Appropriation

Pre-Study: During this stage, the researchers must do empirical analysis of prevalent practices, as well as examine any current research, tools, and media, before proceeding to the subsequent step. The objective of this study is to conduct a thorough examination of existing research from three separate viewpoints: technical, organizational, and social. It is essential for researchers to record their findings from this study, since it contributes to the development of further solutions. Typically, while establishing a study plan, documentation might be stated in a problem or requirement statement (2).

Design: A design case study should include a detailed description of both the product and the method involved. The document should have a comprehensive account of the complete design process undertaken, as well as the methodologies used to develop a solution for the given challenge. Additionally, it should include an explanation of the stakeholders who are participating and the design principles that are being used. It is crucial to make sure that all of these aspects are accurately documented (2).

Appropriation Study: Documentation is essential for designing case studies. Thorough documentation is required for the introduction, appropriation, and eventual redesign of the IT artifact. This documentation provides assistance during the design process. The stages of design case studies are a continuous and essential activity that requires reflection on each step throughout the whole process. The design process should be conducted via several revisions, even after the technology has been shared with its prospective consumers (2).

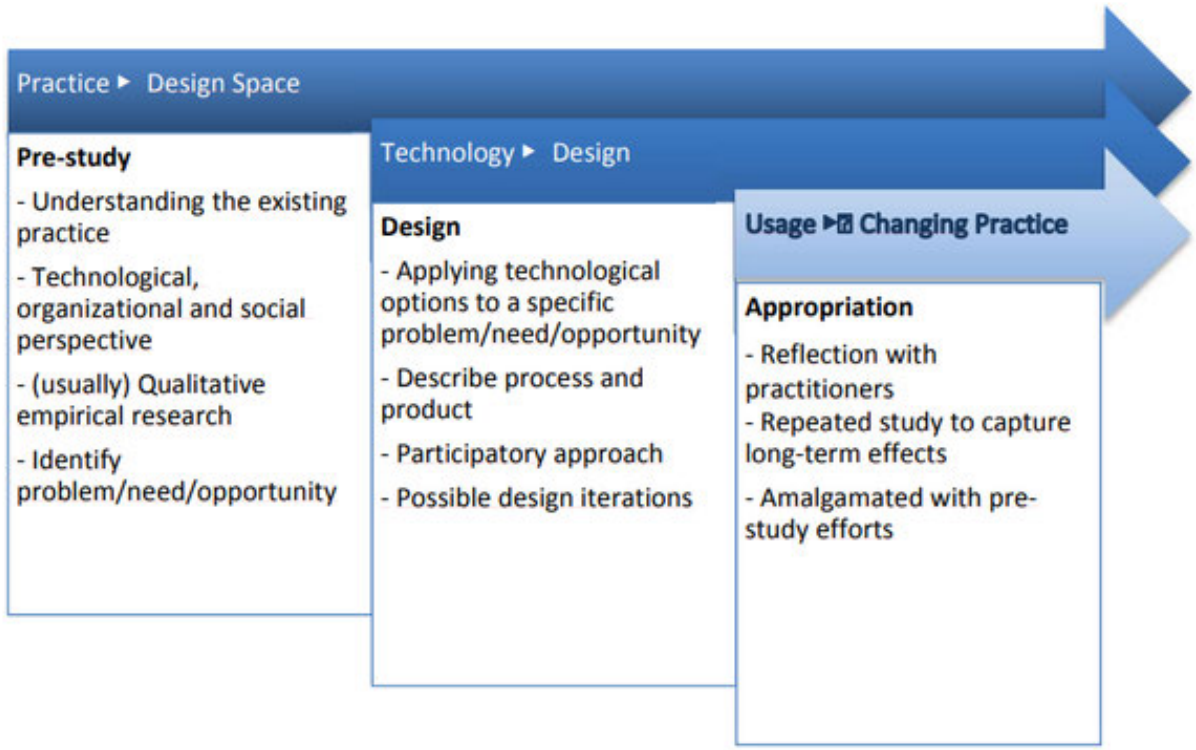


Figure 3.1: Design Case Study (2)

To dive deeper into the case study research process, research by Dr. Robert K. Yin, explains the case study research as characterized by a sequential but iterative process. According to Yin, the figure 3.2 outlines five important considerations when conducting a case study: rigorously conducting the research, distinguishing it from non-research case studies, drawing generalised conclusions if necessary, efficiently managing the effort involved, and understanding the comparative advantage of case study research. Each phase of his case study research is precisely specified as follows (3):

Plan: During this stage, researchers must ascertain the specific circumstances or issues that will be examined in the case study. Additionally, it is important to consider the conventional issues in the research and determine if the researcher intends to do a case study.

Design: At this level, it is essential to fully understand the problem and develop a logical and organised thought process. Formulate a theoretical framework, propose a hypothesis, and identify the relevant concerns that may provide guidance and advance the associated case study. Formulate general conclusions based on the obtained insights.

Prepare: During this phase, the researcher assembles the necessary evidence for the case study. Develop a case study procedure and a broad strategy that researchers would utilize for case study design.

Collect: During this stage, gather various data about the case study. Various types of patterns

and insights may assist with the study.

Analyse: During this stage, thoroughly examine all the accumulated data and evidence that was acquired in the preceding phase.

Share: Finally, after all the steps have been concluded, correctly publicize the research after meticulously writing and composing it. Initiate your task at an early phase and identify your target demographic in order to customise your content effectively. Incorporate both written and visual resources while studying, in addition to supporting evidence.

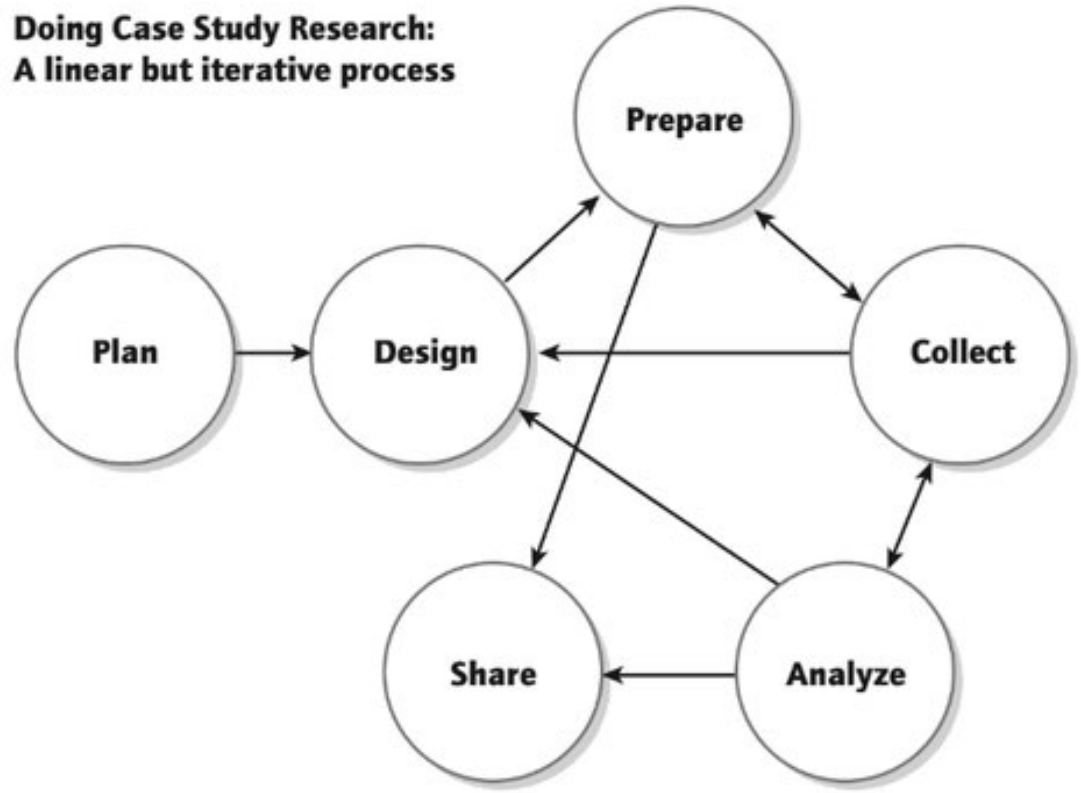


Figure 3.2: Case Study Research by Yin (3)

3.2 Empirical Pre-Study

This section discusses the use of the design case study technique in this thesis. This research study used empirical approaches to ensure consistent results (32). The purpose of this preliminary research was to gain insight into the current state of the Studierendenwerk Dormitory and to explore potential remedies. Qualitative research methods are related to empirical research since the researcher relies heavily on the participant's experience and observation (33).

3.2.1 Data Collection

The pre-study and data collecting included the use of qualitative research methods. This process included conducting in-depth interviews with students living in the dormitories. Qualitative research is beneficial for the researchers to understand the emotions and ideas of the participants. It aids in clearly comprehending the research participant's experiences (2). This pre-study methodology aims to comprehensively understand the student's experiences, preferences, and challenges while living in the student accommodation. During this phase, four steps as illustrated in figure 3.3 as student data collection, including participant recruitment, development of guidelines for the interviews, interviews with the participants, and transcription of the interviews.

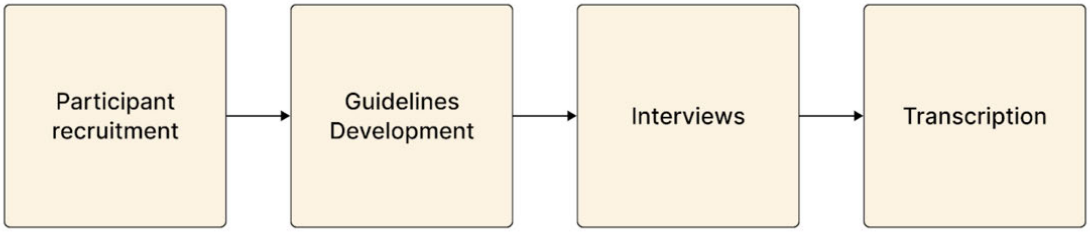


Figure 3.3: Steps involved in data collection

Regarding data collecting for the Studierendenwerk administration, multiple efforts were made to contact the administration and get insights into their in-depth processes. However, they were unsuccessful due to insufficient staff for critical tasks and a heavy workload, and therefore, they could not provide any information. Presently, there are only two individuals responsible for managing all the tasks, which hampers their ability to allocate time to other responsibilities. This demonstrates the need for either an extra workforce or an efficient method that will allow them to do their duty more rapidly.

3.2.1.1 Participant Recruitment

In qualitative research, there is no standard number of interviews or a standardized sample size for recruiting the participants for the interviews. The entire sample size of the study is dependent upon the number of individuals from whom the researcher can get comprehensive insights (34). That is, the sample size is sufficient when no more interviews are required, which could provide new insight into the research. Thus, this stage, where no further information is gained from the interviews, is called data saturation (34). Participants were chosen from various dorms to better understand the perspectives and issues encountered in multiple rooms and dormitory settings. Diversity among participants was also examined throughout the interviews since students from various cultures and backgrounds may influence people's perspectives and ways of life. This stage aimed to identify people who may contribute significant insights to the investigation. The recruitment of participants was accomplished by spreading the word among students. During

the procedure, students were given a short outline of the research study and an introduction to the project's purpose to help them comprehend the issue.

For this study, 10 participants were recruited for the Interviews using a Snowball and Convenience Sampling method. In snowball sampling, researchers start by selecting a small number of participants (seeds) who meet the study requirements and would be most helpful in solving the research problem. These participants are invited to the interview, and they are then requested to suggest or recommend eligible applicants who would be an excellent match for the research and willing to participate. These candidates may further propose more applicants (35). Convenience sampling, or opportunity sampling, is a sample approach based on the researcher's convenience. Participants are chosen based on their relevance to the research study's objectives. They should fit specified requirements, such as availability or location. In convenience sampling, the participants share vital features relevant to the investigation, so they are recruited for the research (36). The table below presents the demographic data of the 10 participants that were interviewed for this qualitative research investigation. The candidate's age ranges from 18 to 30 year. Table 3.1 provides details of the participants.

Participant	**Gender**	**Age**	**Dormitory**	**Country**	**Interview Type**
P1	Male	25	Engsbachstraße	India	In-person
P2	Female	27	Engsbachstraße	India	In-person
P3	Male	25	Engsbachstraße	Pakistan	In-person
P4	Female	28	Engsbachstraße	Bangladesh	In-person
P5	Male	26	Adolf Reichwein	Egypt	Online
P6	Female	28	Adolf Reichwein	India	Online
P7	Female	30	Adolf Reichwein	Nigeria	Online
P8	Female	18	Glückaufstraße	Russia	Online
P9	Female	20	Glückaufstraße	Germany	Online
P10	Female	28	Tiergarten	Bangladesh	Online

Table 3.1: Interview participant's demographics

3.2.1.2 Guideline Development

An interview guide, according to Whiting, is a collection of questions (37). These interview guidelines were created for the interviews, which contained questions to ensure that the interview was appropriately structured and maintained consistency. The guidelines served as a structure that facilitated the conduct of comprehensive interviews and the collection of the most relevant data on students' experiences. The criteria were created with a distinct focus on the study question and the research objectives. Every question was carefully designed to get the most relevant understanding in order to address the research inquiry. The criteria were established to encourage students to reflect on their experiences and express their narratives pertaining to the research question. The questions were open-ended so the participants could share their candid experiences in detail. Researchers create interview guidelines with open-ended questions that start with words like who, what, where, and when they want to investigate any situation or perspective on a particular problem (38). The questions were formed sequentially, keeping in mind that a logical flow was maintained throughout all the interviews. The research conducted by Kallio et al. in 2016 outlines a five-phase process for developing interview rules for a semi-structured interview (39). The five stages involved in the development of semi-structured interview rules are as follows:

1. Determining the necessary requirements
2. Acquiring and using prior knowledge
3. Creating a preliminary interview questionnaire
4. Conducting a preliminary test of the interview guide
5. Concluding and presenting the comprehensive interview guide

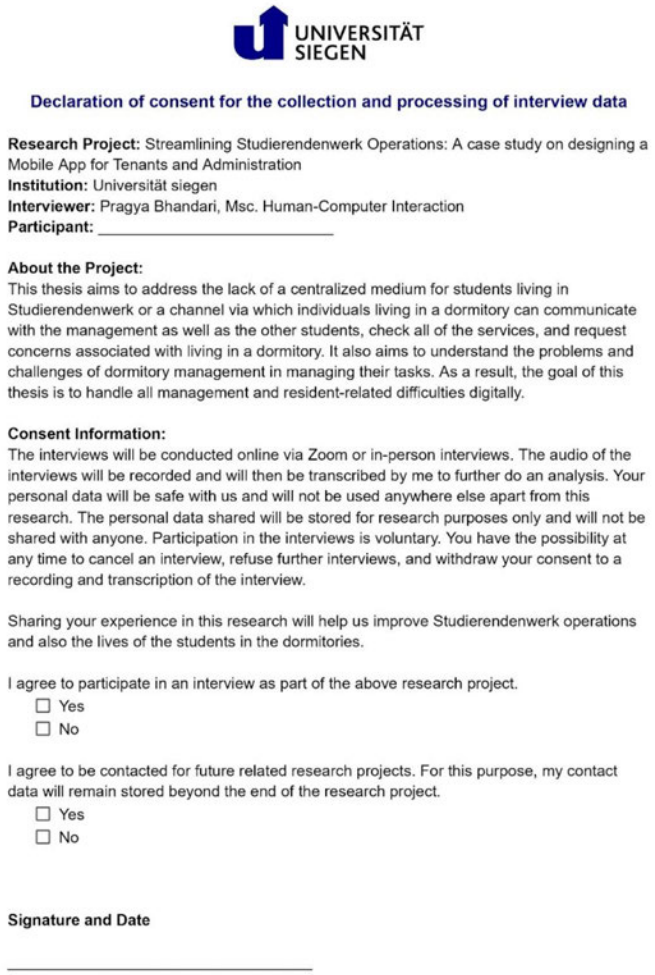
These phases were considered throughout the process to form the interview guide. The study questions were divided into three sections. The first part aimed to get insights into the booking process and the students' perception of the hostel. The second part was comprehending their experience of moving in and the difficulties they encountered upon their first arrival. Lastly, in the third part, there were questions related to the challenges that participants face daily in terms of the services and challenges faced among the other residents of the student accommodation, and lastly, some questions regarding the platform solution for the problems.

Interview Questions

1. Demographics Information:
    - Name
    - Gender
    - Age
    - Nationality
    - Which dormitory do you stay in?
    - Since how long are you staying here?

2. Could you describe your process of finding a room in this dorm?
3. Why did you prefer this room?
4. After reaching Germany, how did you get access to the room?
5. Were you given a tour of the dormitory amenities?
6. Can you provide a description of your dormitory life?
7. What are the primary obstacles you encounter while living in a dormitory?
8. What are the most common problems you face in a dormitory every other day?
9. Have you had any issues pertaining to theft or vandalism?
10. What are your thoughts on the cleanliness and upkeep of your dormitory?
11. What is the procedure for contacting the authorities in the event of any problems?
12. Are your concerns resolved promptly? What is the average duration for issue resolution? Provide an example of any of the challenges that you encountered.
13. How do you solve your problems on your own apart from talking to the authorities?
14. Do you encounter any particular tasks or activities that you find challenging or require a significant amount of time in the present dormitory arrangement?
15. What are your daily tasks in the dormitory? How do you dispose of your garbage or other unwanted items that you don't need anymore?
16. How do you currently communicate with fellow dormitory residents and management?
17. Have you faced any difficulties in building relationships or getting along with your flatmates or other residents?
18. Have you ever faced any other kinds of challenges with other residents? If so, could you please tell me about it?
19. What amenities or services do you wish were better organized within the dormitory?
20. How do you receive important announcements or notifications related to dormitory events, maintenance, or other matters?
21. If you could change or improve one thing about the dormitory, what would it be?
22. Have you ever shared feedback or suggestions with the dormitory authorities? How do the authorities react to it?
23. What are the key features that you consider necessary for a platform specifically tailored for dormitory residents?
24. What kind of information would you like to have readily available through the app (e.g., events, maintenance schedules, laundry availability, etc.)?
25. How important is real-time communication (chat, forums) for you, and what topics would you want to discuss through the platform?
26. What would be the frequency of your use of the platform, and what factors would drive your continued usage of it?

Consent Form: In the figure 3.4, before commencing the interviews, permission was obtained from all participants, informing them of the use of their insights from the interview.



UNIVERSITÄT SIEGEN

Declaration of consent for the collection and processing of interview data

Research Project: Streamlining Studierendenwerk Operations: A case study on designing a Mobile App for Tenants and Administration
Institution: Universität siegen
Interviewer: Pragya Bhandari, Msc. Human-Computer Interaction
Participant: _____

About the Project:
This thesis aims to address the lack of a centralized medium for students living in Studierendenwerk or a channel via which individuals living in a dormitory can communicate with the management as well as the other students, check all of the services, and request concerns associated with living in a dormitory. It also aims to understand the problems and challenges of dormitory management in managing their tasks. As a result, the goal of this thesis is to handle all management and resident-related difficulties digitally.

Consent Information:
The interviews will be conducted online via Zoom or in-person interviews. The audio of the interviews will be recorded and will then be transcribed by me to further do an analysis. Your personal data will be safe with us and will not be used anywhere else apart from this research. The personal data shared will be stored for research purposes only and will not be shared with anyone. Participation in the interviews is voluntary. You have the possibility at any time to cancel an interview, refuse further interviews, and withdraw your consent to a recording and transcription of the interview.

Sharing your experience in this research will help us improve Studierendenwerk operations and also the lives of the students in the dormitories.

I agree to participate in an interview as part of the above research project.
☐ Yes
☐ No

I agree to be contacted for future related research projects. For this purpose, my contact data will remain stored beyond the end of the research project.
☐ Yes
☐ No

Signature and Date

_____

Figure 3.4: Consent Form

3.2.1.3 Qualitative Research: Interviews

Qualitative research was conducted through semi-structured interviews with 10 participants from various dormitories and the interviews lasted from 20-45 mins. Semi-structured interviews were chosen for this research study due to its suitability in investigating the mindsets and views of participants about complex issues, which would aid in uncovering answers to the research question. (40). The interviews were conducted both online and in person, depending on the participants' flexibility and availability. The interviews were recorded after the participants' consent was obtained. These interviews helped get in-depth insights into the experiences of different participants living in various dormitories and their challenges. Ethical considerations were also made while conducting the interviews. The interviewers were explicitly notified about the confidentiality of their data, assuring them that it would not be disclosed elsewhere and would

just be used for research objectives. The participants were also notified that their participation was entirely optional and that they had the freedom to terminate the interview at any point if they felt uneasy about answering any of the questions.

3.2.1.4 Interview Transcription

After conducting the interviews, the next step in the data-gathering process was to transcribe the interviews to analyze and gain valuable insights. Loopanel was used to transcribe all the interviews as shown in the figure 3.5. This phase is essential since the transcripts help organize all the critical information and simplify evaluating the information gathered from the interviews.

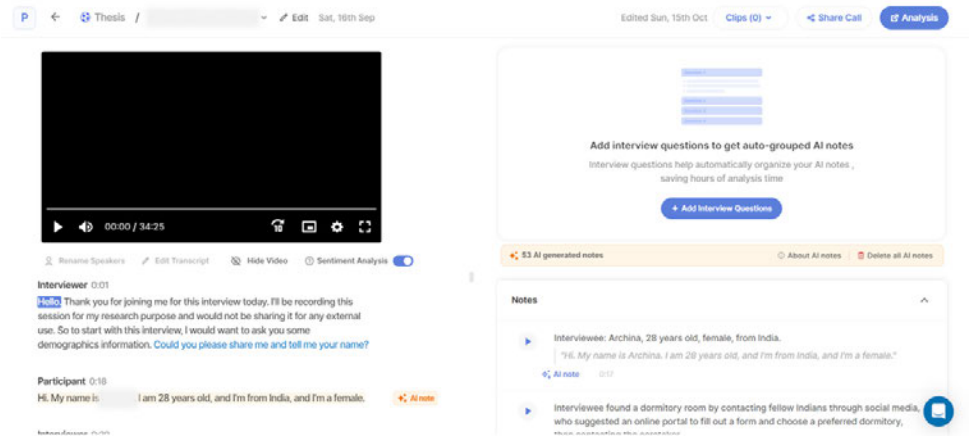


Figure 3.5: Looppanel Transcription tool UI

3.2.1.5 Quantitative Research: Survey

Quantitative research is a study approach that focuses on using numerical data to represent and analyse observations in order to describe and understand the events being observed (41). In order to expand the target audience, the last step in the data-gathering procedure was obtaining a survey from a larger pool of participants. The poll was conducted with Google Forms to get participant feedback. The survey was carried out using Google Forms to collect participant feedback. The poll received responses from 42 participants, who shared their experiences with the university dormitory. The survey form was shared and circulated among friends, the university telegram group, and students from Hemrat, a community of students that organizes social activities for the students living in the dormitory. The poll was able to reach a large audience and get their contributions. The survey was filled out by students who lived in different dorms, and as a result, the responses contained experiences from various dormitories.

Survey Questions:

1. Demographics Information:
    - Age
    - Gender
    - Country

2. How long have you been living in the dormitory?
3. Which Studierendenwerk dormitory are you currently residing in?
4. Have you faced any challenges or problems while living in the dormitory? (Skip if irrelevant) (Multi-Select)
5. Please specify the problems in detail for the above question. (Skip if irrelevant)
6. What features or services do you think are currently lacking in your dormitory experience? (Please specify or skip if irrelevant)
7. What features would you like to see in a dormitory application? (Multi-Select)
8. Would you be interested in using a dormitory application to enhance your dormitory living experience?
9. Do you have any specific suggestions for additional features you'd like to see in the dormitory application?

Among the 42 survey responses in the figure 3.6, 40.5% of the students resided at the Engsbachtraße dormitory, which offers both single rooms and doublette rooms. 28.6% of the residents come from Adolf-Reichwen Straße. This dormitory offers apartments or WGs with 3 and 4 occupants. The study had an 11.9% response rate from Glückaufstraße and a 9.5% response rate from Im Tiergarten. Glückaufstraße consists only of shared apartments (WG).

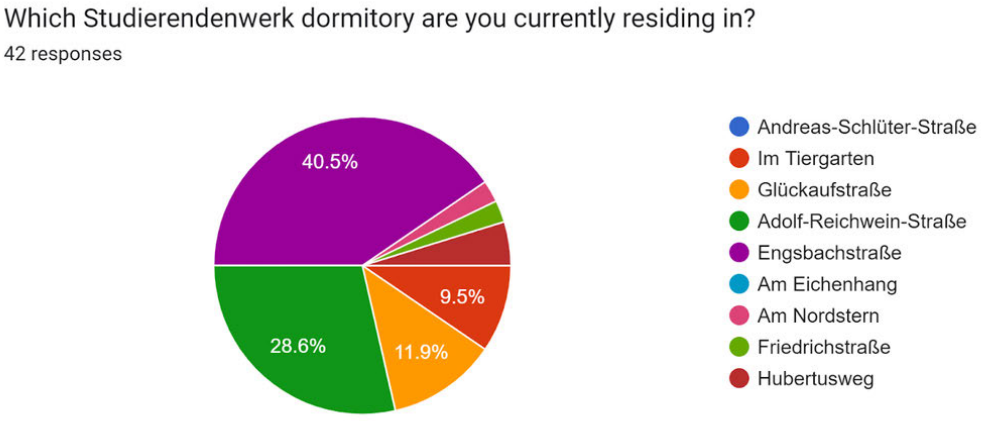


Figure 3.6: Total survey responses from various dormitories

Based on the survey results in the figure 3.7, half of the foreign students who completed the form are of Indian nationality. The University of Siegen has a significant number of Indian students, particularly in the fields of Mechatronics and Computer Science. 28.6% of the replies are from German students, while the rest responses are from students hailing from Iran, Pakistan, Vietnam, Syria, and other countries.

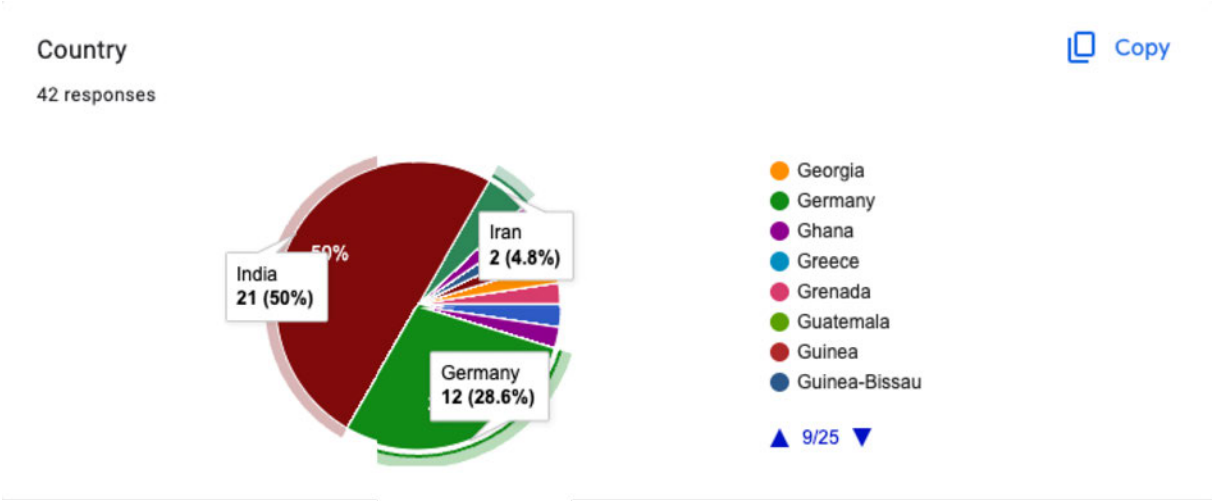


Figure 3.7: Geographic Distribution of Students

3.2.2 Data Analysis

The practice of analyzing data to find recurring themes and insights from user research is known as data analysis (42). Figure 3.8, displays the flow of data analysis as decribed by Hartson and Pyla. The subgoals of research analysis according to them are also listed below(4):

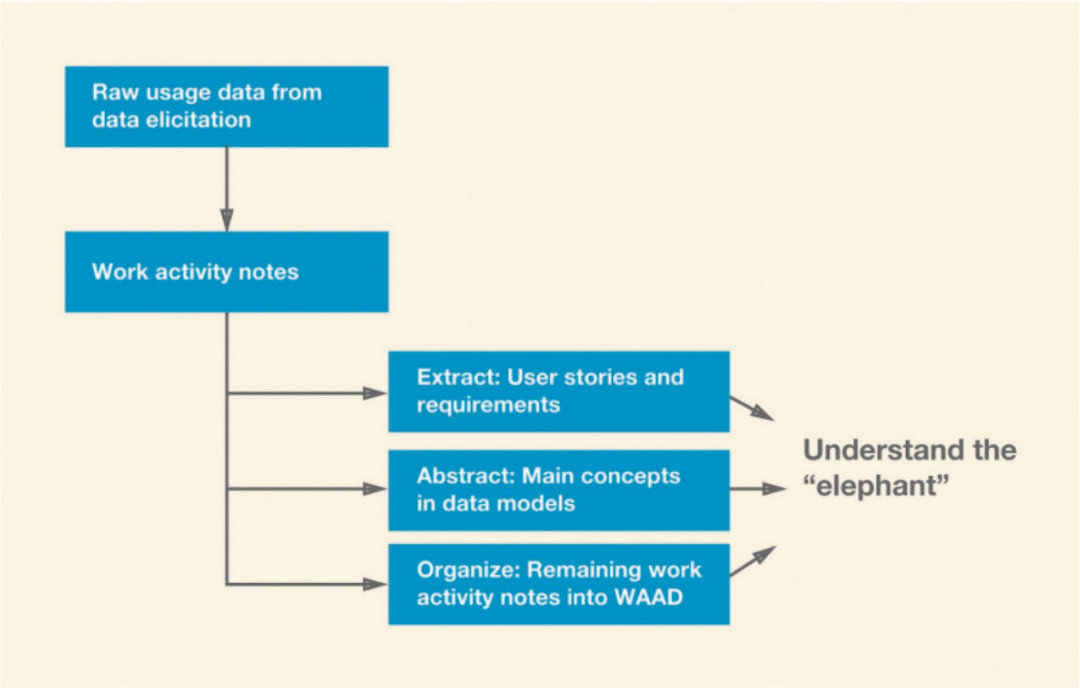


Figure 3.8: Flow diagram of data analysis (4)

- **Goal 1:** Condense the fundamental nature of your findings from user study. This involves the process of combining and analysing information gathered directly from users in its original form.

- **Goal 2:** Outline the specific characteristics and functionalities that consumers will need in the system or product. This involves collecting pertinent information about the user's wants and creating user stories based on those specific requirements from the unprocessed user data.
- **Goal 3:** Document and explain many facets of work methodology as easily shareable depictions.
- **Goal 4:** Document additional aspects of the labour process, teachings, or revelations in concise micro summaries. Categorise all the notes and generate affinity maps and categories based on similar subjects discovered throughout the research.
- **Goal 5:** Develop a comprehensive depiction of the total comprehension of the work practice, omitting elements that are already included in the existing models. Categorising notes.
- **Goal 6:** Comprehend the whole of the domain and the operational framework.

3.2.3 Affinity Diagram

According to the Neilsen Norman Group, "Affinity diagramming" is grouping linked information into different classifications (). This facilitates the organisation of a substantial quantity of ideas and concepts into categories that can be effectively evaluated. Figure 3.9 illustrates how these clusters are created. According to the Neilsen Norman Group, "Affinity diagramming" is grouping linked information into different classifications (5). This facilitates the organisation of a substantial quantity of ideas and concepts into categories that can be effectively evaluated.

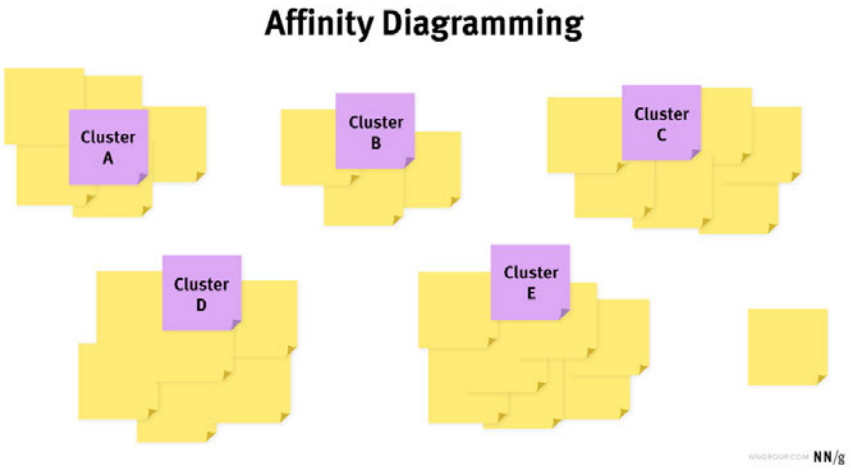


Figure 3.9: Clustering information together in themes (5)

Following an intense and careful reading of the interview transcripts, all the interviews were analyzed. Later, affinity diagrams were developed, and the issues the students were experiencing were classified. Creating the creative affinity diagram involved carefully considering and reviewing the collected data, and recurring themes and patterns were identified by multiple students in qualitative and quantitative research. This process aimed to gain a deep level of understanding and underlying issues that were depressed by the students.

3.2.4 Personas

Using the insights from the affinity mapping, two personas were created for this report using Figma (**?**)(Design tool) for student and administration (Figure 3.10 and Figure 3.11). Making persona promotes empathy for a specific user group, which keeps things focused and avoids the designing of something that works for everyone (Harley, 2015). According to an article by N N group, "A persona is a fictional, yet realistic, description of a typical or target user of the product" (43). Alan Cooper first defined personas in 1999 (44). They are imaginary character profiles that describe the actions, motivations, frustrations, and ultimate goals of a product or service's target users (45). Although these personas are fictitious, they should be described as actual persons (43). Personas are developed by a process of conducting interviews with people and recording important discoveries. They are then built by defining behavior patterns, objectives, skills, attitudes, and surroundings. An excellent persona depicts the user's daily routine and the other entities described above (46). Personas are helpful to stakeholders and design teams because they help them understand the requirements and preferences of users. They are used to discuss users and aid decision-making throughout the design phase (45).

Component	**Description**
Identity	Provide the user's first and last name. Give demographic information, such as age.
Status	Details if it is a primary, secondary, or anti-user of the system
Goals	Define what the user goals are. And goals related to the specific product.
Skill Sets	Provide details about the user's expertise. Include education, training, or any specialized skill.
Tasks	Provide information on the frequency, importance, and time the user takes to do the critical tasks.
Relationships	Include information on the user's associates since this may provide insight into other stakeholders.
Requirements	Include information about the needs of the users. Give quotations that could be relevant to the needs.
Expectations	Provide information about how the user thinks the system works.
Photograph	Include a photo of a human face suitable with the name.

Table 3.2: Components of Persona (10)

When creating a persona, many components must be considered (Table 3.2); however, infor-

mation on every component is optional. Designers can provide as much information as they have available. Even if the personas are fictitious, the information in the persona should be similar to and authentic to that of a genuine user (10).

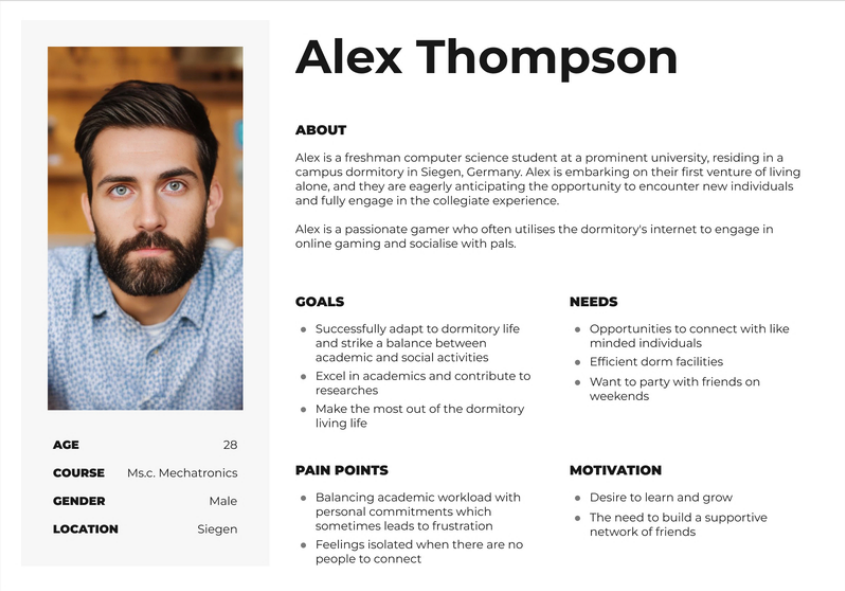


Figure 3.10: Persona of the student

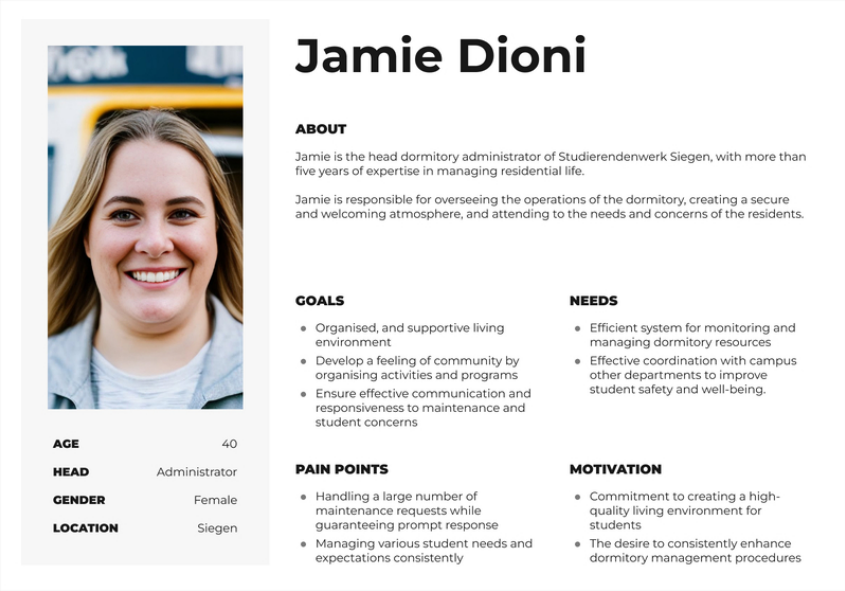


Figure 3.11: Persona of the Adminstrator

Although it is ideal for working with data-driven personas as it is accurate information, there are advantages to using experience and assumptions to create reasons. According to Sundt and Davis, these assumption-based personas are quick and easy to create ((45). Donald Norman also considers creating assumption personas, called proto personas, which are meant for quick alignment when no research exists. These personas can be based on user data or assumptions about the user and their requirements (47). Since there was no information about the dormitory administration work, therefore, an assumption-based persona was created for them.

4 Results

According to the study, several students expressed their concerns about the dormitory and also highlighted the common problems they confront. The students encounter the following primary challenges (Figure 4.1): Laundry availability problems (50%), Kitchen Issues like availability, and cleanliness (41.7%), Communication with authorities (38.9%), Noise Disturbances (36.1%), Flatmate conflicts regarding cleanliness (30.6%), Room booking/changing (25%) and Less Social Interaction and Security/Safety Issues (19.4%).

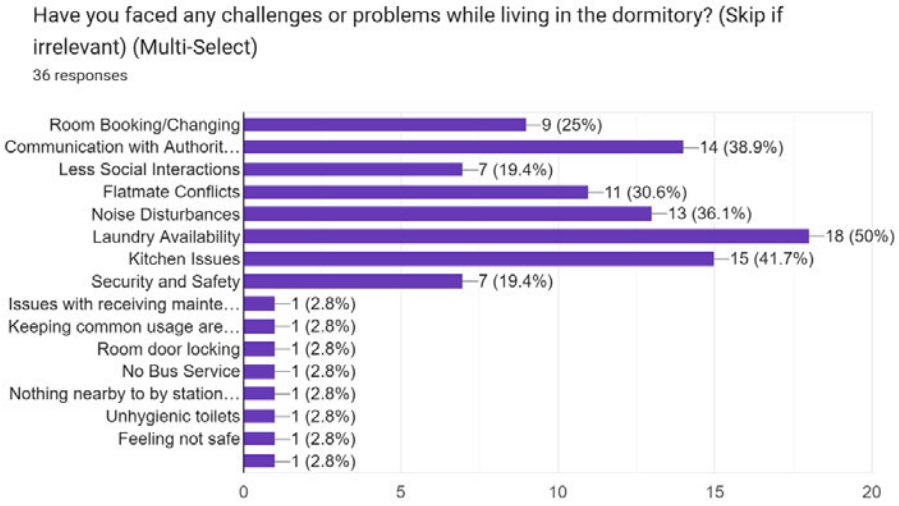


Figure 4.1: Challenges faced by the students

The poll findings indicated in the figure 4.2 that a significant majority of the students expressed interest in using such an application, with 71.4% of them endorsing the concept. While 23.8% of the responses expressed neutrality towards the notion, the remaining responses indicated a lack of interest.

The interview transcription and survey descriptions exhibited many recurring issues. The following presents the categories and responses obtained from the survey and interview:

Cleanliness Issues: Maintaining cleanliness is essential for ensuring pleasant and sanitary living circumstances. However, cleaning problems are prevalent in dormitories. The majority of problems are associated with unsanitary communal areas and equipment, such as a soiled kitchen floor, filthy microwave, dirty restrooms, or inadequate waste disposal.

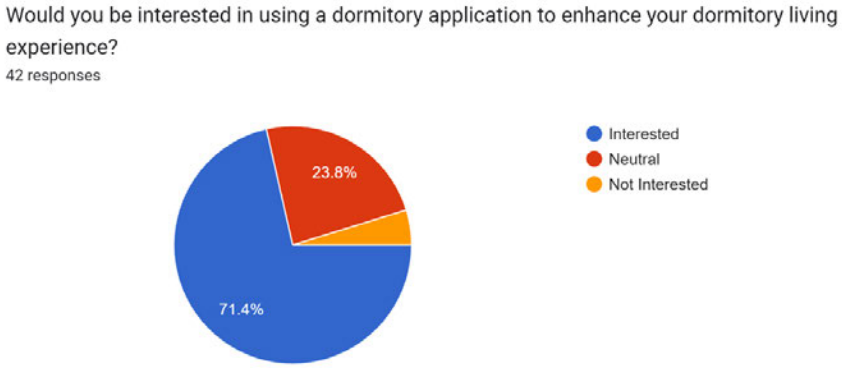


Figure 4.2: Student Interest in Using Dormitory Enhancements

"...So that's one challenge of using the common kitchen and I guess the next is the garbage. Disposal of garbage is a big issue, I guess in 58 at least in the third floor because everyone takes it very lightly..." - *Participant 1*

"...So basically one thing which is very living with people that you have to deal with few things is the cleanliness problem that not everyone is following the rule and you have to poke everyone. You feel like you are some mother of the house but that shouldn't be the case..." - *Participant 6*

"...So we have like, four tasks and they keep changing every week, so every week you have to do different tasks, and cleaning is like, I don't know, not so easy sometimes, especially if we talk about plates and stuff like this in the kitchen..." - *Participant 9*

Security Issues: Certain dorms exhibit inadequate security measures, including instances of vandalism, malfunctioning door locks, and unauthorized individuals gaining access. These concerns are being neglected, either owing to carelessness or an overwhelming workload that prevents prioritizing these critical activities.

"...But yes, one day I think we were going out early morning and then we went out at around 06:00 and there was this vandalism that took place early morning in the like it was I think around 07:30 that our front main door was stoned..." - *Participant 1*

"And also you are calling thief sometimes from DHL or from Amazon, some packet something people when they just order, they put in front of the door..." - *Participant 4*

"...I don't know whether it's a church or the cult, but they break inside our hostel and they were knocking our doors. And so that's why people do put a lock in the door all the time..." - *Participant 10*

Laundry and Party room Issues: Occasionally, the laundry facilities get excessively reserved, leaving individuals unable to find any unoccupied machines. Consequently, they are

compelled to take their clothes and return to their apartments, and awaiting the availability of the wash or dryers once again.

"... There are too few machines and a lot of people, many times when you decide to do the laundry, I think there are around three laundry machines shared between, I think, more than 100 or 150 people. And when you decide to go to the laundry room, you take all your heavy laundry..." - Participant 2

"If there could be a way to know laundry room availability then it would be very helpful..." - Survey

"The party room is locked for many months now. We did not like the solution proposed by Studentenwerk of forming a committee and organizing partys every week..." - Survey

Communication Issues: An additional concern is the communication between students and administrators. While not applicable to all dorms, there are instances when some concerns are overlooked and not promptly addressed.

"If something is broken in public area like cooking stove, toilet flush, bathing shower head etc is irreplaceable I feel. The Hausmeister never listen or respond to our issues" - Survey

"Communication between Studierendenwerk and tenants..." - Survey

Contract Details: Other issues include inadequate communication of crucial contract details and occasional delays in delivering the contract.

"I had to call them a few times because had like, two weeks left till I really wanted to move in because otherwise I would be homeless. Yeah, I called them. I also sent them a few emails, and then finally...." - Participant 9

"...starting date of the last 3 months notice period while leaving the room should be mentioned. I faced this problem, I mailed on 9th but then I got to know that it should be till 5th of the month. So, now I have to pay extra rent for one month." - Survey

4.1 Similar Themes

An affinity diagram was created which gave a more comprehensive data perspective and consolidated thoughts on a single entity (Figure 4.3). Doing so provided greater clarity, which would later assist in brainstorming and thinking of better student ideas. The procedure of constructing an affinity diagram often involves a collective effort of individuals inside a room (5). Researchers use post-it notes to jot down their thoughts and ideas on the insights gained from the interview. After that, they sort the Post-it notes into several different categories. However, Figjam (a digital tool) was used to do this task.

Figure 4.3: Affinity Diagram from the qualitative and quantitative research analysis

4.2 User Stories

Upon identifying common themes from the interview, it was crucial to build user stories to streamline and clarify the concepts that would be captivating for the application. A user story is a description of functionality or features that provides value to either a user or purchaser of the software, as stated by Cohn (48). Cohn defines a user narrative as including three elements:

1. A short synopsis of the narrative or story that may serve as a point of reference and organisational tool.
2. Engaging in discourse over the story contributes to its complexities.
3. Tests for data capture, transmission, and story completeness determination.

User stories are simple and may be written by anybody, including stakeholders, without understanding modeling abilities (49). Daneva and Pastor stated, “User stories stimulate collaboration and facilitate planning, estimation, and prioritization.” It is worthwhile to employ user stories because they are easy to understand for the design and development teams, and they can be conveniently used for product iteration planning since they promote detailed deferral (48). Cohn suggests using the following structure for writing a user story:

As a **[role]**, I want to **[goal]**, so that **[benefit]** (48)

In the context of this statement, the term "role" refers to the person or entity that will get advantages or make use of the feature. The term "objective" refers to the specific feature that has to be accomplished. Lastly, the term "benefit" refers to the ultimate value that will be obtained after the feature is put into action (49). These user stories provide information about what needs to be accomplished and are helpful when implementing features. Stakeholders or product owners may assign these stories to their teams to effectively split the workload.

A few user stories were created to assist with implementing features for this thesis. These stories help identify the requirements and potential benefits each feature may provide.

For Students:

1. As a student living in the dormitory, I want to easily report maintenance issues, such as broken items or plumbing problems, so that they are addressed promptly.
2. As a student living in the dormitory, I want to be in contact with other residents through a messaging system or forum to stay informed about group community activities, so that I can stay in contact with my peers.
3. As a dormitory student resident, I want to know the availability of common areas, such as laundry facilities, and drying areas, so that I can reserve them and use them when needed.

4. As a student residing in the dormitory, I desire to receive notifications regarding significant announcements, including maintenance schedules, policy updates, and emergency notices, so that I am always informed.
5. As a resident of the dormitory, I would appreciate the ability to access my dormitory account, so that I can view the precise details of my stay contract.

For Administration:

1. As a dormitory staff member, I would want access to a dashboard that provides a thorough overview of room availability, occupancy rates, and any pending maintenance or administrative tasks, so that I streamline the management of the resources.
2. As a dormitory administrator, my objective is to efficiently communicate crucial information, including critical announcements, policy updates, and emergency alerts, so that they are informed in a timely manner.

4.3 Feature List

Based on user research results, a comprehensive list of features was developed for the student application. These aspects are specifically tailored to meet the diverse needs of students throughout their whole stay in the dormitory, as seen in the three stages of the interview: during the room application process, while moving into the dormitory, and when living in the dormitory. However, due to lack of data from the administration, it became challenging to comprehend the functioning of the room booking system. Consequently, no provisions were made for addressing the booking concerns faced by the students. The planned features for the application include:

1. **Appointment Booking:** Allows students to book appointments with dormitory administration for various needs.
2. **Complaint Booking:** Enables students to file complaints for maintenance, repairs, conflicts, or any other issues within the dormitory.
3. **Task Splitting:** Facilitates the division of tasks among flatmates, creates schedules, and provides reminders to ensure tasks are completed on time.
4. **General FAQs:** Provides answers to frequently asked questions about dormitory life and general rules for tenants in Germany, including information on ARD, garbage disposal, and more.
5. **Events and Communication:** Offers access to information about upcoming events in the dormitory and the city, along with a communication channel for flatmates and the entire dormitory.
6. **Information Access:** Allows users to access their rental contract information, renew contracts, change rooms, and find emergency contact information when needed.

5 Implementation

User-Centered Design (UCD) is a design technique that places importance on engaging with users to improve comprehension of user needs, task specifications, design refinement, and assessment (Figure 5.1). According to Mao and other researchers, UCD is commonly regarded as the primary factor determining the utility and usability of a product. It is stated as an efficient technique for combating the constraints of conventional system-centered design (50). As stated in an article by the Interaction Design Foundation, UCD is a design method that is iterative in nature. The design approach prioritises the inclusion of people and comprehending their needs at every stage. The article asserts that the User-centred design process has four distinct stages (6).

1. **Understanding:** In this phase, the designers understand the context in which the designers might use the system.
2. **User Requirements:** In this phase, designers identify and try to understand the user requirements and needs.
3. **Design:** After gathering user requirements and analysis of the problems, the designers then move to the designing phase and develop the solutions for the users.
4. **Evaluation:** The designers then move to the evaluation phase where they test use their solution with the users and evaluate it against the user's requirements. If the solution matches with the users needs and satisfies all their requirements then the solution is likely to be usable for the users. Or else the process is done again until a satisfactory result is obtained.

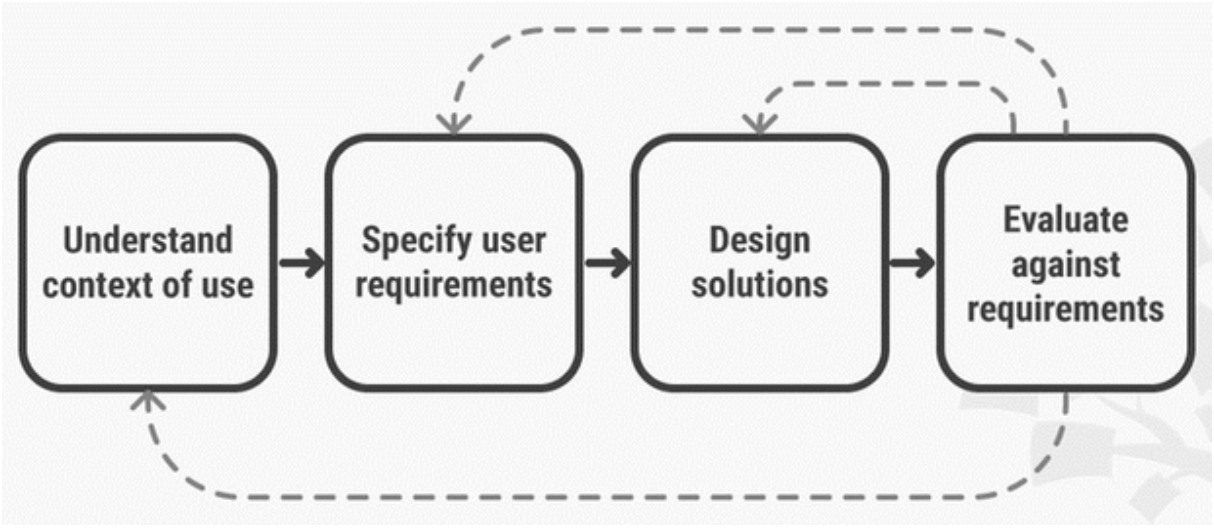


Figure 5.1: User-Centered Design Process (6)

Don Norman gave six principles of design and during the implementation of this thesis, these were taken into consideration for creating a seamless design. These principles are as follows (51):

1. **Visibility:** Increased visibility of functionalities enables users to choose their next actions inside the system. If the functionalities are not prominently shown, users may struggle to comprehend the subsequent steps in the system, including where to click and the intended flow of the product, resulting in a poor user experience contrary to the designers' expectations.
2. **Feedback:** Providing feedback to users is essential for informing them about their activities. Feedback refers to the information provided to users on their activity inside the system and the tasks they have completed. There are several forms of feedback, including physical and verbal. Feedback may include positive feedback, helpful feedback, and warnings. Feedback assists users in determining whether they are doing tasks correctly or not.
3. **Constraints:** Constraints are a design concept that involves limiting human engagement with the system.
4. **Evaluation:** The designers then move to the evaluation phase where they test use their solution with the users and evaluate it against the user's requirements. If the solution matches with the users needs and satisfies all their requirements then the solution is likely to be usable for the users. Or else the process is done again until a satisfactory result is obtained.
5. **Mapping:** Mapping refers to the correlation between the controls and their corresponding effects. All potential artifacts in this universe need a clear correlation between their controls and their resulting impact.
6. **Consistency:** Consistency relates to the implementation of interfaces that sustain a consistent visual and interactive experience throughout an entire system. It will possess comparable processes and components that are used to accomplish a job. It should adhere to analogous typographic guidelines, as well as include comparable pictures and iconography. For instance, a reliable procedure may include using the same category of button field for interaction
7. **Affordance:** Don Norman states that "perceivable action possibilities" refer to acts that consumers believe are feasible. Designers must develop affordances that cater to the needs of users, considering their physical and perceptual capabilities, goals, and past encounters (52). Affordance is a quality of an item that helps people comprehend how the product may be used. For example, people perceive the mouse buttons as clickable. This is called the affordance of the mouse.

This article describes the five visual design principles that have a substantial impact on user experience (7). The design of the product for this thesis took into account these 5 crucial principles as stated by Gordon(Figure 5.2):

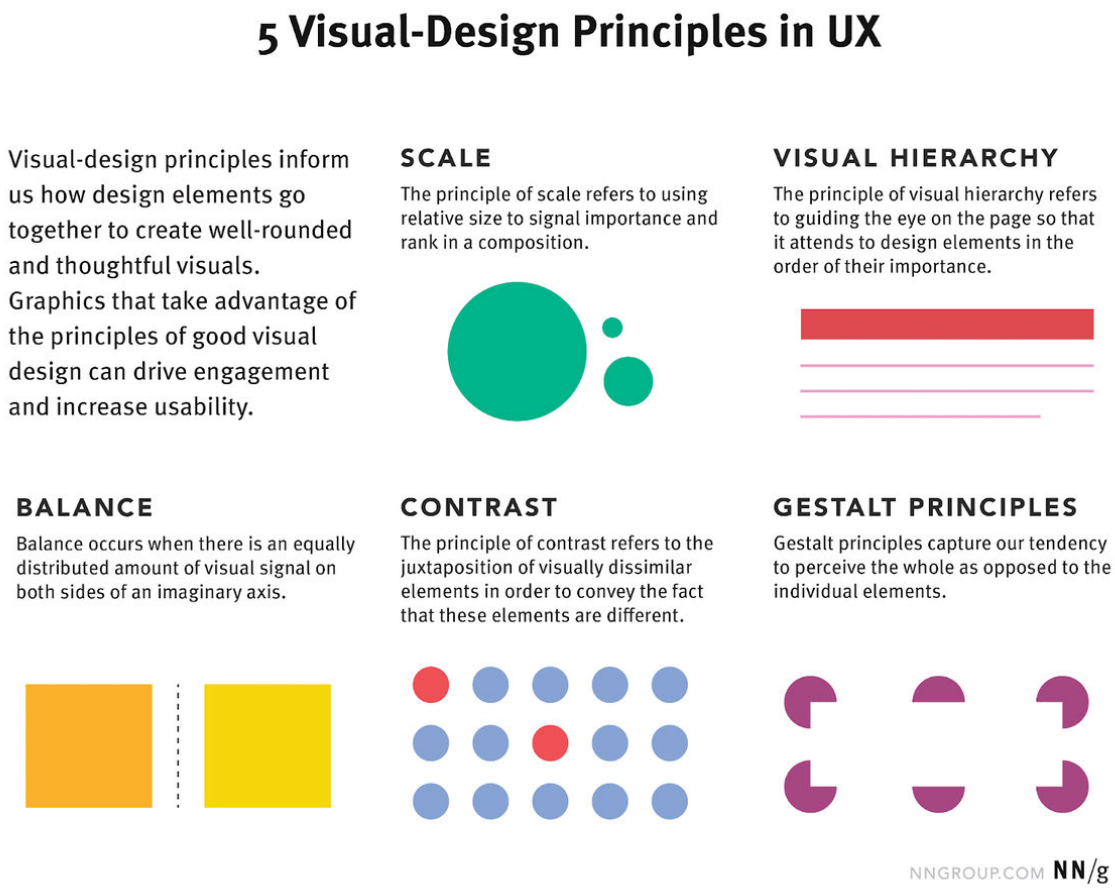


Figure 5.2: Visual-Design Principles in UX (7)

5.1 Ideation

Following the completion of the analysis of all the interviews and the gathering of significant insights about the students, the subsequent stage was to generate several ideas regarding how an application may help the students cope with their issues. During the interviews, several students also expressed their preferences for the functionality of an application that would be useful to them and provide them with advantages. The brainstorming session was crucial since it laid the foundation for a solution that prioritised the children and was driven by empathy for them. Working with students throughout the interviews generated numerous suggestions and a wide variety of ideas.

5.2 User Flow

To comprehend the overall structure of the app and the many strategies that the user might use to accomplish their tasks, it was crucial to establish a user flow of the application. A user flow, as defined by the Nielsen Norman Group, refers to a series of interactions that outline the standard or optimal sequence of steps required to successfully complete a common tasks using a

product (53) Figure 5.3 illustrates the looks of a userflow.

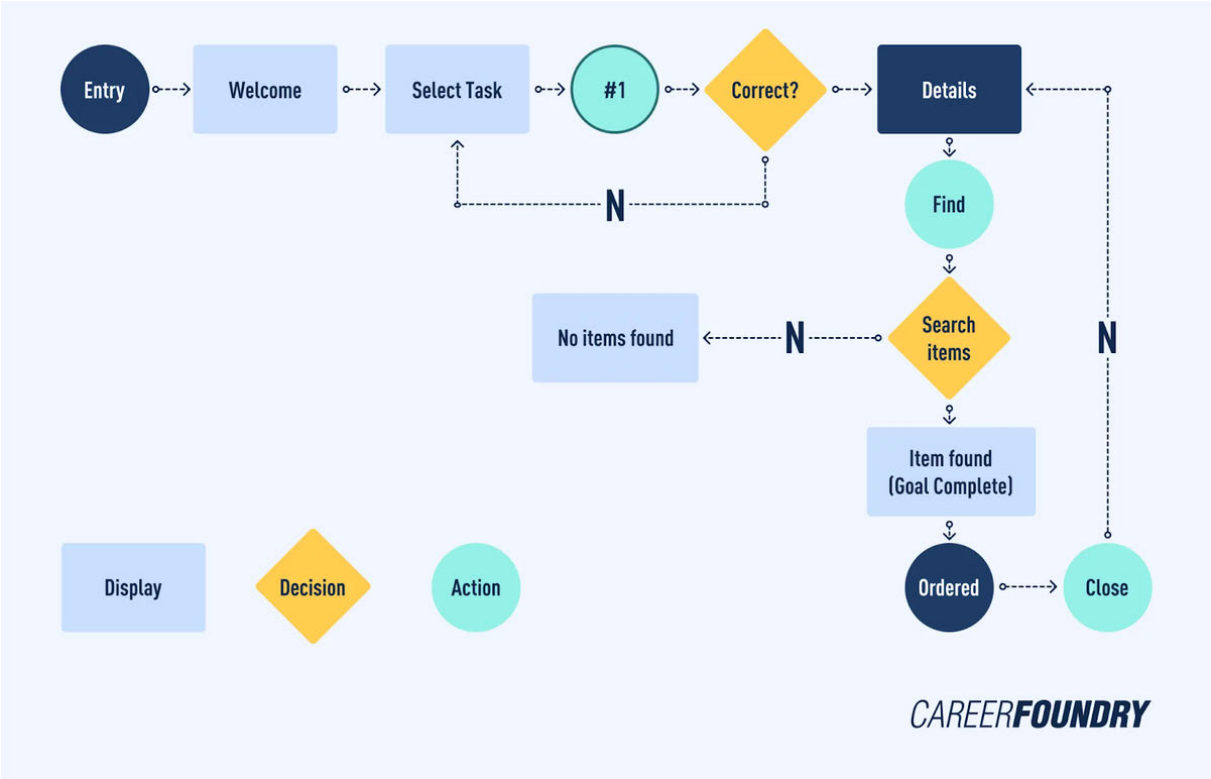


Figure 5.3: User Flow Diagram example (8)

5.2.1 How is User Flow designed?

A user flow is a visual representation, often shown with arrows and instructions, that takes users around a website or application. User flow aims to create a path that meets the user's needs. To create a successful user flow, six steps are followed using the steps described by Career Foundry in their article "What are user flows" (8):

1. **Understand the User's Journey:** First and foremost it is important to understand the user and the path they would likely take in the product. It is important to create a persona that lists all their needs and motivations to use the product.
2. **Match Product Goals with User Aspirations:** The product being offered to the consumer might have diverse purposes that may vary from the user's own objectives. As mentioned in the previous point, it is crucial to focus on creating a persona that states all the user goals and tries to align the user flow with user goals to create the most effective and efficient user flow for the user.
3. **Pinpoint User Entry Points:** Understand the beginning of the user flow. Carefully consider all potential user pathways before engaging with the product.
4. **Craft the Steps to Help Users Complete Their Tasks:** Craft the Steps to Help Users Complete Their Tasks: Determine the stages between the initial and the final points of the user flow. Attempt to reduce the quantity of stages used in the procedure.

5. **Visualize the User Flow:** After doing all the previous steps properly, the next step is to visualize the user flow with the use of a whiteboard, pen and paper or any digital software. User flow is made by using UML conventions. For example (Figure 5.4), ovals are used for start and end points, rectangles are used for the visualizing steps and diamonds are used for decisions.

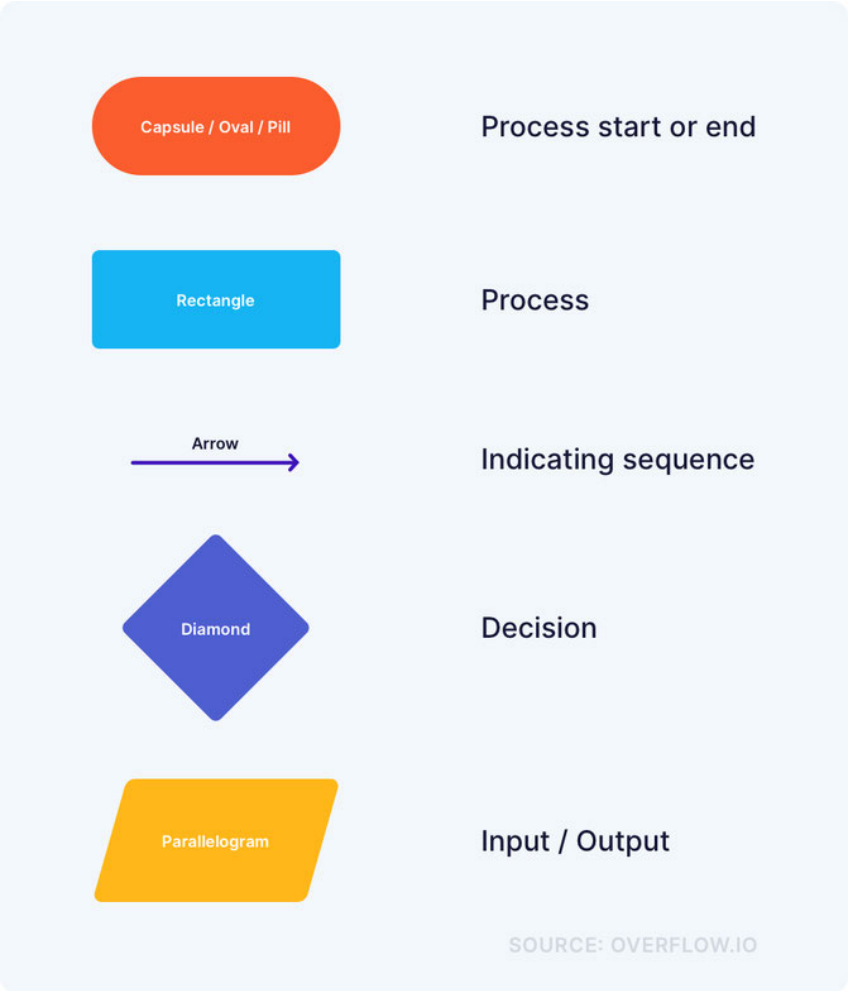


Figure 5.4: Visualise the User Flow (8)

6. **Refine the Flow with Feedback:** The initial user flow is then shared with the team for feedback. After gathering the feedback the user flow is refined and finalized. Considering all the necessary procedures to establish a user flow. A user flow was created to represent the conceptualized solution.

Figure 5.5 depicts the userflow that was designed for the application.

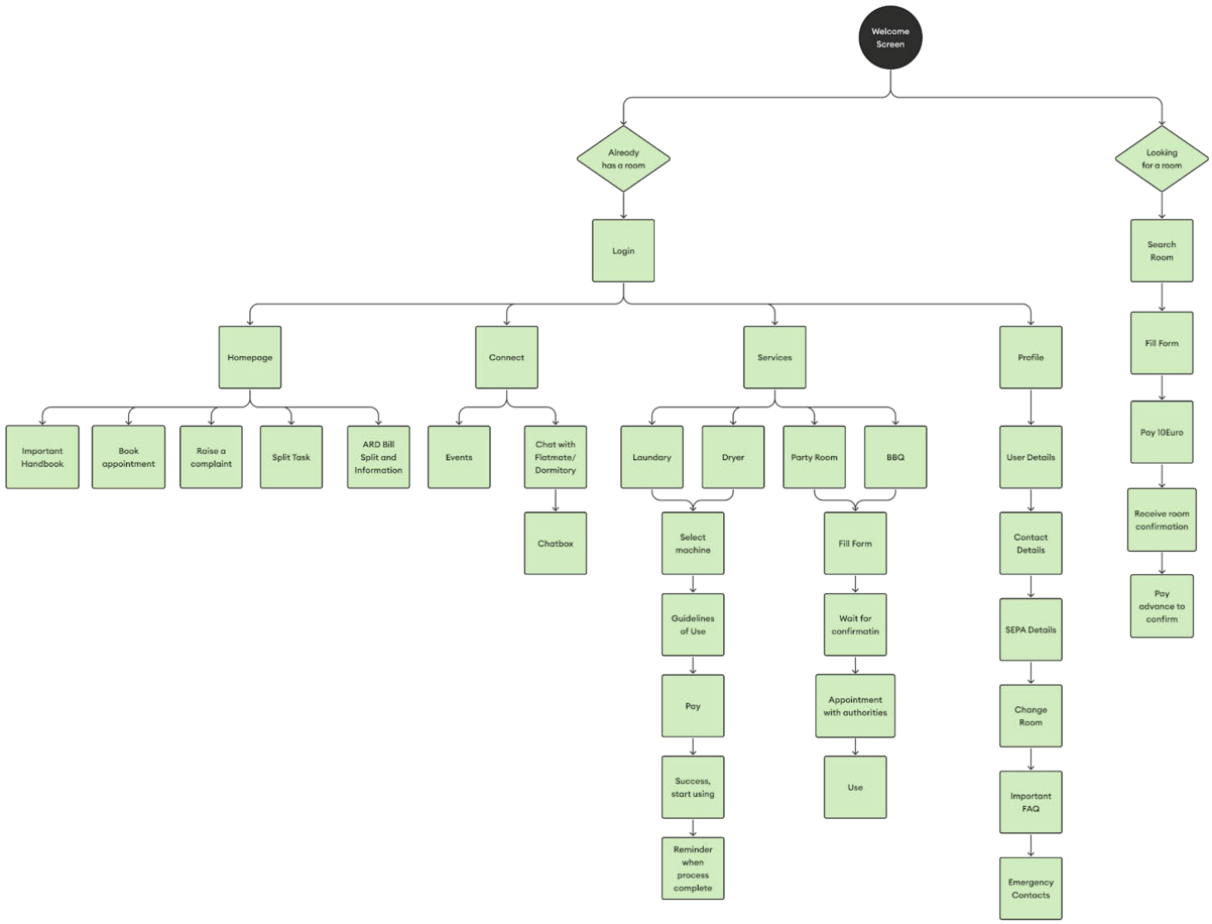


Figure 5.5: User flow created for this research

5.3 Wireframes

Following the creation of the userflow, the subsequent phase included generating wireframes to provide a fundamental framework for the application (Figure 5.6). This aided in comprehending the location and method of designing a certain feature. The visual depiction of diagrams known as wireframes provides the project's fundamental foundation and structure (54). It also gives details on the relationships between each component of the design. It is helpful during the first stages of product design brainstorming since it serves to summarize the design without providing many specifics. A clear picture of the product's functionality Information Architechture (IA), page structure, and layout is given via wireframes. Wireframes place more focus on the outline and structure of the product than on the images or visuals. There are three types of wireframes (55):

1. **Low-fidelity wireframes:** These wireframes serve as the first foundation and are intentionally simplistic. These drawings are mostly executed using traditional tools such as pen and paper and are crafted without relying on grids, pixels, or predefined forms.
2. **Mid-fidelity wireframes:** These are a little advanced from the lo-fi wireframes with more structure and priority given to the features of the product than to the content. That

is it still lacks texts and images.

3. **High-fidelity wireframes:** These wireframes display pixel-perfect precision and include an improved structural arrangement compared to mid-fidelity wireframes.

In this thesis, a combination of mid-fidelity and high-fidelity wireframes were generated utilising the design tool Figma.

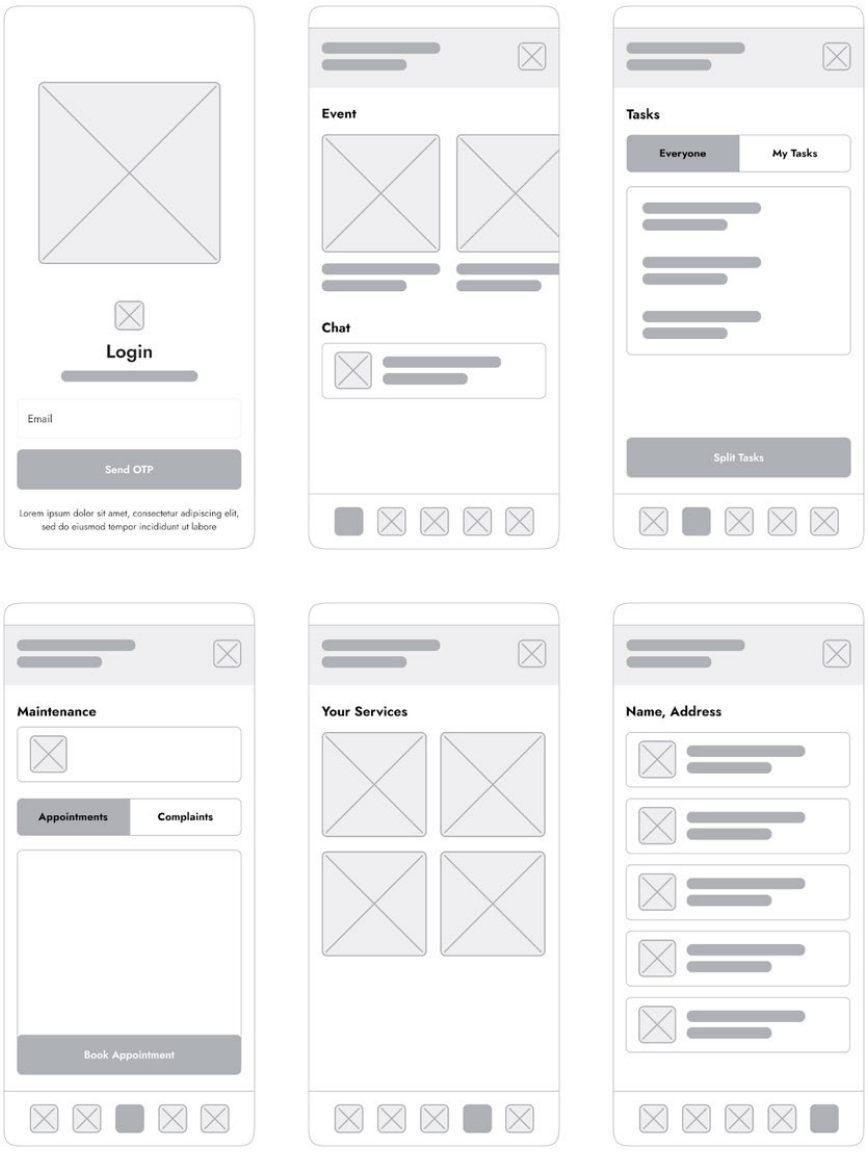


Figure 5.6: Wireframes designed for the Studierendenwerk App

5.4 Design

Following the wireframes, the next crucial step in the design process is the creation of real visual designs, including colors, appropriate elements, typefaces, and other necessary components. In

the design phase, the goal was to create a design that is easy to use and efficient for the users. During the creation of the user interfaces, three factors were taken into account, as recommended in the article by the Interaction Design Foundation (56):

1. **Usability and Likeability:** It's critical that users can do their tasks quickly, simply, and with the least amount of difficulty possible. The design must be invisible, implying that it should be as easy to execute as going about one's everyday business. It should be easy to use and have a straightforward user experience so that the user can accomplish their final goal.
2. **Enjoyable:** The designs should be enjoyable and satisfying to use.
3. **Communicate brand values:** Additionally, the UI must convey the brand's design principles and values. The Studierendenwerk brand colors are used in the design to promote both consistency and brand identification.

The UI was designed using the notion of modular design. A modular design technique involves breaking intricate design systems into elementary modules to enhance the organization of complicated systems. This design approach consists of breaking down the complicated system into distinct and autonomous components. The notion was first developed by Starr in 1965 (57). The module design is used across several sectors, such as in the case of IKEA furniture, where diverse pieces of furniture are provided that need assembly into a unified whole. LEGO is another well-known illustration of modular design. Modular design enables anyone to personalize, recycle, enhance, or uphold product designs. The design technique is very advantageous and practical as it enables designers to efficiently reuse design components.Using reusable components in design is an extremely sustainable method that not only saves time but also enhances workflow efficiency. Furthermore, it ensures uniformity throughout the whole system (58). There are five elements of modular design (59):

1. **Purpose:** The module should have a distinct and well-defined purpose.
2. **Interface:** The module's interface should be comprehensible and user-friendly.
3. **Encapsulation:** The data and implementation of the module should be kept private.
4. **Implementation:** It should be straightforward and uncomplicated to execute.
5. **Connection:** The interdependence between each module should be minimized.

5.4.1 UI Design for Student Application

The user interface screens were generated with the design software Figma (Figure 5.7). These aspects are intended to enhance the quality of student living by promoting organisation, efficiency, and pleasure in dormitory life. The user interface was designed by categorising the elements into components, and each screen was constructed via the Figma components, which are capable of being reused. According to Paul Rand, design is more than just assembling, organising, or editing. It is about adding value and significance by clarifying, simplifying, embellishing, and making it serious, compelling, and even somewhat intriguing (60). This is the first version of the design, which was subjected to user testing and got feedback.

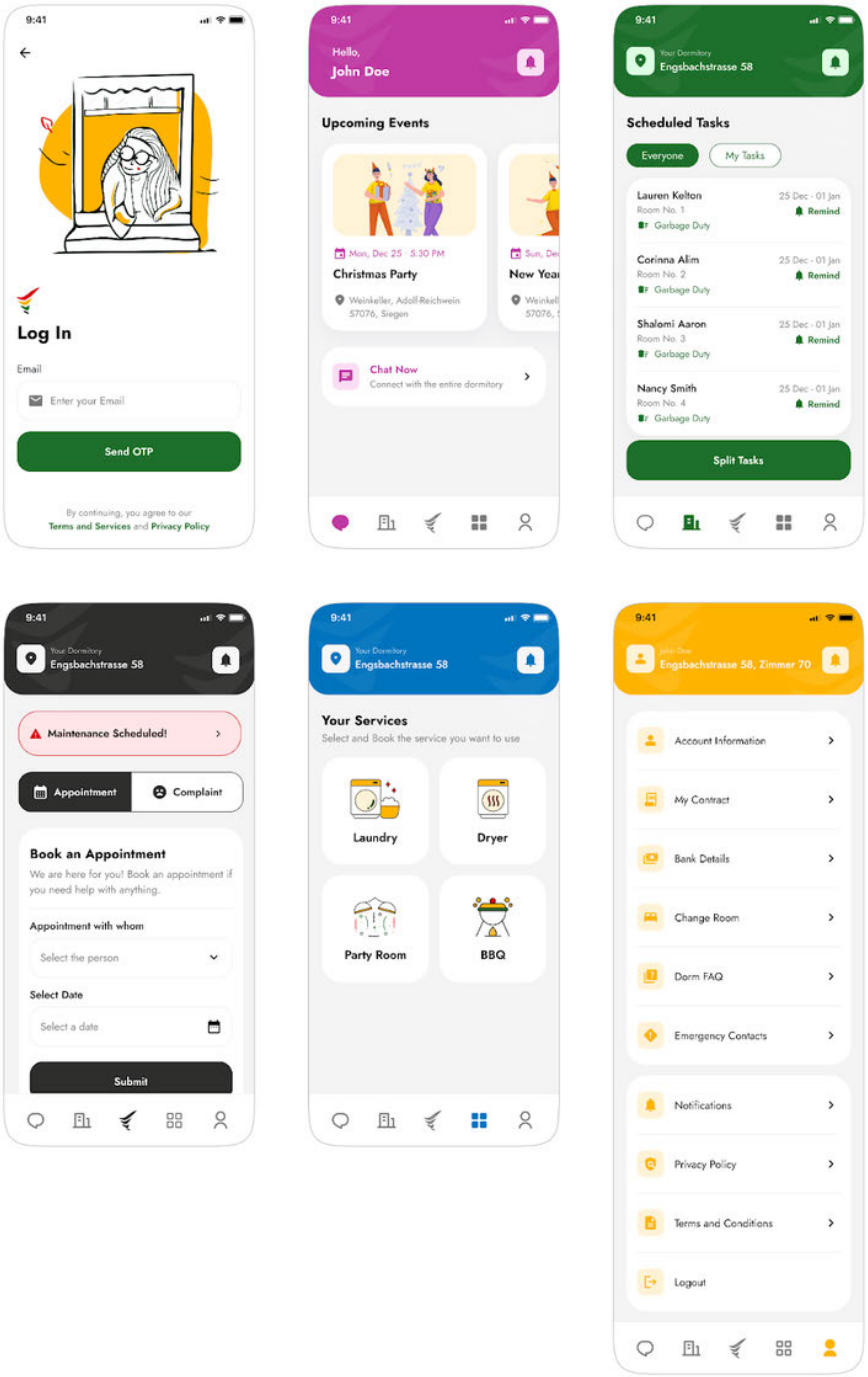


Figure 5.7: UI Design Draft 1

5.4.2 UI Design for Admin Panel for Dormitory Administration

Despite the little information available on the demands and requirements of the dorm administration, a few designs were developed for them, considering the assumption that they still rely on a manual method of communicating with the students. As mentioned previously, since there are relatively few people employed in student management and a significant number of students, a well-featured student management administration system could be very useful. Therefore, **6** necessary admin panel features were carefully considered. It will be connected to the student application, and this panel will receive any requests sent by the students.

Dormitories: In this view in the figure 5.8, the authorities can see the overall count of students residing in the dormitory at a single glance. They can easily switch between several dorms using the drop-down menu and get detailed information on the inhabitants. In addition, they can conveniently view the number of available vacant rooms.

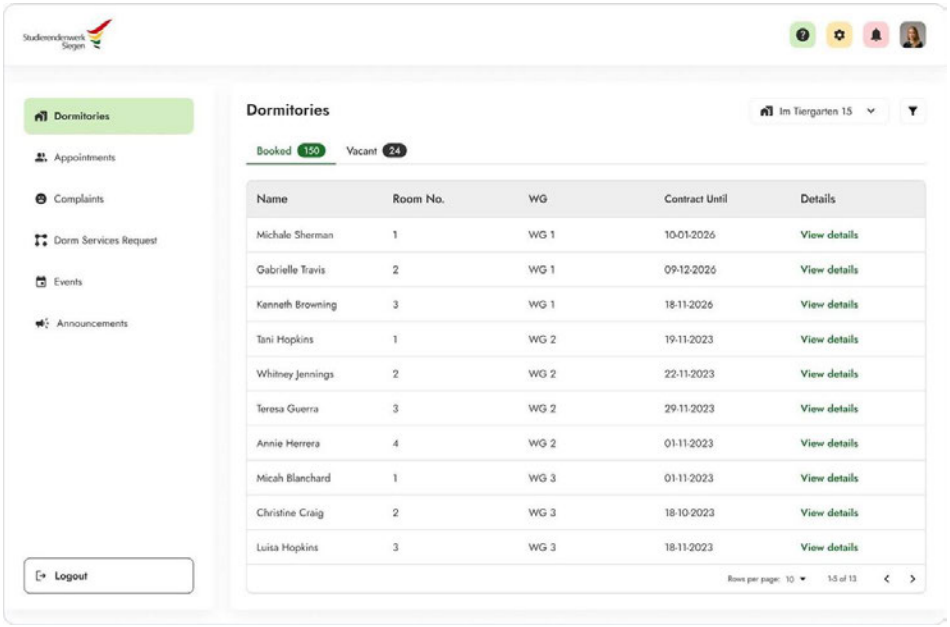


Figure 5.8: Dormitory Details UI

Appointments: The authorities can access and review all the appointments made by the students, and they may choose to either approve or reject any of these appointments. In addition, they have the flexibility to access the appointments that have already been arranged. In addition, they have the option to set their availability slots. Furthermore, users have the opportunity to set up their availability slots, giving them the flexibility to only accept appointment requests within their designated time periods (Figire 5.9).

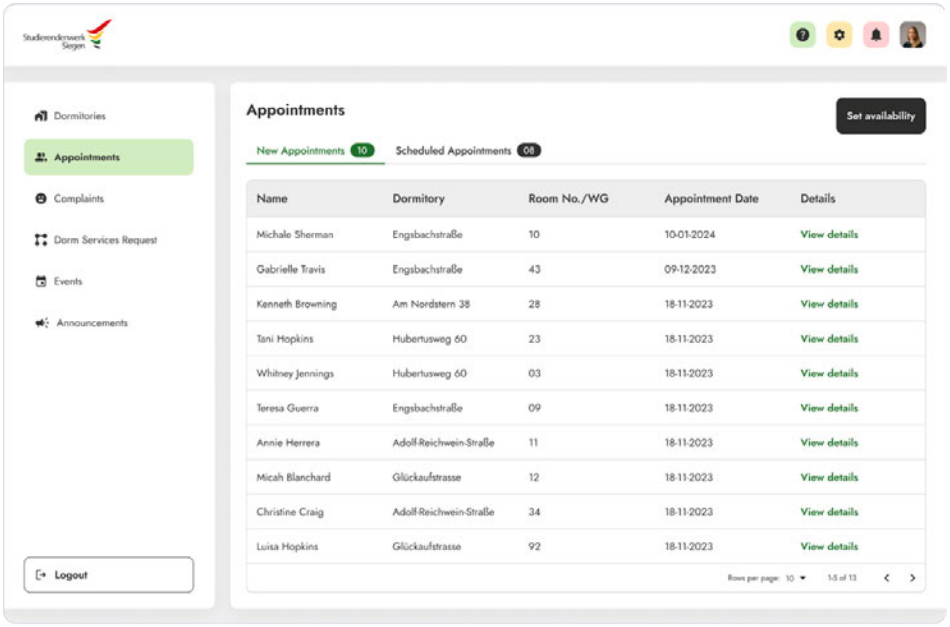


Figure 5.9: Appointments details UI

Complaints: In this screen in the Figure 5.10, users may categorise the complaints by dorm or choose a particular dormitory from the drop-down box. They can also view new, active, and resolved complaints, ensuring that no problem goes overlooked.

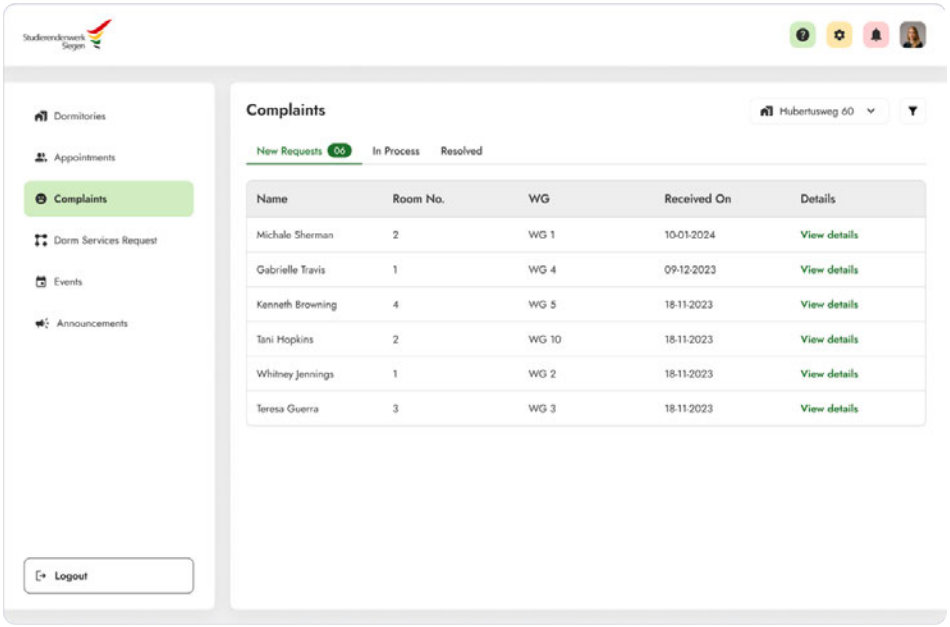


Figure 5.10: Complaints details UI

Dorm Service Requests: In this screen in the figure 5.11, users can reserve any service, such as a party room or BBQ room, students may submit a request with the desired date, their contact information, and a description of the event.

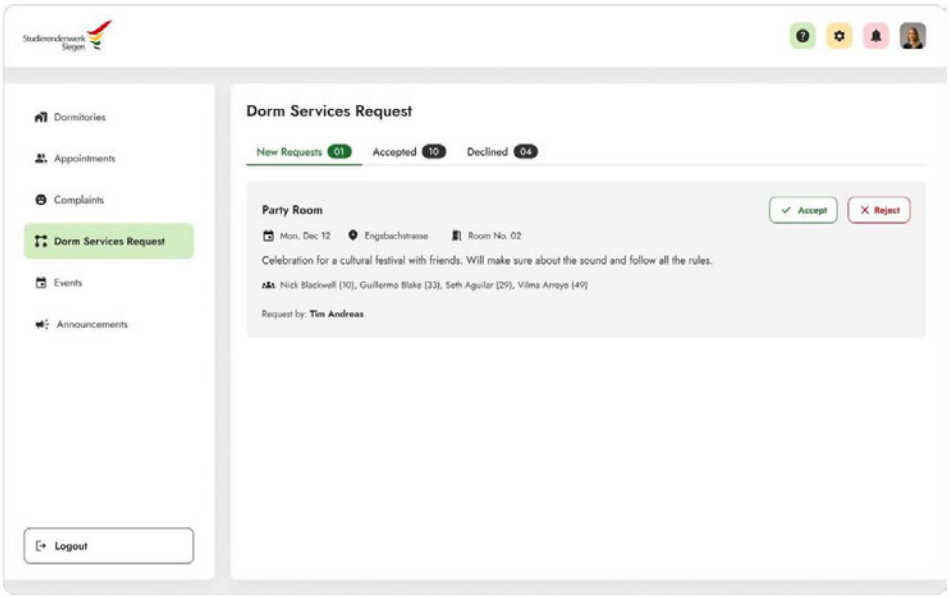


Figure 5.11: Dorm services request details UI

Events: The administration can create events and send out notices to the students. For instance, if there is an event taking place in any of the dormitories and the administrators want to inform all the students, they can do this by using the administrative panel (Figure 5.12).

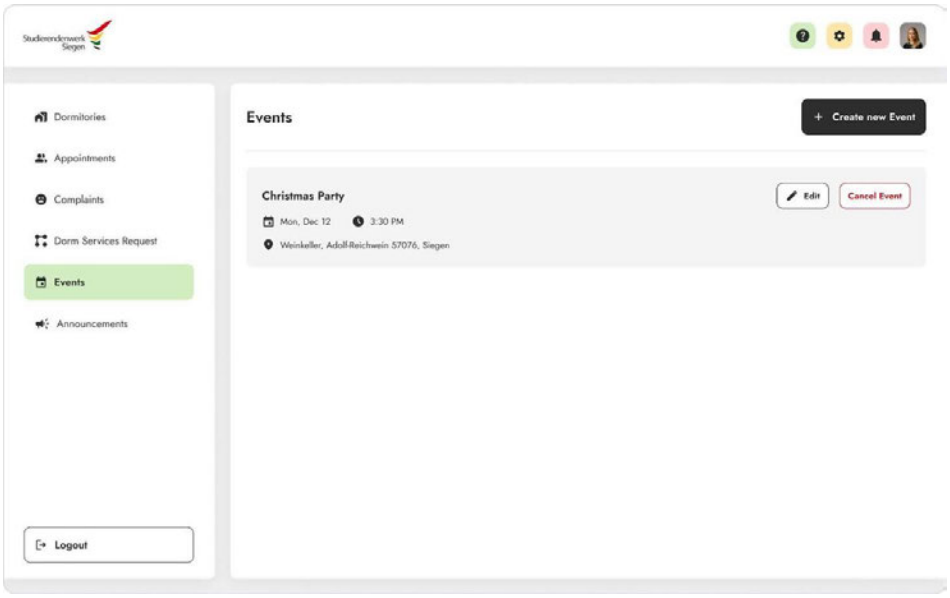


Figure 5.12: Events details UI

Announcement: The administration additionally has the flexibility to provide announcements using the administration panel. For instance, if there is any scheduled maintenance, the platform may be used to alert all students. They can be used to provide specific information like the date

and kind of repair. In the event of a change in plans, administration may update or cancel the maintenance notification (Figure 5.13).

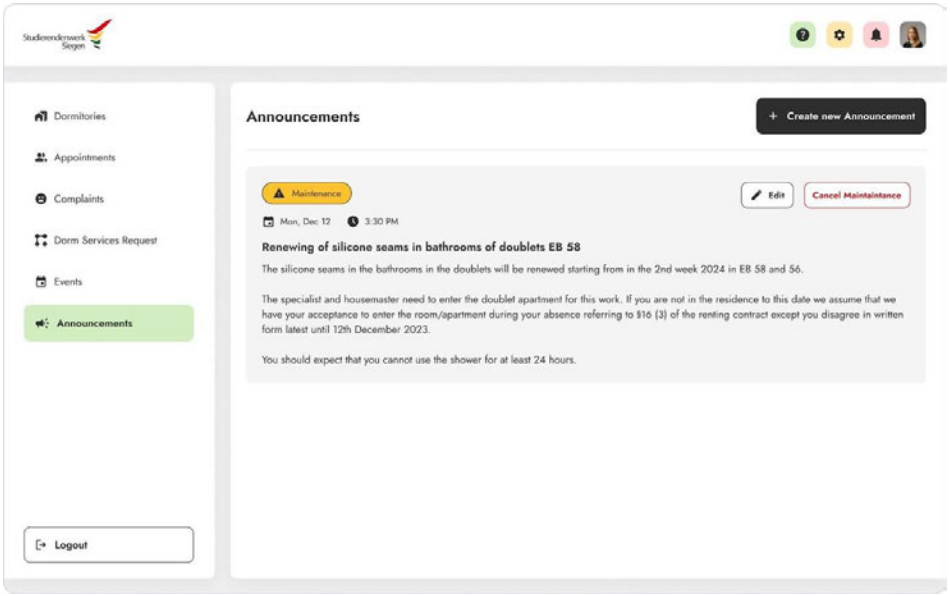


Figure 5.13: Announcements details UI

6 Evaluation

Evaluation refers to the methodical gathering of data on the practicality of a product. This data is gathered from a group of users who are involved in a certain activity or working in a given environment (20). The phase is crucial since it involves testing the product's design with several consumers. This chapter provides a thorough explanation of the evaluation procedure and the subsequent outcomes. This input will be included in the next part of the iteration process.

6.1 Usability Testing

Barnum defines usability testing as the process of monitoring users as they interact with a product, as they complete actions that are both authentic and significant to them (61). Usability testing is essential for confirming that the product meets user needs and allows them to do jobs efficiently and effectively. It is crucial to make sure that the application efficiently satisfies the requirements of its users. According to Moran from Nielsen Normal group, the primary objectives of usability testing may vary depending on the research, but they often include the three objectives as displayed in the figure 6.1 (9):

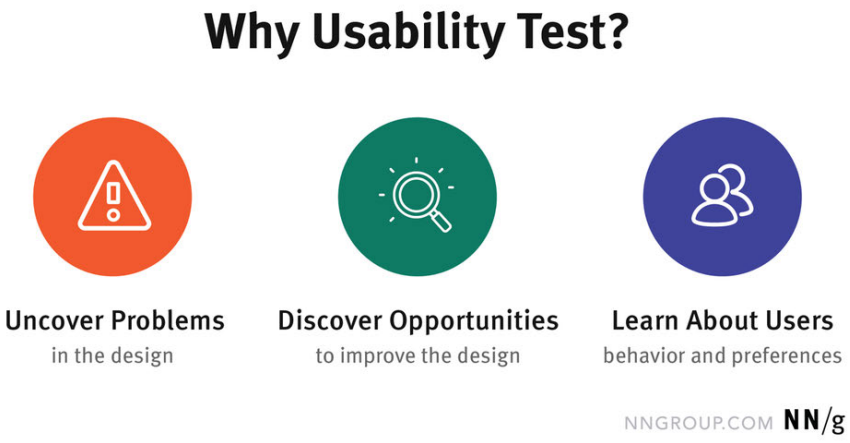


Figure 6.1: Why Usability Test (9)

1. Discovering or identifying flaws in the design of the product or service
2. Identifying or uncovering chances to enhance the design of the product or service
3. Understanding the target user's behaviours and preferences

Moran additionally suggests that there are several kinds of tests for evaluating the usability of a product. However, the fundamental components of these tests remain consistent, namely the facilitator, tasks, and the participant who executes the tasks under the guidance of the facilitator.

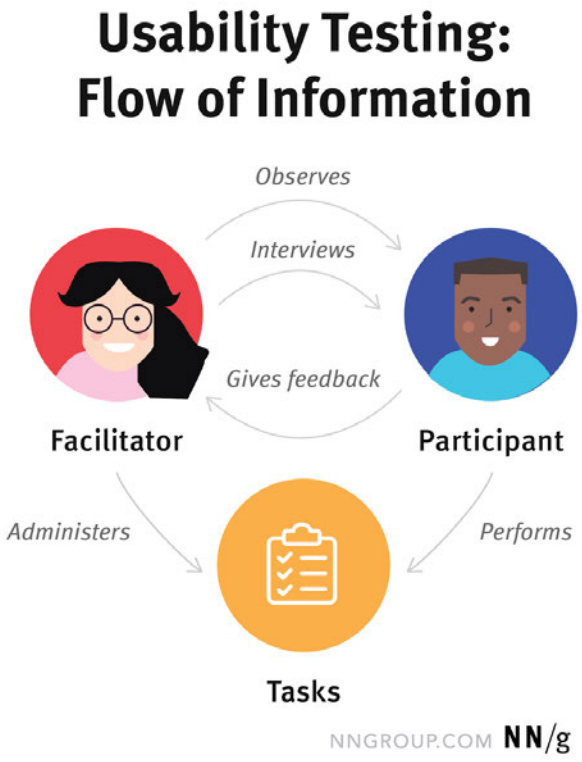


Figure 6.2: Usability Testing: Flow of information (9)

6.1.1 Testing Methodology

The testing included the selection of a small group of students who took part in a cognitive activity involving verbalizing their thoughts. Their cognitive processes and their manner of engaging with the device were documented, and their input was then used to enhance the product's design.

1. **Participant Selection:** A total of 5 students were selected to reflect the varied demographic of the dormitory. These students were assigned certain tasks to undertake and were asked to perform the tasks while thinking out loud.
2. **Test Scenarios:** Participants were instructed to do typical actions such as scheduling an appointment, filing a complaint, and accessing the main page.
3. **Feedback Collection:** Observations were conducted to assess the user experience in terms of usability, navigational effectiveness, and overall user satisfaction.

In following table 6.1 provides the list of feedbacks that were recieved from the students.

Sections	**Feedback**
Navigation	Confusing navigation as there exist too many options for the users to click on.
Appointment and Complaints	Participants had difficulty accessing detailed information about their bookings and the status of their complaints.
Communication	Communication regarding general matters with the authorities is absent in the first version. For instance, at the shared bathrooms of Engsbachstraße dormitory, if the handwash runs out, residents are required to send an email to the house meister to request a refill.
Task splitting	The structure was complex, causing the user to be confused by the process and they were unsure of how to continue.
Connect	The chat interface included many intricate features such as the ability to send priority messages and create groups, which were not essential for the users.

Table 6.1: Feedback received from the users

7 Re-iteration

After the evaluation phase and considering feedback from the testing, reiterations of designs were made. A design iteration refers to the iterative process of continuously enhancing a product at regular intervals via redesign. These design revisions might be categorized as high-fidelity, mid-fidelity, or low-fidelity sketches (62). Designing a great user interface in the initial or first draft can be very challenging. Even the most skilled designers may not be capable of producing a flawless design on their first try. Therefore, iterations of any design are crucial for continuous development and progress (63).

Homepage: Upon logging into the account, the user lands on the homepage (Figure 7.1).

Before	**After**
Difficult navigation with so many options that were not clear	The new design features only three navigation options, simplifying user navigation. Each icon is accompanied by text, enhancing comprehension. At the top, users can access their profile and view notifications. The homepage also offers quick access: • Booking appointments • Filing complaints • Splitting tasks with flatmates • General FAQs about the dormitory and its rules. Consolidating these functions on the homepage provides users with immediate access to the most frequently used features, eliminating the need to navigate through multiple screens.
Navigate to new screens to view maintenance	A maintenance section now provides information about upcoming maintenance directly on the homepage.
Previously, there was no direct option for students to communicate with authorities outside of complaints or appointments.	In the new iteration, a chat option is introduced, represented by a chat bubble icon at the bottom right of the screen, allowing students to easily communicate with authorities.

Table 7.1: Changes in the Homepage UI

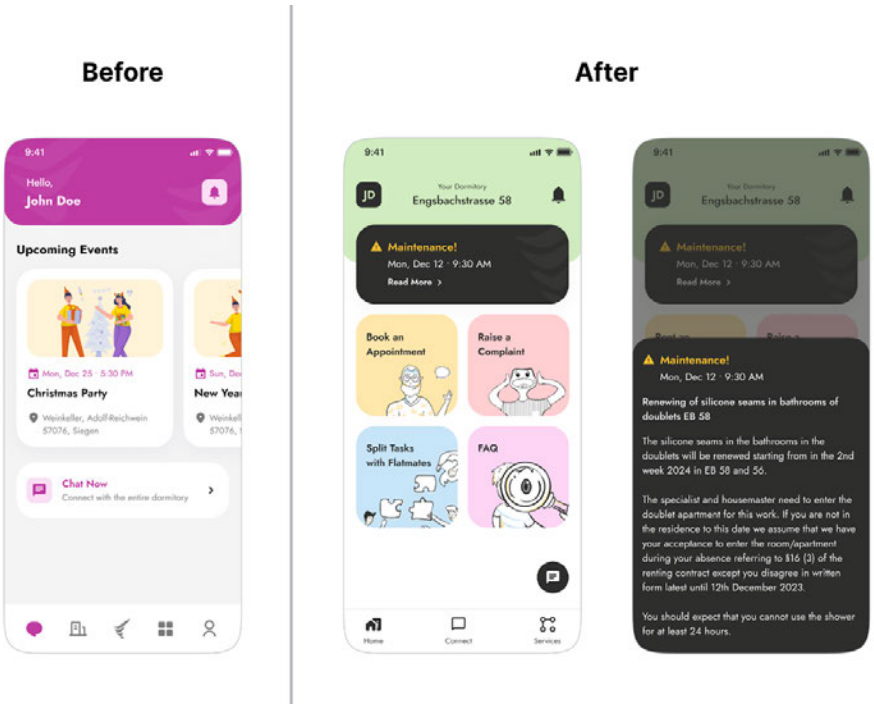


Figure 7.1: Changes in the Homepage UI

Book an Appointment: The before and after designs are depicted in the figure 7.2.

Before	**After**
The booking appointment section was located on a separate navigation screen	By integrating it into the homepage, we enhance accessibility for users by providing the users an option for quick access.
Users could not view their booked appointments and could only make new bookings without access to detailed information.	In this iteration, users can now access comprehensive details about their appointments.
There is no available option to access the status of their appointment. Whether it has been accepted or declined.	Users can view the current status and whether it is still pending or has been approved by the dormitory administration.

Table 7.2: Changes in Booking Appointment UI

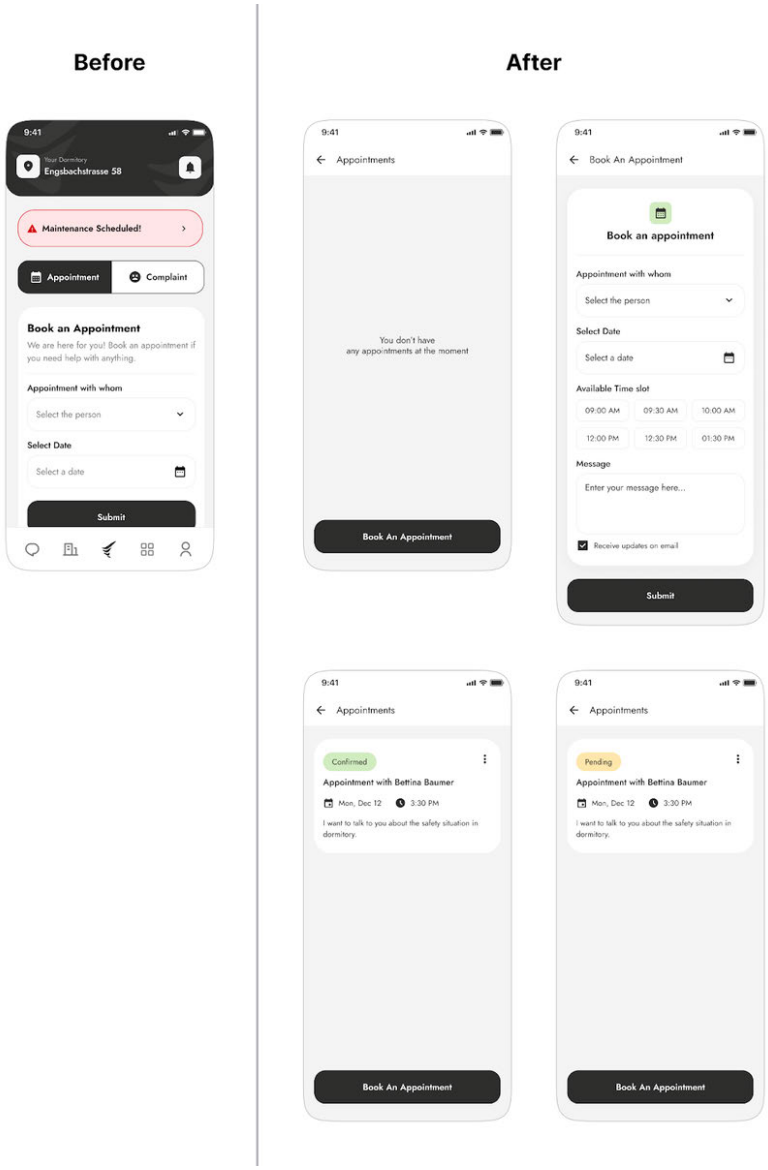


Figure 7.2: Changes in Booking Appointment UI

Raise a complaint: The before and after designs are depicted in the figure 7.3.

Before	**After**
In the previous drafts, users could not see the status of their complaints or when those would be resolved	Users can now view the status of their complaints, and administrators can set a resolution time from their admin panel. Students can see this information in their application, including the scheduled time for resolution.

Table 7.3: Changes in Raising Complaints UI

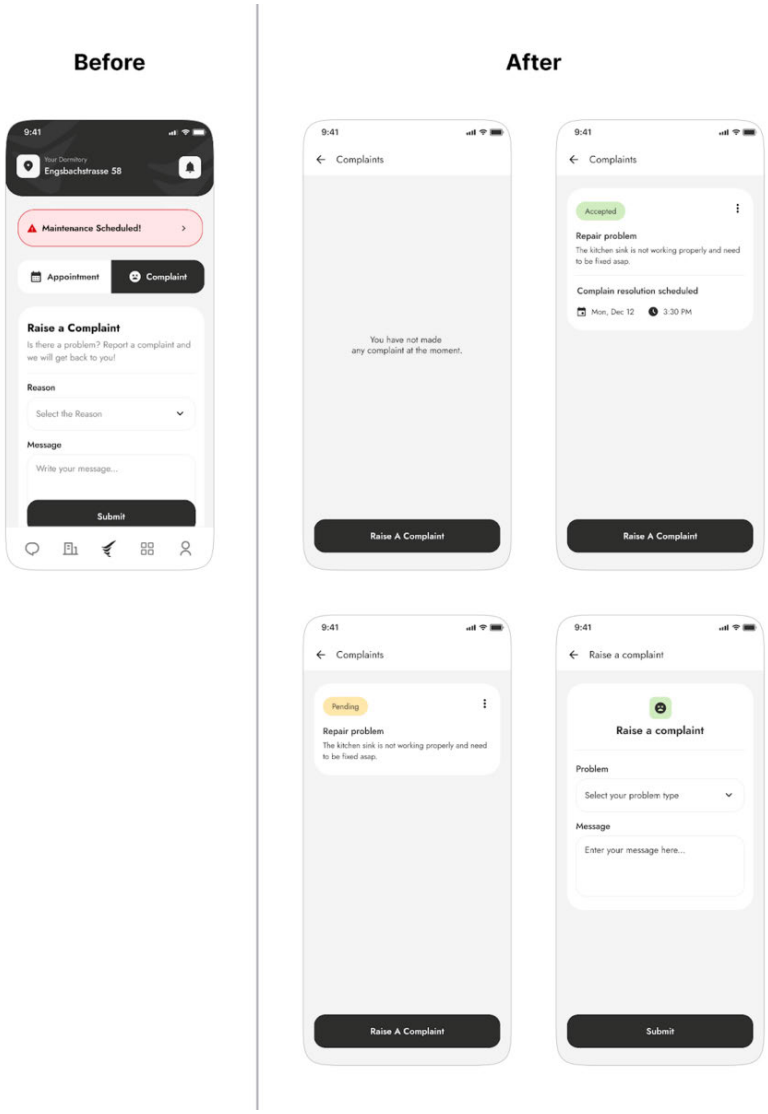


Figure 7.3: Changes in Raising Complaints UI

Split Task: The before and after designs are depicted in the figure 7.4.

Before	**After**
Users regarded the structure of the initial screens to be a bit complex as it lacked some structure	In this iteration, the tasks are arranged according to the most recent tasks rather than the names of the students. This method focuses on the task's date.
Users were struggling to understand where to focus on the page	The reminder button has been made larger, making it easier to click as well as the interactive buttons are visible.

Table 7.4: Changes in Raising Complaints UI

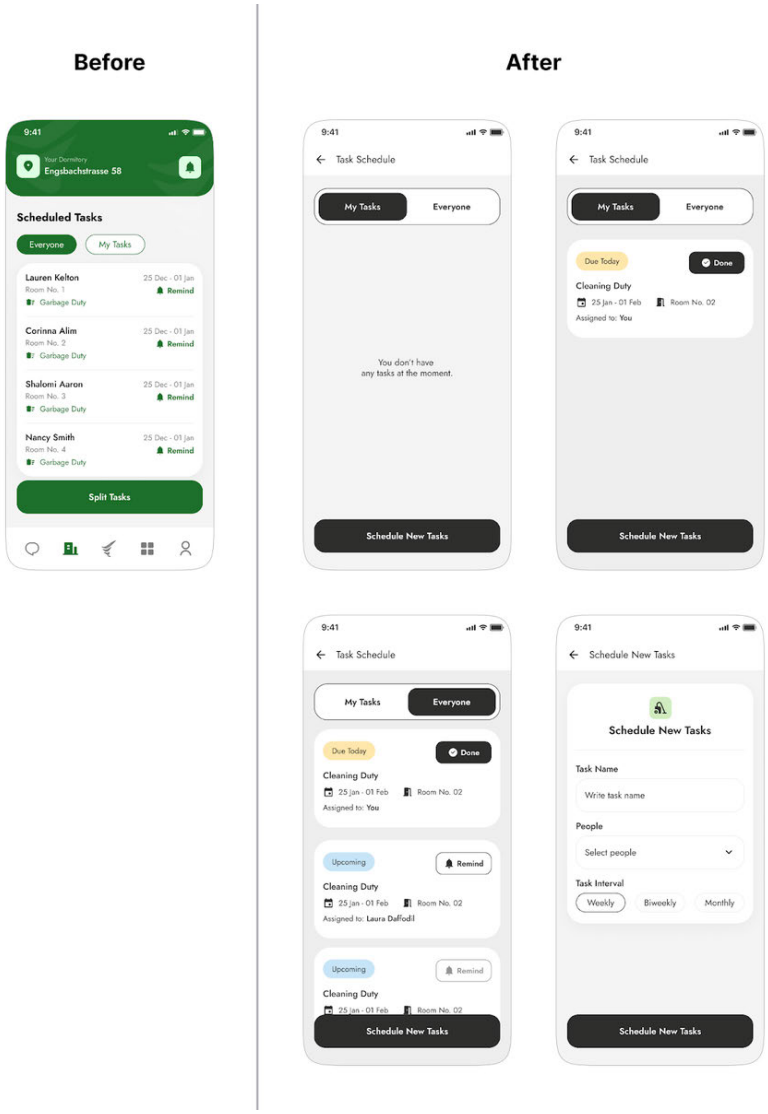


Figure 7.4: Changes in Splitting Tasks UI

Connect: No major changes in UI, just structural changes as shown in the figure 7.5.

Before	**After**
-	Connecting with students has been transferred entirely to new secondary screens
Earlier had a priority message function to send important messages in the group chats	The priority message function has been removed since it could be misused by most users by creating false alerts

Table 7.5: Changes in Connect UI

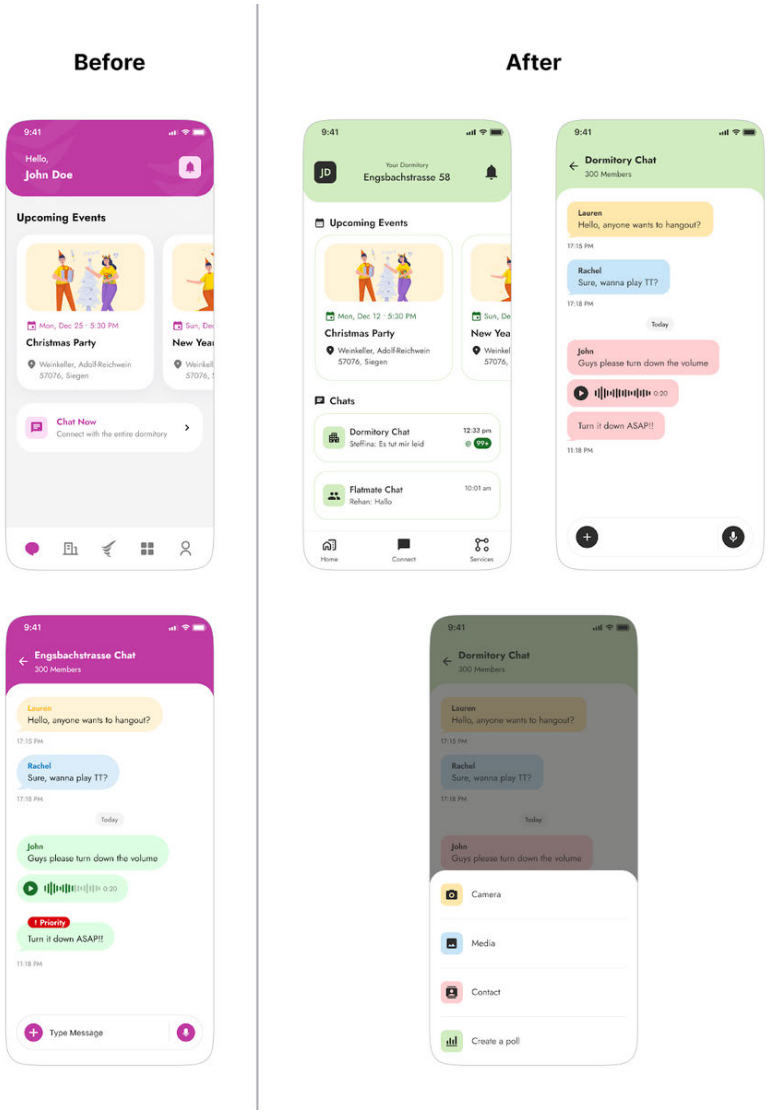


Figure 7.5: Changes in Connect UI

Services: These screens are simplified iterations of the original proposal, enabling customers to reserve washing machines, dryers, party rooms, or BBQ rooms as shown in the figure 7.6.

For laundry bookings, users can view the number of available machines, check which machines are in use, and see the remaining time for each laundry cycle. If the timer is off and clothes are still in the machine, users can send a reminder to the machine's current user, prompting them to retrieve their laundry. This feature helps students avoid unnecessary trips to the laundry area, only to find no available machines. Additionally, users can pay for the machines with their cards, making the laundry process cashless and eliminating the need for coins. For booking the party room, students can fill out a simple form with details such as the desired booking time, responsible persons, and a description of the event. This streamlined process makes it easier to request and secure a room for events.

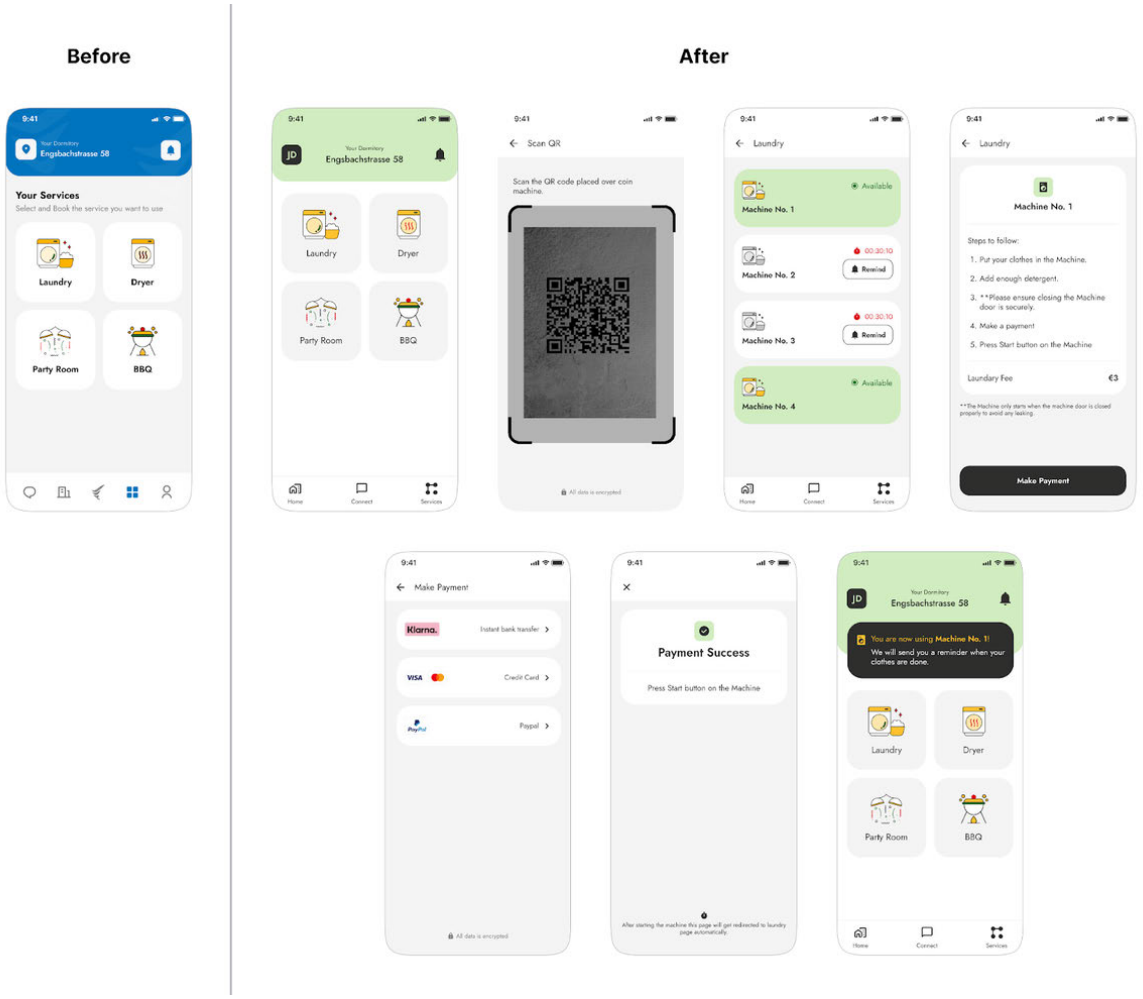


Figure 7.6: Changes in Services UI

User profile: These screens are identical to the original, but the color has been changed as yellow had low accessibility and less contract. The inside screens have been polished more, and the overall structure of the screens has been increased. Within the user profile, individuals have access to their account details, including information pertaining to their rental agreement, expiration date, and timely notifications prompting them to renew the contract if it is nearing its conclusion. They may also end their contract anytime they wish as shown in the figure 7.7.

They may request a room change, by multi-selecting the dormitory that they want to live in. If individuals have a particular room preference, they may indicate their choice and pay an additional price of 50 euros to switch rooms via their profile. They can also see emergency contacts in the event of an emergency.

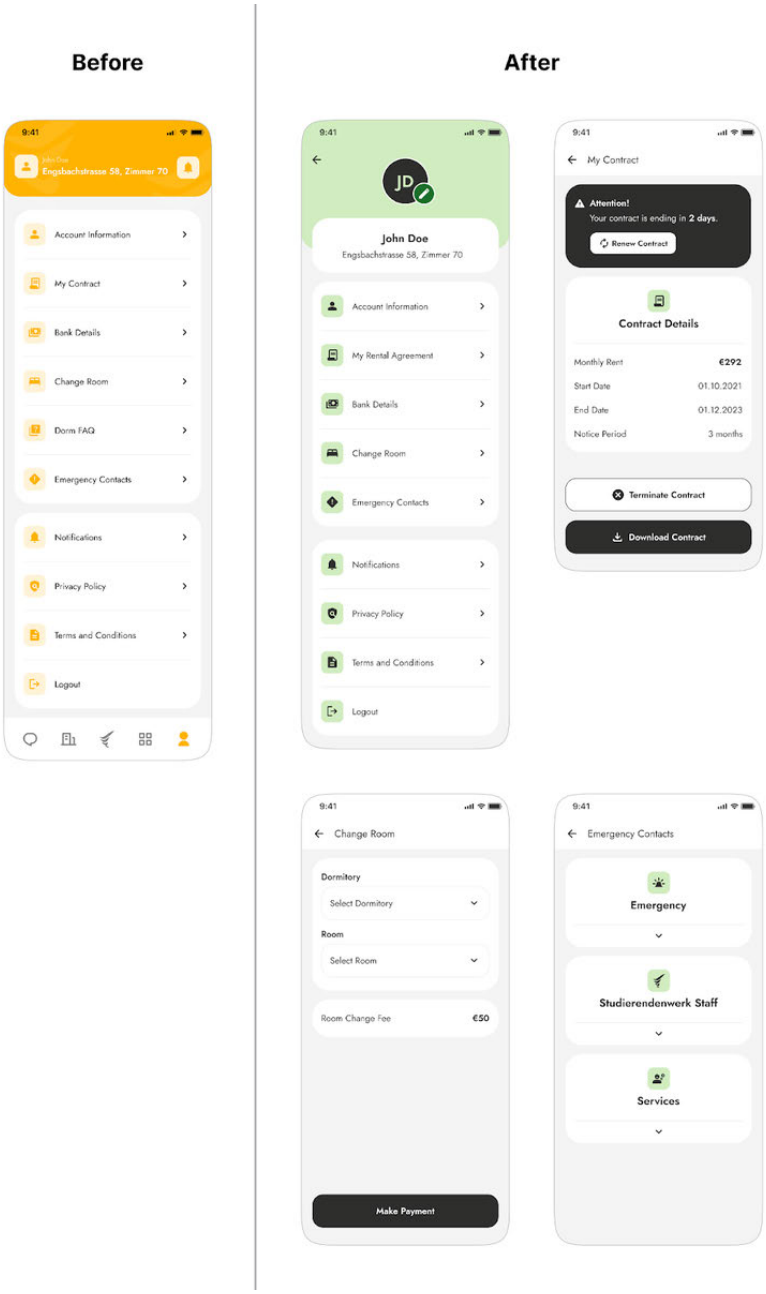


Figure 7.7: Changes in User Profile UI

8 Discussion

Some arguments of this thesis are consistent with some aspects of the existing literature and are connected to themes that have been previously explored in the context of other dorms. The current research findings indicate that a communication tool for direct communication is advantageous and valuable for the users. This occurrence has also been seen in the exisiting literature. Additionally, a system that enables students to oversee their contracts and other pertinent information is also beneficial and was also seen in the literature.

8.1 Challenges

There were a few challenges on the way to completing this thesis and these were:

1. **Diverse problem areas:** Upon conducting interviews with the participants, it was discovered that there exist a multitude of distinct challenges. For instance, one student recounted being locked out of her residence over a weekend and expressed uncertainty about how to resolve the situation. Another student said that he resides close to the laundry area, and other students use the dryer throughout the night, causing significant disruption to his sleep. Despite the prohibition on using the dryer at night, students persist in doing so. Each of these difficulties is distinct, and it was a struggle to categorize them and devise a comprehensive solution to address numerous issues simultaneously.
2. **Dormitory-specific problems:** Some of the challenges encountered by the students were dormitory-specific. Some dormitory students have experienced theft and vandalism in their dormitory, while others find it unusual that such issues may occur in a dormitory. For example, there have been 2-3 vandalism occurrences on Engsbachstraße, and the students want a camera installed at the front door to protect their security.
3. **Managing biases:** As a fellow student residing in the dormitory, I had the challenge of conducting unbiased interviews without influencing or misinterpreting the participants' issues, so as to avoid forming any personal prejudices. It was crucial for me to maintain an open mind and attentively listen to their issues without any preconceived notions, adopting the role of a researcher rather than that of a dormitory resident.
4. **Lack of Administration research:** The Studierendenwerk dormitory did not participate in this procedure owing to its heavy workload. Currently, there are only two individuals overseeing the students, and it was challenging to secure their availability for assistance in this research project. Insufficient administrative research prevented the evaluation of the intended result. The concepts were created only on assumptions, without any specific insights to comprehend the administration's needs and requirements from the admin panel. There may be some features in the admin panel that might be beneficial for administration,

while others may not be. However, it is difficult to make definitive statements without doing a study on the matter.

8.2 Limitations

1. **Research sample size and sampling method:** The sampling method employed and the sample size were relatively small in comparison to the total number of students residing in the dormitory. Additionally, each dormitory presents distinct issues, and the research objective can be influenced by the cultural aspects of the predominantly international student population. It is possible for biases to occur since what may be considered an issue for one student may not be seen as a problem by another student.
2. **Success evaluation:** Due to the limited sample size of the study, evaluating the efficacy of the product is challenging. In order to correctly evaluate the efficacy of the project, it is important to conduct further evaluation with a bigger sample size of students, regardless of the favourable comments received about the application by a less samle size of users.

8.3 Future Scope

This user interface may be put into use later after being tested by more students. This approach has several benefits to offer. This solution currently has a large number of features. These features may be reduced in the future to make it more focused. Alternatively, further features could be introduced. Both the admin panel and the application may be made more precise in the future with the correct direction and implementation from the administration. To get better outcomes, further study must be conducted. The students proposed several features they want to be included in the application. However, due to the program's existing abundance of functionality, their proposals were disregarded. By doing thorough user research, it is possible to implement even these notions in the future. These thought-provoking concepts need further investigation to ascertain their feasibility and potential to enhance or alleviate the student experience. One such idea: locker rooms shall be introduced so that students may store their belongings in the lockers, exactly to avoid having to pay an extra three months' rent after the contract expires. Another concept that emerged throughout the conversation with the students was the opportunity to connect with others who have similar interests and values. A significant number of students have a sense of social isolation when they lack companionship for conversation. Students propose using an application to connect with like-minded individuals, such as a German-speaking companion from their dormitory, in order to practise the language. This concept invites further research, and it is very likely that favourable outcomes would be achieved via further study and future implementation. Upon thorough evaluation of this application, this solution shall be suitable for continued development and may be recommended to the central Studierendenwerk of all institutions. This application has the ability to function as a robust and essential software for each of the Studierendenwerk organisations. It can be further improved and more features may be included according on the requirements of each unique dormitory. It would be intriguing to find out the feasibility of deploying this application on a wider scale, including several dormitories.

9 Conclusion

This thesis used a meticulous method to address the difficulties encountered by students residing in the Studierendenwerk dormitories in Siegen. This study emphasises the wide array of concerns faced by students, such as maintenance problems, communication and complaints. The study indicates that there are many concerns and responses from the students on the desired features of the dorms. Several concerns and suggestions brought up by the students were not practical to tackle in this thesis because of their physical or intricate character, which could not be handled using digital technologies. The main goal of creating applications is to provide a user-friendly interface that specifically aims to simplify administrative tasks. The application underwent evaluation using a significantly small sample size, which also resulted in receiving positive feedback. However, a small sample size may introduce biases, and doing thorough testing with a bigger cohort of students would facilitate obtaining input from a broader population, resulting in more accurate and impactful results. The obtained input was valuable in refining the design and identifying specific areas for development and additions. Once the solution is assessed by a wider audience, it has the potential to be adopted not just by Studierendenwerk Siegen but also by other dormitories with similar setups. This adoption would improve the overall living experience. In addition to this, the administration solution of the admin panel also has the capacity to effectively handle a substantial number of pupils and their inquiries. The future scope of this project will prioritize removing unnecessary features and including features that are essential to the majority of users. The only way to do this is by incorporating an increasing amount of input from the consumers. This thesis emphasizes the significance of user-centered design in generating effective and efficient solutions.

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