

Thesis Project Portfolio

Roommate Management System: An Effective Tool under the COVID-19 Pandemic

(Technical Report)

Analysis of Importance of Roommate Relationships: A Study of Roommates Relationships and Effects

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

Weilian Wu

Spring, 2022

Department of Computer Science

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Sociotechnical Synthesis

(Executive Summary)

Designing Software Application to Roommate Management System

Accommodation is a social problem that cannot be ignored for everyone in the United States.

More than one third Americans live with at least one roommate who is not romantic partner. Therefore, having a good relationship with roommate is also a crucial problem for everyone. For my STS research project, I focus on how the relationship among different roommates is important and analyze how to improve the relationships. For my technical project, I focus on how to design a software application and provide good services to users who want to find good roommates.

In my STS research, I was trying to figure out the importance of having a good relationship with roommates. It is an interesting topic for me because I think it is a social problem related to most everyone in the United States, especially for college students. It is important to consider various factors what bring a good roommate such as the same daily habits, hobbies and similar living conditions. At the beginning of my STS project, I was struggle on how to find the importance of having a good relationship with roommates. According to my research result and theory, the relationship of roommates could affect mental and physical health. Therefore, it is important to have a good relationship especially for college students. The greatest challenge of my project was designing the features with python and its frameworks. It requires me to collect user's information and give reliable result to see. For my technical project, I was trying to design a software application with python and its framework-Django. It is an effective tool for me because its flexibility and reliability are helpful.

The features of applications are created based on the user's reflections. My research project focus on designing specific features. For example, the daily information survey and the survey will provide a grade to other users. My analysis of the roommate management system used the percentage to determine whether he or she will be a potential good roommate.

My STS and technical research projects try to explain the importance of good roommate's relationship and how the web application helps people in society improve the current condition. Both of my research projects focus on how to implement programming language and its framework to provide service for customers. The research project still requires more improvement and maintenance on different features.

I would like to thank my STS professor: Kathryn A. Neely, my Technical Professor Daniel G. Graham and my Advisor N. Rich Nguyen. Thanks for their help on my final project and I truly appreciate them that spend time helping me in some occasions. Thank you everyone. I really enjoyed every minute with you.

Technical Report T

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Daniel G. Graham, Department of Computer Science

Roommate Management System: An Effective Tool under the COVID-19 Pandemic

CS 4991 Capstone Report, 2022

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Abstract

During the COVID-19 pandemic, the increasing price of an acceptable housing accommodation became acute, making it crucial to have a roommate finder application for people who want to share a house or an apartment to reduce financial pressure for all roommates. Developing a good web application is necessary, and it is easy to design a good user experience website by implementing HTML, CSS, python and its frameworks in web. A good roommates management system is anticipated so that those who move to a new place can easily find roommates by accessing online. In my web application development, I will collect user preferences and design features based on user reflections. In the future, the web application would be launched online so that people can access it readily.

1 Introduction & Background

“Computers are good at following instructions, but not at reading your mind.” – Donald Knuth, the “Father of Analysis of Algorithms”

The housing market in the U.S. faced unprecedented challenges during the COVID-19 pandemic. Accordingly, more young adults chose to live with parents and more adults chose to share a living place with other roommates. There are various roommate finder applications on the market such as Reddit or Roomies. However, these apps consider whether the application’s recommendations produce a compatible and a satisfactory roommate. In my technical project, so my purpose of design a simple but useful roommate management system is necessary so people can find potential good roommates for themselves.

2 Related Works

A previous project published in Bootcamp and designed by Panwar inspired my project. Panwar argues that his design solution for a problem statement works in a mobile app (Panwar, 2021). As software engineers, we must assume that potential difficulties exist in designing a web application. Panwar assumes that a user’s behavior will influence the products. However, the validity of decisions cannot match the level of decisions based on real data. Therefore, it is crucial to make trade-offs in the design process.

3 Process Design

Developing

3.1 Review of System Architecture

There are various of programming frameworks on the market, and each one of them is designed to address different customers’ needs. Python and its framework Django are the core of the web application. By implementing the open-source framework based on Python, it is flexible and

simple to deploy different features of the web application (Figure 1) Django also has a strong template tool which are files with HTML code that are used to render data. It is an effective software tool designed to build and run web application. The MVC architecture provides an architectural pattern with 3 parts: Model, View, and Controller/Template(Figure 2). Its unique architecture provides a clear structure for software engineers to build an application.

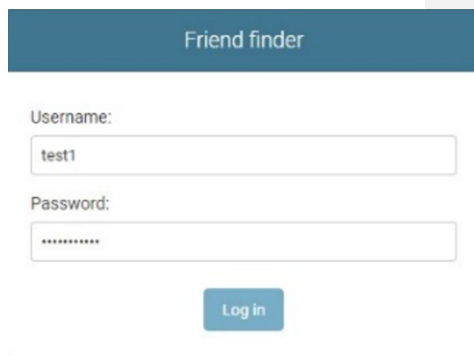
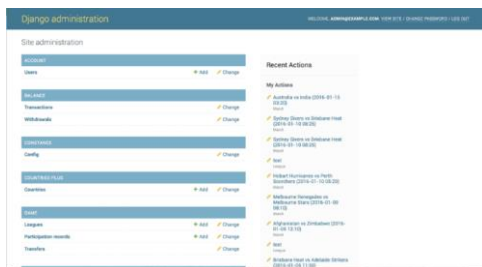
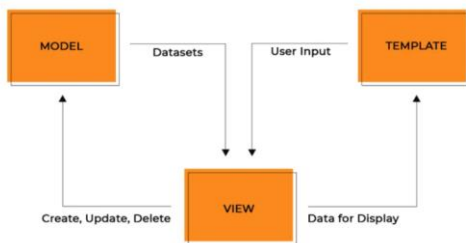


Figure.1 Django Administration Interface

Figure.2 MVC Architecture



3.2 Web Page Requirements

The roommate finder application meets all general requirements of a web application.

The user interface must be clear to see and

operate. User expectations are one of the most important requirements of the web application. They can create their own accounts with usernames and passwords (Figure.3) Users can edit their own information, including username, real name, roommate preference, etc. (Figure.4) User expectations also decide functional requirements. The web application allows customers to send and receive friend requests to others and the algorithm provides a percentage showing the degree to which an individual is a preferred roommate based on the customer’s preferences.

Figure.3 Example of User Login Page

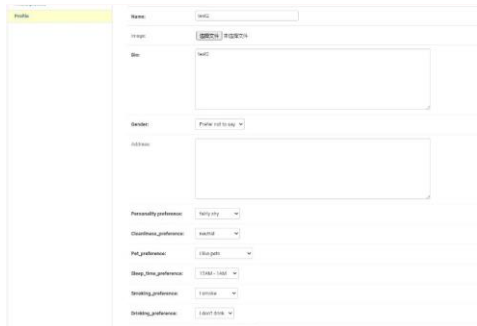
3.3 Challenges

Deploying the web application online will be the first major challenge because deploying manually may causes errors and it is difficult to fix errors and tasks. The features of the web application are also ever-changing. It is also hard to deploy new features automatically, and it is hard to be observed whether everything is working as

expected. The maintenance costs much more time than usual, so it is important to improve the performance before it is deployed online to public.

4 Results

I deployed Django framework with Python HTML, CSS, and bootstrap for the front-end development. The roommate finder app will be deployed on cloud application platform so users can access the web application freely online. Anyone can use our app to navigate and look for their roommates online. Therefore, new users can create their own username and password. Then they could enter more accurate information about themselves. It becomes a user-friendly app but requires more improvements.



The image shows a user profile form with the following fields:

- Name: [text input]
- Age: [text input]
- Sex: [text input]
- Gender: [text input]
- Address: [text input]
- Personality_preference: [dropdown menu]
- Clothing_preference: [dropdown menu]
- Food_preference: [dropdown menu]
- Sleep_time_preference: [dropdown menu]
- Smoking_preference: [dropdown menu]
- Drinking_preference: [dropdown menu]

Figure.4 Example of Basic Features

5 Conclusion

People have an obvious preference for using software applications during the COVID-19 pandemic. It is important to have clear trends regarding what software engineers should do. Therefore, as an engineer at the University of Virginia, it is necessary to build an application to satisfy users' requirements. Software engineers can develop applications with current programming language and its frameworks.

6 Future Work

The process of designing and maintaining an application requires lots of time and energy. Users' requirements for app functionality are always changing. Therefore, it requires adequate information from customers so that software engineers can develop more features of the roommate management system. The designed page may not perfect, and it requires more attention to fix. Collecting users' responses is also crucial when software engineers design an application. Therefore, protecting user privacy is another important issue for the whole process. It is also important to consider how to ensure that users will enter accurate information or not. In the future works, more relative aspects could be considered into the application's features such as international or cultural background.

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- [4] Figure.2 From *Documentation*. Django. (n.d.). Retrieved April 6, 2022, from <https://docs.djangoproject.com/en/4.0/ref/contrib/admin/>
- [5] Figure.3 From my private project. The Django Roommate Finder App.
- [6] Figure.4 From my private project. The Django Roommate Finder App.

STS Research Paper Title

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Advisor

Kathryn A. Neeley, Associate Professor of STS, Department of Engineering and Society

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Signed: _____ Weilian Wu _____ Date: _____ 04/24/2022 _____

Approved: _____ Date: _____

Introduction

“The spread of computers and the Internet will put jobs in two categories. People who tell computers what to do and people who are told by computers what to do.”

---Mar Andreessen, Entrepreneur, Inventor of Netscape

In the United States, accommodation is playing an important role in people’s daily life, and according to a Pew Research Center study, more and more Americans are “increasingly sharing a home with other adults who they are not romantically involved” (Fry 2020). Accommodation keeps high rates, and people are more difficult to find a shelter which satisfies their preference. According to the statistics, 36% American households rent their home (Miller 2021). Having a roommate becomes a common phenomenon in the U.S. Therefore, having a good relationship with roommates is crucial because positive relationships may help protect people from psychological disease, and it can be an important aspect of one’s entire life (Erb Renshaw Short Pollard 2014).

A good roommate relationship can be a crucial aspect in people’s daily life. The relationship among roommates could be a type of interpersonal relationship commonly and distinctively. The conflicts between different roommates are also common experiences for people in the U.S. Although research on roommate relationships has existed for decades, there are not enough literatures which introduce clearly and summarize enough about the roommate relationships. In this paper, I argue that good roommates’ relationships could affect people in mental and physical health, and we can better understand the relationship by applying ethical method so that it could be led to the development of having a good roommate relationship. The next step is to explore how good relationship works and what engineers can do for improving the good relationships.

Argument I: The Relationships Lead to Mental Health and Future.

Relationships are extremely important for those people who have a roommate, and it is also common for college students. Most college students live with roommates no matter in campus or out of campus. The relationship between different roommates is an important aspect of one’s life. However, a satisfactory accommodation has been a challenge for most people because having a good relationship with other roommates is not easy. The financial consequences of having a rate of house are also severe. According to the statistics provided by White House, the price has seen extraordinary growth in home values (The U.S. Government 2021). Meanwhile, the Zillow Observed Rental Index(ZORI) shows that the rental price is increasing rapidly(The U.S. Government 2021). The notable trends in two figures are obvious to see that the price of housing and renting is increasing rapidly. Difficulties emerge now, so for most people, it is important to have a roommate who can share the rent so that people can reduce the financial pressure. Therefore, the affordability matters for everyone in the United States.

Figure 1. CPI: shelter and housing prices

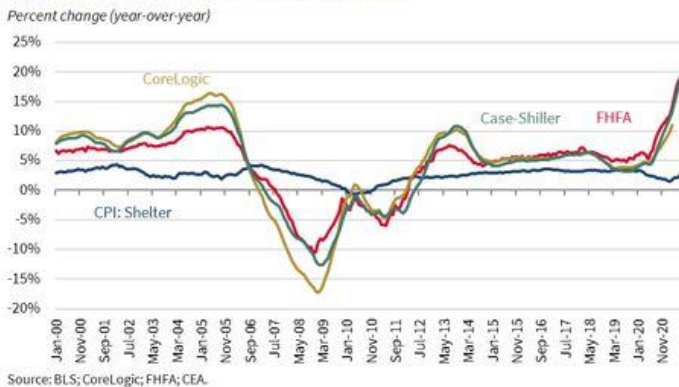
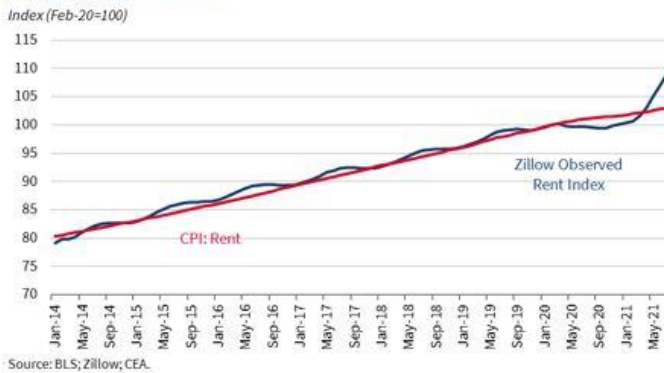


Figure 2. Rental prices



Bad relationships between roommates are usually exist , so the potential psychological disease may be related to negative roommate relationship (Oh Kim 2021). It is obvious to see that positive roommate relationships can help and protect people from psychological distress. Therefore, positive relationships can enhance or improve mental and physical health, and they are absolutely necessary for everyone in the U.S. The purpose of the research is to analyze how important of good roommate relationships for people in the U.S. so that we can understand them and develop the relationships to a better direction. For previous research made by Erb, Renshaw, Short, Pollard at George Mason University, they argue that the importance of college roommate relationships and analyze the social issue with systemic conceptualization. In that research, they believe that the roommate relationship could be protective or risk factors for adjustments and apply for Family System Theory to see analyze roommate relationship conceptualizations. The ethical principle is also necessary when we deal with users' private data and the public research.

Argument II: Methods

Family Systems Theory is a theory that assumes one family member's functioning influences and will be influenced by interactions within various family relationships (Doherty & McDaniel 2010). In the research study, they argue that Family Systems Theory suggests the subsystems within the family could affect other subsystems and overall family functioning (Erb Renshaw Short Pollard 2014). Therefore, Family Systems Theory could be applied to roommate relationships because the relationships between roommates have similar features of families. They also introduce some related studies about roommate relationships. For example, Anderson, Keltner and John (2003) performed a study of 37 same-sex pairs of on-campus roommates. After 9 months of this study, they found that that roommates' emotional expressiveness become more significantly larger (Erb Renshaw Short Pollard 2014).

Furthermore, Family Systems Theory can help us understanding the conceptualization of college roommate systems by giving explanations for interpersonal dynamics among roommates originates (Erb Renshaw Short Pollard 2014). In a study which conducted by public southern university, 17 students from chological functioning and other 21 from positively functioning of origin environment played interpersonal conflict scenarios. The results show that both male and female participants from dysfunctional family environments exhibited significantly more negative behaviors than participants from positively functioning environments. As an engineering student, I believe that more ethical principles could be applied to analyzing how software improve the relationships between different roommates.

Neely and Luegenbiehl's "Beyond Inevitability: Emphasizing the Role of Intention and Ethical Responsibility in Engineering Design" can be applied to engineers (Neely, Luegenbiehl 2008). Neely and Luegenbiehl argue that the design-focused discourse will focus on terminology of engineering design which places more emphasis on individual ethical responsibility and control. Engineering ethics usually involve a broader range of ethical and moral problems in society. Engineering design also contributes a meaningful approach for research purpose. The product of a web application is an example of software engineering. Neely and Luegenbiehl argue that engineers have responsibilities to realize the ethical principles with large-scale technologies. For software engineers, it is more important to have these responsibilities because software engineers always deal with users' private information and algorithms would reflect information to users. Many software engineers don't realize their ethical responsibilities. For example, software engineers in Facebook (Meta) don't realize that Facebook is exacerbating social polarizations and its algorithms are damaging Americans (Benton 2021).

Argument III: Results

The most important aspects of the results are how important of good relationships could be and Family Systems Theory could be applied to different groups of roommates. First, the groups of roommates are interpersonal systems like family members. Roommates live together and have similar challenges like negotiating expectations of other roommates or family members. Roommates' mental and physical health are interdependent with others. People could also bring familiar relational patterns from their families of original relationships into new roommate relationships. Therefore, Family Systems Theory enhance people's understanding and explain how roommate relationships could be developed over time. Moreover, examining the

individual differences such as race and sexual orientation between roommates could also give an opportunity to see different patterns that influencing the functioning of roommate relationship (Erb Renshaw Short Pollard 2014). Since people have different personal hobbies, daily habits or other behaviors such as drinking or communication styles, the research has shown that the roommate relationship may be related to these with optimal or detrimental outcomes. In that research study, they explain a conducted study which has 180 pairs of roommates in a large Midwestern university. This study indicates that roommates who have similar communication patterns are high in willingness to communicate and reported the highest roommate satisfaction and liking (Martin & Anderson 1995). It could be better to understand how roommate relationship works between different races or ethnicities in the U.S. because the cultural effects can't be ignored. For engineers, it is important to know what ethical principles could lead to a good management of roommate system. By applying Beyond Inevitability, engineers can know the responsibilities when designing a software application.

Conclusion

The research indicates that roommate relationships are extremely for everyone in the U.S. and its potential effects could not be ignored. Bad relationships could lead to psychological mental issue and trigger more disasters in the future. By applying Family Systems Theory, we can see that roommate relationships could be improved, and it enhances our understanding of roommate relationships to a higher level. Future studies of roommate relationships could compare the results with different studies. It requires more improvement on understanding on

how different cultural backgrounds of different roommates' relationships. For future study, it could explore more on different cultural effects and sexual effects for different genders. My purpose of this research paper is to improve our knowledge of how the roommate relationships affect people in mental and physical aspects and for engineering students, it requires us to have good ethical practices to design a roommate management system. Therefore, as an engineering student, it is important to know how the software could affect the relationship between different roommates.

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Prospectus

Undergraduate Thesis Prospectus

Proposals for Consensus-Building Social Media
(technical research project in Computer Science)

The Public's Reliance on Social Media: The Risks Emerge
(sociotechnical research project)

By

Weilian Wu

December 10, 2021

On my honor as a University student, I have neither given nor received unauthorized aid

on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

Weilian Wu

Technical advisor: Daniel Graham. Advisor, Department of Computer Science

STS advisor: Peter Norton, Department of Engineering and Society/ Kathryn A. Neeley,
Associate Professor of STS, Department of Engineering and Society

General Research Problem

How does social media foster social polarization in the United States?

How has social media fostered social polarization in the United States? As the pandemic has increased recourse to social media as a substitute for face-to-face sociability, it has amplified social media's effects. According to the Pew Research Center, almost two-thirds of Americans consider social media a negative influence on their daily life (Auxier 2020).

Proposals for Consensus-Building Social Media

How have program developers proposed or developed social media platforms that foster and promote consensus building across diverse social groups?

As the negative influences of social media increase, different social groups are starting to focus on how programmers design the software. Since the rising concerns for Americans, they consider how to promote the current virtual environment and consensus across diverse social groups. Diverse social groups can realize how engineers work and then how Americans can leverage social media to promote the society.

project goals

The purpose of this project will address is to focus on how the programmers who developed social media platforms are influencing diversity in the U.S. Software engineers are often unaware of the impacts which their programs have on others. Software engineers are involved in all processes when designing and finally launching to society, so professional and ethical developers are indispensable in a project team. Therefore, my technical research will focus on collecting data from diverse social groups and analyze how the engineers give different influences on them, especially under the global pandemic environment because people are more dependent on social media now.

unusual constraints

Diverse social groups may have different attitudes towards social media, so there are difficulties in collecting data. Therefore, a comprehensive dataset will provide a trustable result. Since I collect data from publicly legal website, this does not violate the law or the privacy of others.

state of the art

Obtaining valid and efficient data and analyzing it will be the core of the project, and the social polarization will be beneficial from the project(Bessi 2016). Since the social media is influencing diverse social groups, the project shows a great improvement on the social media.

Future analysts can take advantage of this project and promote a better algorithm in the software. By collecting comprehensive data, it is the best way that I can analyze useful information from it, and step will avoid inaccuracies in undone part.

methods

I will mainly use web-crawler to collect data from publicly available website and use Python and MySQL as the program tools to analyze and generate the data. I will not conduct experiments or model systems since the data comes from the publicly website.

conclusion

I would like to conclude a result correctly in how the software developers have developed platforms for social media and foster consensus building across diverse social groups in the U.S. By the end of this project, I would like to see how engineers will impact our society and I hope younger generations can also analyze the data in the future and compare with my collecting data to see what difference will be.

The Public's Reliance on Social Media: The Risks Emerge

In the U.S. since 2015, how have Facebook and its critics competed to determine if and how Facebook's damaging social effects are to be managed?

Facebook and its critics are competing to determine how its damaging effects will be managed. Will it continue to be substantially unregulated, in the hope that it will regulate itself, or will Facebook be subjected to public regulation? Social media has tended to accept and even promote divisive and inflammatory content as a means of elevating user engagement. The effects have been polarizing. Hu et al. (2017) found that Facebook's emotional effects vary by user

personality type; for example, “perceived social support and psychological well-being” were “stronger for introverts than for extraverts.”

Facebook has changed the political landscape of the U.S., especially through its newsfeed (Madrigal, 2017). Although it has become a notorious means of propagating misinformation (Bene, 2017), Mark Zuckerberg, CEO of Meta Platforms, claims he invites Congress to regulate Facebook. Zuckerberg argues that regulators should restrict harmful content, election integrity, privacy, and ensure data portability (Isaac, 2019). He has approved Amplify, a project he says will show people more positive stories about their social network through Facebook’s newsfeed (Mac & Frenkel, 2021). Yet Facebook’s critics are unpersuaded.

Privacy advocacies such as the Privacy Agency strive to protect the user’s online privacy (Kika, 2021). Jim Steyer, the CEO of the nonprofit Common Sense Media, has pressed Congress to adopt legislation that would better protect children’s privacy (Ghaffary, 2021). Alex Abdo, litigation director of the Knight First Amendment Institute at Columbia University, called for legislation “providing a safe harbor for research and journalism that is in the public interest and that respects user privacy.” The Knight Institute urged the company “to amend its terms of service to permit public-interest investigations that respected user privacy” (Knight, 2021). Facebook did not agree.

Frances Haugen, a former Facebook insider, has urged Congress to subject social media to strict regulation. (Ghaffary, 2021). Daniel Hanley, a senior analyst at the anti-monopoly group Open Markets Institute, argues that Haugen’s proposals don’t target at the underlying business model (Lima, 2021).

According to Kitchens et al. (2020), Facebook tend to polarize its users because its algorithm promotes user engagement, expressed for example in “likes” and comments. Inflammatory content tends to drive the most engagement.

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