Improving Functionality and User Experience in the Search for Housing

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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

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ABSTRACT

The housing search process in the United States is needlessly complicated and time-consuming. One potential solution is a mobile- and offline-friendly housing search web application that helps users find housing or protect their current housing situation. I propose designing an application that utilizes search functionality and machine learning (ML). Figures help to illustrate the features of the application. Some outcomes of this project include an improved understanding of housing search applications and the difficulties of integrating certain software features as well as a cohesive design for the proposed application. The next steps might include further information gathering from potential users, corresponding updates to the design based on user feedback, and a working prototype of an application feature.

Index Terms - Housing search, machine learning, progressive web application.

1. INTRODUCTION

The housing search process is flawed and not all resources are available to those who need them. Millions of Americans use websites to search for housing. A Census Bureau survey from 2019 to 2021 found that 46.0% of Americans used websites to search for housing (Rhodes & Bragdon, 2023). However, 54.3% of affluent households, or those that were 200% above the federal poverty line, tended to use websites to search for housing compared to 30.2% of low-income households who tended instead to use word-of-mouth to search for housing, indicating a lack of access to online housing search resources. Low-income communities tend to have lower access to the internet, which may be part of the reason (de Wit, 2023). In addition, the information available in housing listings and the listings themselves have been found to vary along racial and class lines, resulting in continued neighborhood segregation which started with the Depression-era practice of racial segregation or redlining (Besbris et al., 2021).

Making the housing search process easier and more accessible can make the difference between vulnerable people finding new homes or ending up homeless. Low-income people and minorities are more likely to live in areas with lower health outcomes due to redlining which segregated neighborhoods and stifled their development. Such groups are also more likely to suffer from displacement from gentrification or the process in which a low-income community is radically transformed with rapid investment and an influx of higher-income migrants. As a result, the cost of living increases too quickly and pushes out long-time residents.

2. RELATED WORKS

Besbris et al. (2021) use millions of listings and data analysis to explore how online listings for apartments display different information depending on the racial and socioeconomic demographics of the neighborhood where the property is located. For example, landlords tended to post listings that mention qualifications such as minimum incomes and credit scores in neighborhoods

with predominantly Black and Latino residents while posting listings that mention amenities such as building materials and kitchen appliances in predominantly white neighborhoods. Such behavior can contribute to increased and continued segregation of neighborhoods by race and socioeconomic status.

Yoo (2019) of the US Census Bureau argues that machine learning can be used to determine which areas are experiencing gentrification and will experience it in the future using publicly available data. ML is the training of algorithms on large amounts of data to find patterns and develop the ability to predict future outcomes. Yoo used the following criteria to determine if a housing unit underwent gentrification over time: 1) if all household members in a housing unit are different from the members that were there in the past; 2) household income growth exceeds the income growth rate of the average Census tract/land unit; and 3) households reported moving for better jobs, homes or neighborhoods. Yoo trained various types of ML models using Census, commercial, and other types of public data. Results suggested that apartments rented by high school-educated people in urban centers are more likely to be gentrified. Yoo found that the random forest classifier was the most accurate at predicting gentrification with an accuracy of 83% compared to the next highest 75%. Yoo argues that ML models can serve as early warning systems of gentrification and a way to combat developers who are already aware of which neighborhoods to target for development and higher property values.

3. PROPOSED PROJECT DESIGN

The proposed project is a mobile- and offline-friendly housing search web application (web app) that helps users find housing or protect their current housing situation. Web application in this case entails a website that appears to function like a standalone application. Web apps can be advantageous over standalone, native apps because they can be used without installation while taking up less storage, they are easier to develop and update, and they are platform-independent meaning they can be accessed on any device whether the device is an Android, iPhone or computer (Amazon Web Services, n.d.). Users can also create shortcuts for web apps that can be accessed via icons from the home screens of mobile devices just like native apps. The initial setup for both native and web apps requires some form of Internet connection via WiFi or mobile data. However, web apps suffer from a lack of Internet connectivity because they are essentially websites that are designed to provide a native app-like experience. Therefore, the proposed project features offline-functionality that allows users with Internet connectivity issues to continue using the application, though to a lesser extent. This involves local and network data sources, the former of which provides housing listings when the user is disconnected and synchronizes data with the latter whenever connection is reestablished to retrieve the most time-accurate data (Android Developers, n.d.).

Overall, the web app features the following pages or ‘views’ which the user can see: 1) Search/Homepage, 2) Account Creation/Login, 3) Search Results, 4) Messaging. A mobile-friendly, responsive web app is readable and accessible whether the user accesses it from a computer, smartphone or tablet. Figure 1 below depicts responsive web design. The left-hand screenshot shows the welcome overlay on LEGO.com when accessed from a desktop computer while the right-hand screenshot shows the same webpage on a mobile device. Despite the change in screen size, shape, and orientation, the website retains its readability and usability for users. The proposed project will behave similarly across devices.

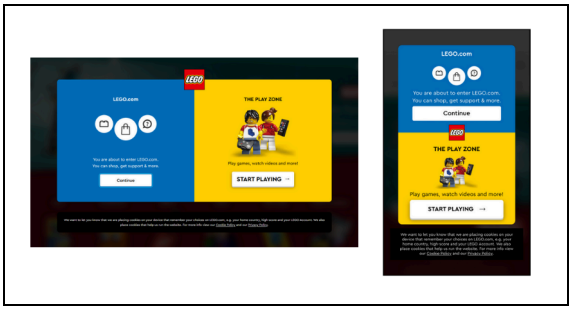

Figure 1: Responsive Web Design of LEGO.com

The web app's main function is to search for housing or housing resources such as contact information for legal or advocacy groups. Figure 2 below displays a user interface (UI) wireframe or prototype view of the results for a user searching for a "1-bedroom downtown". The dark blue button with alternating arrows next to the search bar is for sorting results (e.g. sort by price: low-to-high, sort by newest-to-oldest). The green 'F' button next to it is for filtering results based on user-preferred criteria. Example filters under the search bar show filters like 'rent less than $1500', '1 bed', and 'pets allowed'. These can be removed with a tap of a finger as denoted by the 'X' on the right of each filter. Below the selected filters are the housing listings that fit the user-provided search terms and filters. Each listing features an image carousel that the user can click through, a description of the unit with useful information such as the price and amenities, and some additional features. The purple 'C' button at the upper right-hand corner of each listing serves as the button to contact the listing poster (e.g. property management company). The yellow 'S' button below can be tapped to share the listing with others. Users who do not have reliable Internet access can share listings via SMS/text messaging. Lastly, the light blue numbered box displays the gentrification risk score for that housing unit estimated by a separate ML algorithm. The gentrification risk score is the probability out of 100% that the user might be displaced from the unit due to rapid cost of living increases. As shown by the "Quaint, 1 bedroom cottage" in Figure 2, some listings may be more prone to gentrification than others, with the risk score informing users that such listings are likely not worth a tour or move.

Figure 2: UI Wireframe of Housing Listings with Gentrification Risk Scores

Instead of searching for a new home, the user may want to find information or legal assistance on a matter regarding their current housing situation such as a landlord who won't fix a broken heating system. Figure 3 below shows the same search interface being used to find legal resources such as contacts for advocacy groups and legal counsel that the user can contact to fight for their right to safe and adequate shelter.

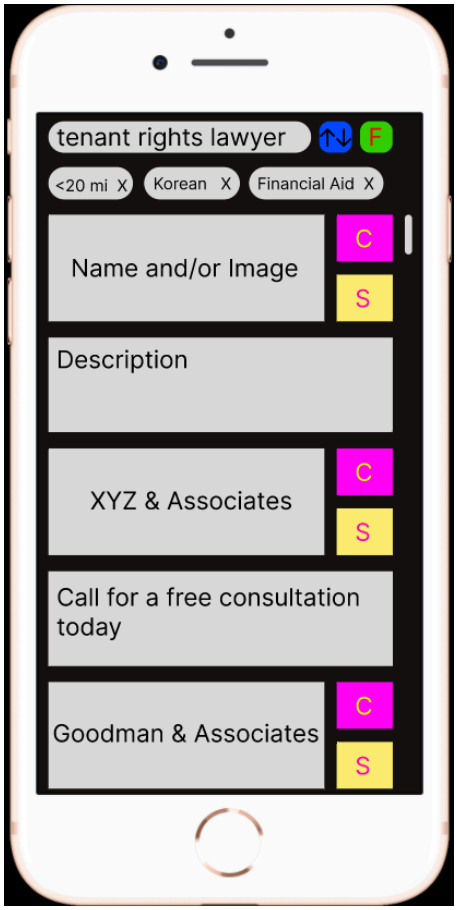

Figure 3: UI Wireframe of Resource Listings

4. ANTICIPATED RESULTS

Anticipated results of the proposed project, if fully implemented, include a decrease in the number of evictions experienced by people living in communities affected by gentrification as well as a decrease in the number of people experiencing a violation of their housing rights. The successful development of the web app might help ameliorate the US housing and eviction crises by providing users with an accessible and reliable means of finding stable housing that they are less likely to be evicted from in the future. Additionally, users may regain a sense of autonomy over their lives as the app helps connect them with legal counsel, advocacy groups, and other resources to help them protect and improve their living situations. At minimum, the project results in a better understanding of the technical requirements of an app with these features.

5. CONCLUSION

The housing search process could be improved, especially for people from the low-income and minority communities who stand to lose and gain the most. Studies indicate that such groups are most likely to suffer eviction from their homes due to gentrification and tenant rights violations. A mobile- and offline-friendly web app for finding housing and improving current housing situations might be useful to renters facing housing insecurity. Although the proposed features are ambitious, the design process served as an imaginative exercise of what might be possible with the integration of powerful software features.

6. FUTURE WORK

In the future, I could improve on the proposed project which was developed over a relatively short duration of time. First, I could gather more meaningful requirements for the web app by consulting stakeholders who stand to gain or lose something from using the application such as renters who move often or deal with their landlords over maintenance or tenant rights issues. Because housing is such a critical and universal human need, extra care must be taken to ensure that the opinions and perspectives of the most vulnerable stakeholders are taken into account.

Further, I could create a more detailed design for app components, especially the most complex features like the ML model and the offline mode as each relies on accurate data. Next, I could implement a prototype for features such as account creation, sharing via SMS/text message, and searching and filtering for listings. From there, I can train and test the ML model and implement the offline mode. Lastly, more data on things like increased traffic into certain areas could improve the model's ability to predict gentrification in the future (Frank, 2017).

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