HOUSENSEI

CS3216 Final Report

Group 1

https://housensei.herokuapp.com

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Introduction

Background

When potential buyers are looking to purchase a flat, they usually do some research to figure out the average cost of the kind of flats that they are looking for. They also want to compare prices against metrics such as location, floor area, storey and remaining lease period. This information helps them learn how to evaluate how much a flat is worth, making them more informed buyers. However, doing research on the HDB property market with currently available solutions is inconvenient and troublesome. Through our user interviews, we discovered that potential buyers tend to find data from HDB websites and compile them into an Excel sheet for analysis. This compilation is often a tedious process involving a lot of manual work. Hence, there is a demand for information on historical HDB property prices to be made more comprehensible and accessible, and for an easy way to compare prices across space and time.

A HDB property is a significant purchase for most buyers, and many look to maximise savings by leveraging HDB grants. However the criteria of these grants are complex, involving a buyer's marital status, monthly income and even whether they have purchased a flat before. The difficulty of checking grant eligibility and amount is exacerbated by the fragmented nature of grant information on the HDB website. As a result, there is no easy way of distilling all grants that the buyer is eligible for and the corresponding amounts based on the buyer's circumstances.

Existing Solutions

HDB offers a Map Service[1] on their website that allows users to access housing information of every HDB block in Singapore. The information that is useful to potential property buyers include the remaining lease period, resale flat prices in the block and within 200m of the block, and ethnic and citizenship quotas. While this information is great for researching about a specific HDB block, the Map Service does not provide easy comparison between HDB blocks and aggregated data across a HDB town or flat types.

Data on resale flat transactions is available on data.gov.sg[2]. However, this information is just stored as a table of block names and prices, without any user interface to interact with and manipulate the data. Buyers would have to parse this data with a visualisation tool such as Excel or Tableau to gain any useful insights.

Information regarding grants is scattered across the HDB website[3]. HDB offers a wide variety of schemes, each with a few associated grants that have some overlaps across the schemes. As a result, each grant

[1] https://services2.hdb.gov.sg/web/fi10/emap.html
[2] https://data.gov.sg/dataset/resale-flat-prices
[3] https://www.hdb.gov.sg/cs/infoweb/residential/buying-a-flat/new/schemes-and-grants

can appear on multiple pages with minor differences based on the scheme. Users would need to scan through many pages to filter out the grants they are eligible for which is very time-consuming and frustrating.

What is Housensei?

Housensei is the all in one solution for HDB property market research. Each of Housensei's features target a group of pain points that we identified through our user interviews.

The heatmap provides a bird's eye view of HDB resale prices across Singapore, allowing users to easily compare property prices across space and narrow down their search to particular regions. Users can indicate a price range that suits their budget and desired flat type to visualise which parts of Singapore they should be focusing their property hunt on. While the aggregated nature of the heatmap makes price data more comprehensible, users who want more detailed information can zoom into towns and even select individual blocks on the map to view resale transaction information at specific locations.

The price history chart presents historical HDB price trends of resale flats grouped by location and flat type, allowing users to directly compare the prices of resale flats in different towns over time. Additional filters for remaining lease period, floor area, storey and year of sale/launch give users the ability to fine tune the data they want to analyse. Users who want to compare BTO with resale prices or estimate how much the value of a particular BTO flat will appreciate after the Minimum Occupation Period, the history chart can also display BTO projects data vis-a-vis resale transaction data. Together with the heatmap, Housensei gives users a better idea on how much they should be paying for a HDB BTO or resale flat in an area.

To tackle pain points regarding HDB grants, Housensei offers a simple grant calculator. By answering a few simple questions, like monthly income amount and citizenship status, the calculator will show users a comprehensive list of grants that they are eligible for and the corresponding grant amounts. The flexibility of the grant calculator allows users who are unsure about any of the questions or who prefer not to provide that information to leave questions blank. In these situations, the calculator will still try its best to show you all the grants that may apply by providing a possible range of total subsidised amount.

Project Timeline and Milestones

Features not implemented
Features added after initial project proposal

	Milestones		
	Tech / Features	**User Testing**	**Marketing**
Week 7	- Transform resale price data - Scrape loan price data - API design - DB design	Conduct user interviews	Gather interest from property buyers and sellers through posts on Reddit and HardwareZone
Week 8	- Resale Price Analyser - Price Heatmap	Conduct one-to-one user testing (Resale Price Analyser)	
Week 9	- Budget Planner - Grant calculator - Bug fixing for historical line graph - Fix features based on user feedback - Simple feedback form within site	- Conduct one-to-one user testing (Budget Planner) - Conduct one-to-one user testing (Data visualisation)	Create marketing plan
Week 10	- Upcoming BTO Alerter - Integration with property sites - Tutorial for visualisation	- Launch prototype and post on forums (HardwareZone, Reddit) to gather feedback - Conduct one-to-one user testing (Data visualisation integrated with financial features)	Market app to forums/telegram groups that are frequently browsed by Singaporean adults (e.g. Reddit, Hardwarezone, FB groups)
Week 11	- Bug fixes - Final tweaks and changes from user testing feedback feedback	- Launch final product and post on forums (HardwareZone, Reddit) - Conduct one-to-one user testing (Data visualisation integrated with financial features)	Advertise our app through Telegram channels such as NUS Computing Grads, Tembusu and USP.
Week 12	In Class Presentation		

Above is a condensed version of our project timeline and milestones, as presented in our project proposal, and later revised in our 2 progress reports. All milestones that were not met are highlighted in red. Although more time than expected was taken to address user feedback due to the large number of UI changes required, our team managed to stick closely to our proposed timeline and milestones. The only 2 features that we dropped were the Budget Planner and BTO Alerter, for reasons explained below.

For the Budget Planner, we opted to instead pivot to a Grant Calculator, which would show potential homeowners which HDB grants they were eligible for. This was due to the feedback received during user requirements gathering, where we learnt that budgeting was not as urgent as determining which grants were available. Since the latter is involved during the initial purchase of the flat, whereas budget planning was more long-term, we decided to focus on the Grant Calculator as it was more in line with our application's goal to help with HDB flat market research.

The other feature we decided not to include was the BTO alerter, which would have notified users about upcoming BTO launches. This was due to several reasons: Since Housensei was a website, it would not be able to easily deliver real-time notifications without making it into a PWA, which was an overkill. Furthermore, the feature was also not very cohesive with our goals for Housensei, hence, we decided to refocus our efforts on the 3 core features, the Heatmap, Price History Chart, and Grant Calculator.

As for our user testing and marketing plans, we opted not to gather interest or launch an early prototype of Housensei, despite our initial plans to do so. These actions were intended to validate the problem we were trying to solve, and gather user feedback. However, we found that our user requirements gathering was more than sufficient in validating our problem statement, and decided that it would also be more productive to conduct more one-to-one user testing, as it would give us more detailed feedback. Furthermore, we also did not want to overwhelm the forums with mentions of Housensei, which may have dissuaded people from trying it when we eventually launched the final product.

Individual Contributions and Roles

External Resources

- Data.gov.sg: Resale Transaction Data
- HDB: BTO Projects Data, HDB Grants information

Roles and Contributions

Member (Role)	**Wenjie (Backend Engineer)**	**Chrystal (Backend Engineer)**	**Siau Chiak (Frontend Engineer)**	**Alex (Frontend Engineer)**
Week 7	Parsed Resale excel into database Conducted user interviews	Setup backend Parse BTO excel into database	Conducted user interviews to identify pain points, gather user requirements and learn about market research process	Conducted user interviews to identify pain points, gather user requirements and learn about market research process
Week 8	Implemented price history API Contributed to Progress Report 1	Implement heatmap API Contributed to Progress Report 1	Implemented Price History Chart v1 - BTO and resale lines - Select towns, flat types and other filters Contributed to Customer Contact Report 1	Implemented Heatmap v1 - Basic islandwide/town heatmap display Setup CI/CD Contributed to Customer Contact Report 1
Week 9	Made adjustments to price history API Conducted user testing	Save coordinates of blocks into resale table Make adjustments to heatmap API	Conducted user testing Implemented changes to the price history based on user feedback - Add related BTO from resale line - Hide lines - Export chart	Conducted user testing Implemented changes to heatmap based on user feedback - Allow editing of heatmap legend - Allow panning and zooming to interact with heatmap

Week 10	Conducted research on HDB grants and eligibility Represented each grant eligibility with a JSON structure Contributed to Progress Report 2	Implement Grant calculator v1 Contributed to Progress Report 2	Made improvements to Price History Chart: - BTO display - Integration with property sites - Select line colour Contributed to Customer Contact Report 2	Made improvements to Heatmap - Add block-level resale transactions - Improve performance with memoization Contributed to Customer Contact Report 2
Week 11	Setup Google Analytics Setup Papercup to receive feedback from users Setup HelpHero tutorial for first-time users to familiarise them with our features	Improvements to Grant Calculator - Interactive feedback Created a post on instagram	Created social media accounts for marketing - Instagram - Facebook - Reddit - Hardwarezone Assisted with design of Housensei logo	Made improvements to Heatmap - Allow filtering by flat type General site improvements - Utilise compression to speed up page loads Assisted with design of Housensei Logo
Week 12	Contributed to the script and prepared for in-class presentation	Improvements to Grant Calculator - Allow for unsure option	Launched Google Ad campaign Wrote app introduction and description for STePS page	Improved logo design Contributed to the script and prepared for in-class presentation
Week 13	Contributed to promotional video	Contributed to promotional video	Contributed to promotional video Created a post on instagram	Contributed to STePs poster design
Reading Week	Contributed to Final Report	Contributed to Final Report	Contributed to Final Report	Contributed to Final Report

Application Design

Stack

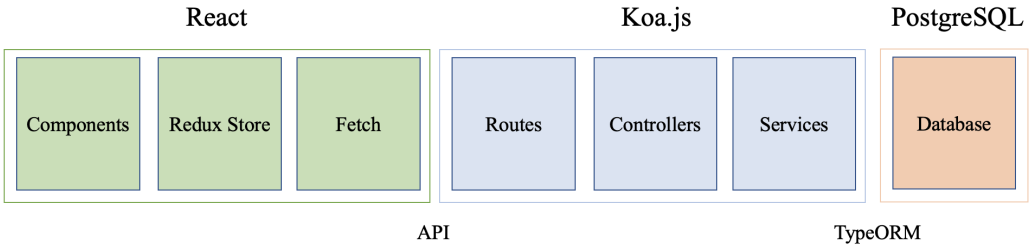


Figure 1: Stack of Housensei.

We use React and Redux for the frontend, Koa.js for the backend and PostgreSQL for the database.

Redux is used to manage and centralize application state. We use Redux Toolkit as it provides easy-to-use boilerplate and useful functions. Redux helps our application to manage global state, which is important in ensuring that user data is persisted when switching between different features, like the Heatmap and Price History Chart. This allows users to use all the different features of Housensei at the same time.

We use Koa.js for the backend. Koa.js is similar to Express.js but is smaller, more expressive and has easier-to-use middleware. We follow a Routes-Controllers-Services layer structure. The routes serve as the entry point into the backend. The controllers call relevant services to construct API responses and send the responses with correct codes. The services contain the database queries and retrieve requested data from the database. We use TypeORM as the ORM.

The database uses PostgreSQL. PostgreSQL is an advanced version of SQL. The database schema is discussed in the next section.

Database

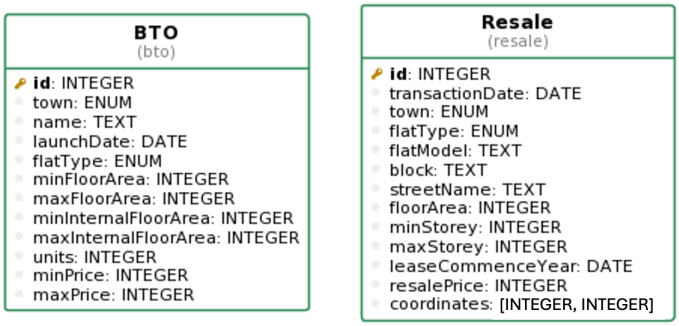


Figure 2: Database Schema.

There are only two entities in our database - BTO and Resale. Each BTO and Resale entity corresponds to a transaction. There are some slight differences between BTO and Resale entities. For example, a BTO has a launchDate but a resale has a transactionDate.

There are several alternatives to a database that we considered. One possibility would have been to store all the data as JSON files in the frontend. This is possible in our case because the data is fully static (only operation allowed on data is fetch). The benefit of using a JSON is that we can completely remove the backend and database, which would make things much simpler as no API calls are needed. However, using JSON files would mean that we have to rely on frontend filtering and computations. That would have been too slow and caused our application to be less responsive. Therefore, we chose to use a database to leverage SQL's efficient filtering and aggregating functions.

Another possibility that we considered is using API calls directly to the original data source. For resale data, it is possible to call the open API provided by data.gov.sg to fetch the resale entities. The benefit of using API calls is that the data is guaranteed to be the most up to date. In addition, we can likewise completely remove the backend and database. However, API calls are throttled and multiple API calls may be needed if the requested data stretches across a number of years. Moreover, each time an API is called, the data needs to be filtered and parsed as the data returned will not be in the exact format that the app needs. This is computationally slow and expensive. We also met a similar issue when calling an API to retrieve resale block coordinates. Initially, we had wanted to call an API from the frontend whenever blocks need to be displayed on the heatmap. However, we would have needed to make 1 API call for each block and the API was rate limited to 250 per minute. That would have been insufficient for our needs. Therefore, we decided to make all the API calls for each resale block in our database at the very start and store these coordinates in our database.

In considering these alternatives, our top priority is speed. We did not want to risk our app being too laggy to the point of it being unusable. Therefore, we carefully considered all our options and made decisions based on the impact on speed.

UI Library

We use Material-UI as the UI framework. MUI has a clean and modern theme. As our app is a data visualisation app, we wanted our app to look easy-to-use yet powerful. We felt that MUI would give our app a simple and modern feel, which was the kind of theme/feeling that we were going for. Moreover, MUI is very popular among developers, which meant that there would be many communities and forums that we could use if we faced problems.

Security

We host the app on Heroku. HTTPS and redirection are implemented as it is part of Heroku's default. Our app does not need user authentication as we do not implement user accounts.

API

The API for Housensei is documented here: https://housensei.docs.apiary.io/. No user authentication is needed for any of the routes as we do not implement user accounts. Housensei only has GET requests and only has four such routes.

We structure the API as <functionality>/<resale/bto>/<island/town>. For example, our API contains routes such as graph/resale and heatmap/resale/island. Our API is structured according to functionality as we need specific return types from the backend for different functionalities. For example, heatmap/resale/island returns prices aggregated by town while heatmap/resale/town returns prices aggregated by block. Relying on the frontend to transform return types was not an option as it would cause too much lag in our application. Therefore, we design functionality-specific routes in order to leverage the fast filtering and aggregation functionality of SQL.

We choose REST API over GraphQL as REST is sufficient for our needs and we do not require that much flexibility of GraphQL. Moreover, our team is more experienced with REST.

Grant Calculator Implementation

We made several architectural decisions in the implementation of the Grant Calculator. The Grant Calculator is a tool to help potential homeowners calculate the amount of grants they are eligible for. Given information on HDB websites and user provided personal information, the goal was to narrow down to a list of grants and possible grant values.

Based on our preliminary research, we found that information on HDB websites were very scattered and convoluted. We realised that the eligibility criteria could be most concisely represented as a decision tree. We had a few options to store this decision tree. We could either store the decision tree in JSON files (in the frontend) or in a table (in the database). We found that JSON format would be most suitable to store the decision tree as compared to a table. A table format would require all permutations of eligibility criteria to be stored as separate rows. That would have been very costly in terms of memory consumption. Another perk of storing the data in JSON files in the frontend is that we do not need to make any API calls. This would result in faster response times to user interaction, which is crucial since the Grant Calculator is meant to be interactive.

The decision tree of each grant was stored in a separate JSON file. A simplified example of a grant representation is in Figure 3. A grant tree has two fields, “attribute” and “options”. “attribute” is a field of the user-provided information, for example, whether the user is married or what flat size the user is looking to purchase. “options” are the choices to the “attribute”. In the case of the attribute on whether the user is married, the options will be “true” and “false”. Each option will either be another sub - grant tree or a grant value. From the point of view of Computer Science theory, a grant tree’s root value is the “attribute” while the subtrees are the “options”. The base case is the grant value (a number).

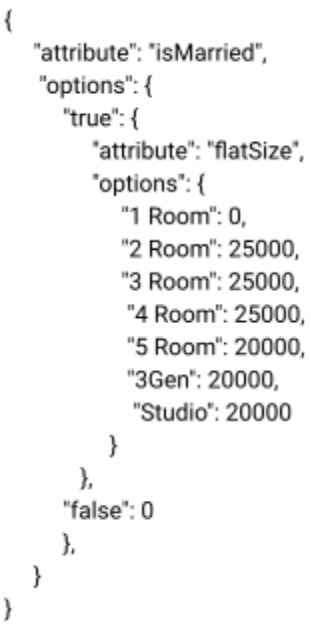


Figure 3: Example of a simplified Grant Tree.

We use this generalised grant tree representation for all grants. It is easy to see how a grant value can be obtained from a grant tree. It is a simple tree recursion algorithm, described as follows. We start at the root of the tree and retrieve the attribute. We obtain the chosen option from the user-provided information. We recurse into the subtree corresponding to the chosen option. This process is repeated until a number is reached. The number would be the grant value that the user is eligible for.

One challenge that we faced was how to incorporate ‘unsure’ options. This was a feature requested by many of our interviewees because there are questions that they do not currently have the answers to (e.g. monthly income). We found that the grant tree representation and recursion algorithm is able to accommodate ‘unsure’ options with only minor tweaks needed. To do this, in the tree recursion algorithm, we allowed for recursion into multiple subtrees when an ‘unsure’ option was picked, instead of only a single subtree. We collected the values obtained at the leaves of each potentially relevant subtree. We computed the minimum and maximum of the possible grant values and presented the eligible grant value as a range.

UI/UX Design

Rather than using mockups/prototypes to validate our UI/UX design, our team instead chose to dive straight into developing the application. This was mainly due to the fact that we made extensive use of 3rd-party libraries for most of our features. Hence, we were unsure whether our planned designs would integrate well with the libraries. Furthermore, due to the highly interactive nature of our application, we did not think that prototypes could provide the same rich experience to users, compromising our user testing. Hence, we decided to prototype the UI design alongside developing our application. Below, we would like to share several UI/UX decisions our team made, and our rationales for doing so.

Heatmap Price Legend

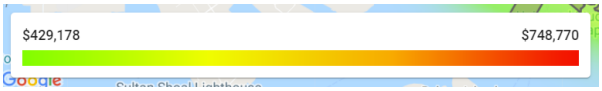


Figure 4: Old Price Legend (Islandwide).

Figure 5: Old Price Legend (Yishun).

In our initial heatmap implementation, the range of the price legend shown varied based on the location shown. This meant that when the heatmap was showing islandwide resale flat prices, the minimum and maximum prices would be based on the minimum and maximum average resale flat price per town. On the other hand, when zoomed into each individual town, the minimum and maximum prices would be based on the minimum and maximum resale flat price in that town.

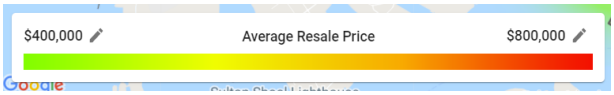


Figure 6: New Price Legend.

While this looked cool from a data visualisation perspective, we realised that it compromised our user experience, as users would be unable to make use of this information. This was because if users were trying to see which areas were outside their budget, a red area in one town did not mean the same thing as in another town. Hence, we decided to keep the price legend fixed regardless of location, and allow users to customise the minimum and maximum prices shown by the heatmap. This way, users can easily compare and contrast different locations to find out which areas are within their budget.

Price History Chart Lines

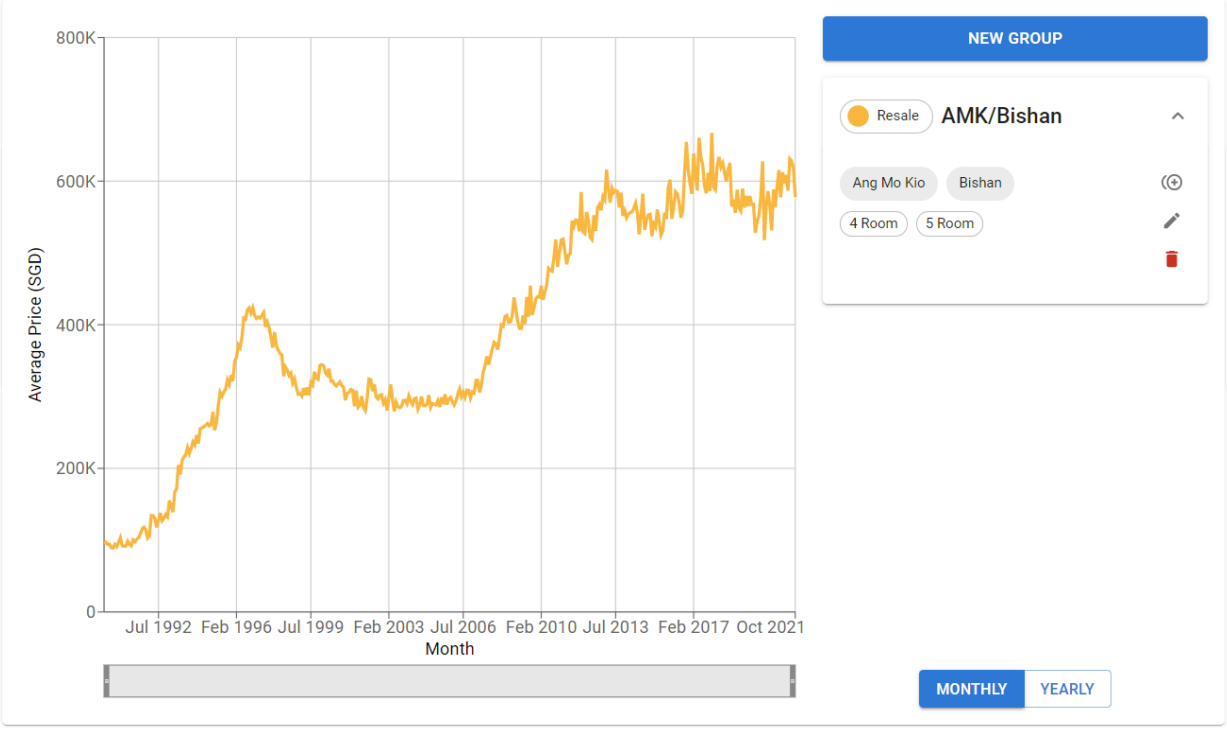


Figure 7: Old Price History Chart, with both towns and flat types aggregated.

Initially, we allowed users to aggregate any number of towns and flat types per line in the Price History Chart. We decided on this approach as it allowed for more flexibility, as users could combine towns or flat types if they wished, and even if users wanted to compare between different towns or flat types, they could simply add a new line. However, we found that this behaviour was confusing during our user testing. Several users shared that it did not make sense to them to average resale flat prices across different towns or even flat types, as the prices could be quite different. Even though users could have simply added separate lines as explained above, we realised that the default behaviour confused users.

After much deliberation, we decided to create a new line in the chart for each town/flat type combination instead. Even though this ultimately led to less flexibility, as users would no longer be able to aggregate several towns/flat types, we felt that the improved clarity of the default behaviour warranted the change.

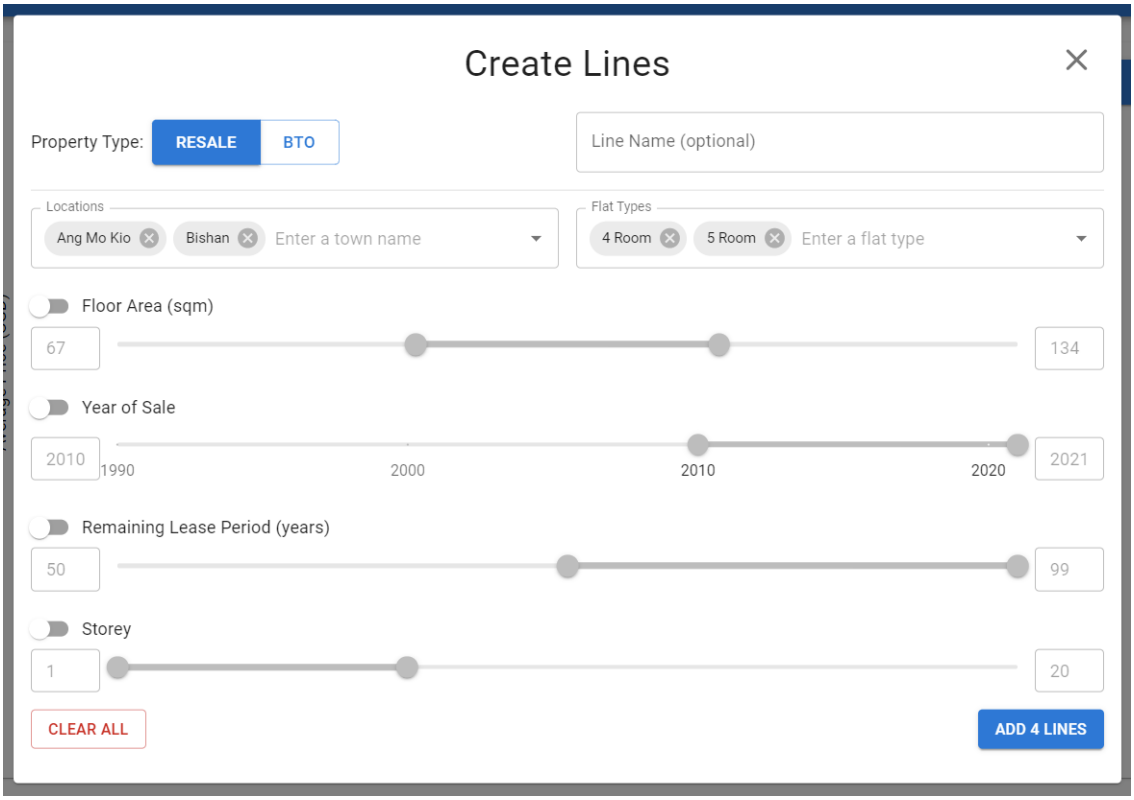


Figure 8: Create button now shows how many lines will be added.

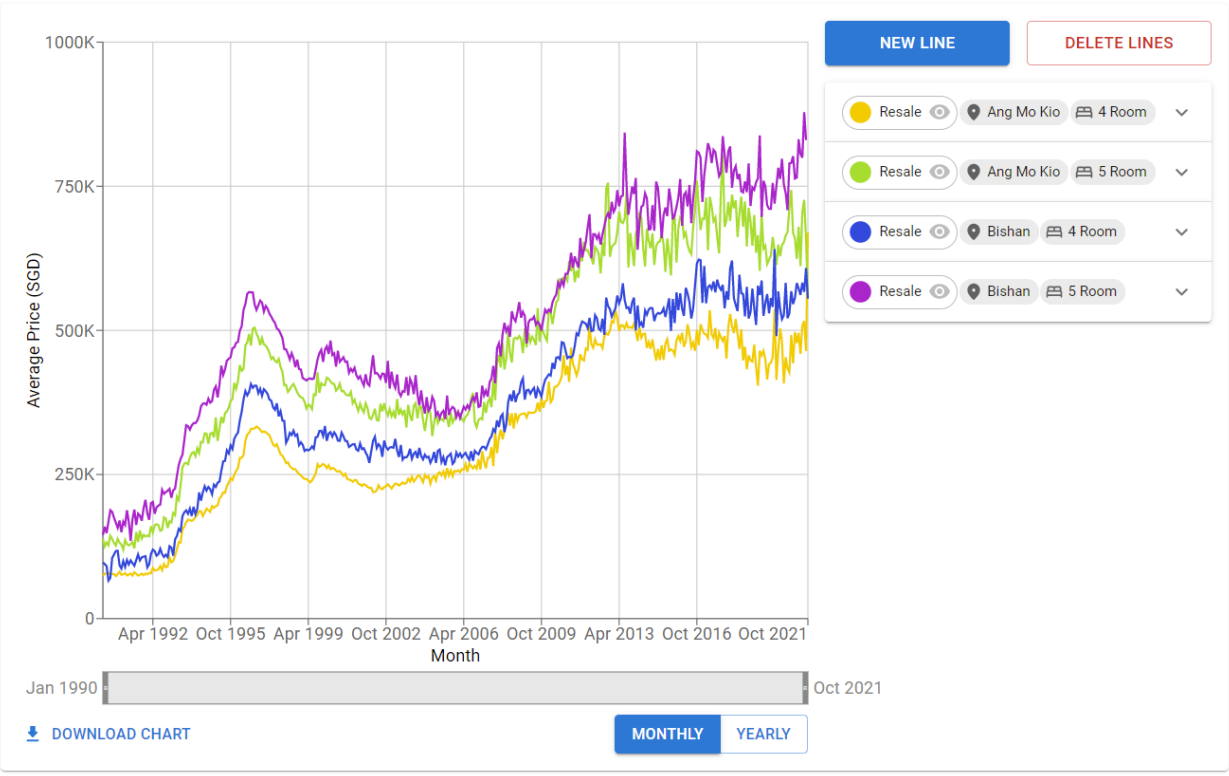


Figure 9: Lines are now created for each combination of town and flat type.

Grant Calculator

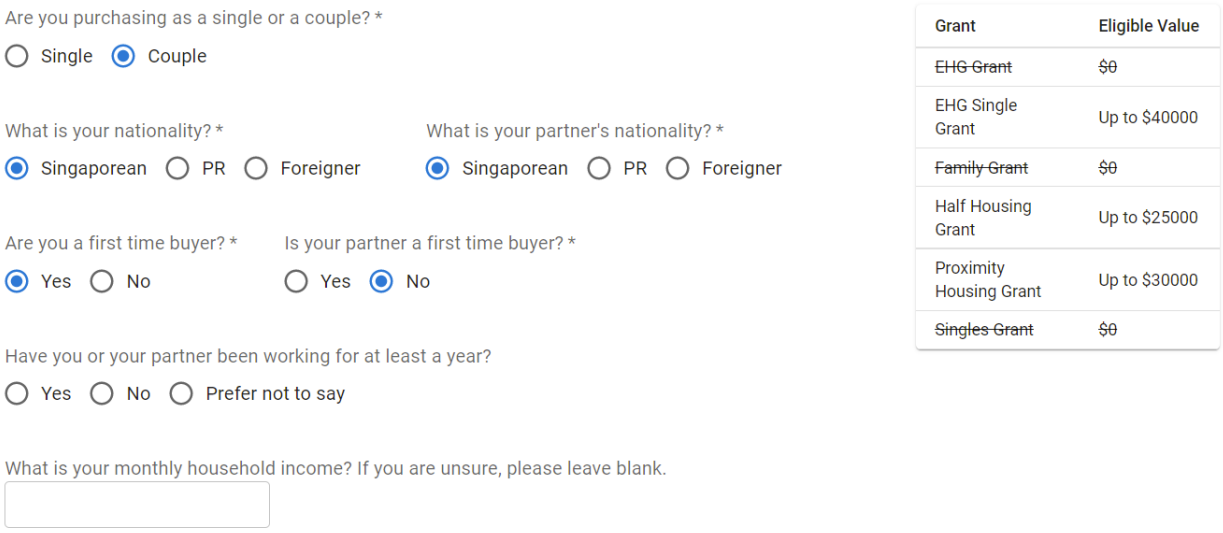


Figure 10: Grant Calculator

One of the problems with financial calculators we discovered was the lack of feedback while using the calculator. This is especially prominent if the financial calculator had a lot of questions, which discouraged users from using them, as there is no perceived progress even after answering many questions. Furthermore, users may be unsure of or prefer not to answer some questions, which these financial calculators do not usually allow.

Our solution for Housensei's Grant Calculator was to allow users to provide indeterminate options such as "Prefer not to say" whenever possible, and show a table of grants alongside the questions. This table updates in real-time based on the questions answered, and shows which grants are available/unavailable, with the approximate amounts for available grants. This way, not only will users get immediate feedback, they can also observe how their choices to the questions affect their eligibility for certain grants.

Marketing

We identified several channels for our marketing efforts to reach out to our target audience, with varying levels of success. We first established a presence on social media sites like Facebook[4] and Instagram[5]. For Instagram, we are mainly targeting young couples/singles who are looking to buy their first house since Instagram is more popular among the younger demographic. Our posts are focused on introducing the features of Housensei as well as providing tips on the BTO process which would be helpful to young prospective homeowners. Our Facebook page, on the other hand, is more catered to the older demographic who are more active on this platform. Thanks to Uncle Soo's connections, we managed to be featured on NUS Computing Facebook page[6] which certainly contributed to greater publicity and awareness.

In order to introduce Housensei to target users, we reached out to forum sites such as Reddit and HardwareZone, where prospective home buyers frequent to share their experiences and seek advice. For HardwareZone, we created a thread about Housensei under the "HomeSeekers and HomeMakers" forum, which attracted over 1000 views and successfully redirected traffic to our site. Similarly, we also created a post under the r/singapore subreddit. The challenge of posting on these sites is that our posts are always taken to be unsolicited advertisements and taken down as a result. Over time, we learn to phrase our posts in a way that is more well-received by the community and its moderators. As an extension, we also expanded our presence to active telegram groups, such as "SG HDB Resale chat" which has almost 2000 members discussing resale flat matters.

To make Housensei more visible to search engines, we launched a Google Ads campaign to suggest our site when users search for key terms such as "hdb bto", "hdb resale price", etc. We also made use of a short introductory video[7] to market Housensei during STePs

Lastly, to seek further collaboration and publicity for Housensei, we sent cold emails to popular property sites like 99.co and PropertyGuru to feature us on their respective blogs. We hoped that they would be supportive of this on the grounds that our Price History feature helps to direct users to their sites to view filtered listings. Unfortunately, the response from them has been lukewarm, probably because the current traction of Housensei is not sufficiently enticing for them.

[4] https://www.facebook.com/Housensei-106633605145258
[5] https://www.instagram.com/housensei.property
[6] https://www.facebook.com/nusschoolofcomputing
[7] https://www.youtube.com/watch?v=9y4724yGkhI

Analytics Report

Since our official release on 23 October, we are proud that, in less than a month, Housensei has received nearly 600 unique users over more than 700 sessions. 10% of the traffic are from returning visitors which shows that Housensei provides practical benefits for prospective home buyers to attract repeated visits. The 3 peak traffics correspond to our initial launch, CS3216 in-class presentation and STePS. It is worthwhile to note that even on regular days when we are not engaging in active marketing, Housensei is still able to attract a steady flow of active users.

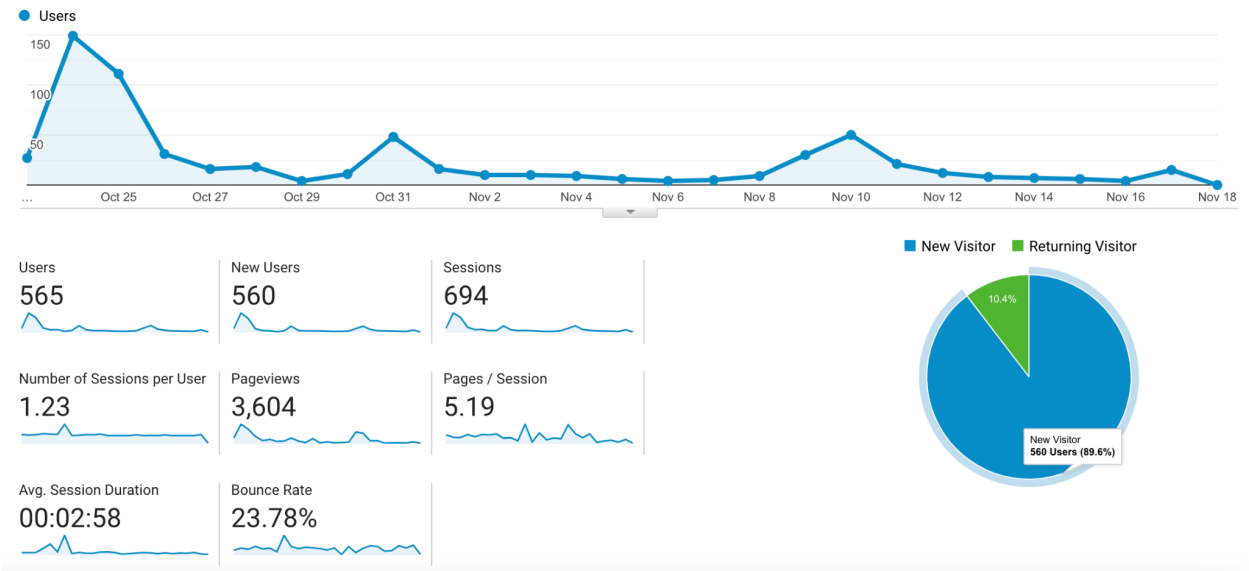
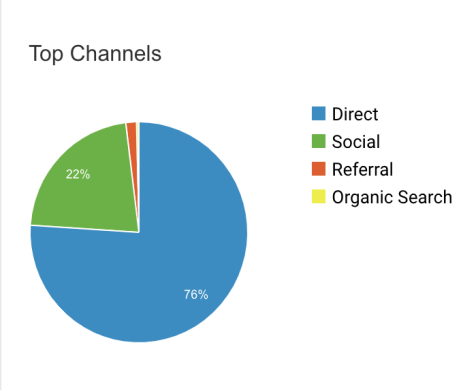


Figure 11: User Activity on Housensei.

An analysis of our user acquisition shows that a large majority of our users come from direct access, followed by social media sites and referral from HardwareZone. Among the different social media sites, our marketing efforts on Facebook have been the most successful, probably in large part due to our feature on NUS Computing and STePS facebook page (and Uncle Soo's page).



1.	Facebook	92	73.02%
2.	Instagram	14	11.11%
3.	LinkedIn	14	11.11%
4.	reddit	5	3.97%
5.	YouTube	1	0.79%

Figure 12: Proportion of users from different channels.

Our Google Ads campaign has also been successful in generating user traffic from Google search engine, with over 20 000 impressions converting to over 100 clicks, thereby increasing our user base.

From our Google Analytics events tracking, we can also identify features that are most commonly accessed by users. For the heatmap, it seems that users find the ability to view all resale transactions within a certain block particularly useful, while for the price history chart, users frequently created new resale groups for price visualization and comparison.

1.	View All Transactions in a Particular Block	951	35.20%
2.	Zoom Out to Island View	386	14.29%
3.	Zoom in to Town View	362	13.40%
4.	Clicked Map to View Town	346	12.81%
5.	Adjusted Year	285	10.55%

1.	Added Resale Group	64	50.39%
2.	Marked/Unmarked a BTO Project on Chart	25	19.69%
3.	Added Related BTO Projects From Resale Group	19	14.96%
4.	Added BTO Group	12	9.45%
5.	Search Listings	7	5.51%

Figure 13: User events tracking.

Future Plans

Housensei is still in its nascent stage and there are numerous ways we can expand on existing features and include monetisation to make the services we provide sustainable and benefit more users in the process.

Currently all the resale transaction data were manually imported into our database through excel files obtained from data.gov. To ensure that our data continues being updated, we can setup a cron job that periodically queries the data.gov api[8] for new data to insert into our database. We can also explore new domains of housing data beyond resale and BTO. A promising area would be HDB rentals, which are increasing in demand in recent times as seen from the rising rental prices across the island, with COVID being a likely key contributor. As the younger generation are more receptive to renting as opposed to purchasing a flat, especially with rising flat prices, there will likely be greater demand for more tools to help navigate the rental market.

In terms of improving user experience, we can definitely make Housensei more mobile friendly since many of our users are directed from social media sites on mobile. Having a sleek mobile interface would leave a good first impression that encourages repeated visits. However, this would also be a challenge since it is difficult to visualize large amounts of data meaningfully on a small screen size which is why it is not a high priority for the time being.

Our monetisation strategy can be two-fold. Firstly we can incorporate advertisements on our site, though this could no doubt be annoying for some users. Another way would be foster deeper collaboration with property websites like 99.co and PropertyGuru by having better integration with their property listings. We can seek a payment for every user redirected from Housensei to their listings page, much like a pay-per-click advertisement for their listings based on the user's interest. Monetisation is essential for us to sustain our services, which includes purchasing our own domain instead of using herokuapp.com as well as database storage costs for the large amount of housing data.

Our next step would be to contact HDB for any potential collaboration, such as funding, greater accessibility to housing data or even potentially taking over our project. With the support of HDB, more marketing channels can be opened up to generate greater publicity and there would be a more seamless continuity of Housensei beyond CS3216 to aid prospective homeowners in their market research needs.

[8] https://data.gov.sg/api/action/datastore_search?resource_id=f1765b54-a209-4718-8d38-a39237f502b3

Insights and Reflections

Having gone through the more technical oriented sister module of CS3217 together, the CS3216 Final Project forced us to consider other aspects of software development, such as graphics design, UI/UX design and marketing. As all of us came from a Computer Science background, all of us had little to no experience with these domains. Over the past 6 weeks, we learnt how to make a decent looking logo, design an intuitive and clean user interface and experienced first hand how to market our creation.

The first two weeks of the Final Project overlapped with the midterm season, yet this was also the most crucial time for developing the app for the project. This was because we went through a total of five brainstorming sessions and three proposal meetings before our final app idea, Housensei, was given the green light by Prof Soo. It was a draining yet worthwhile experience to come up with app ideas and do research on similar apps in the market. We were exposed to the creativity of software developers everywhere as we found that a lot of the ideas we brainstormed have already been implemented. This process also taught us the importance of finding a worthwhile problem to tackle so that our product has a significant and tangible impact on our target users.

As we had no prior experience purchasing a house in Singapore, none of us were familiar with the housing market and policies. As such, we had to do a lot of research and user interviews to understand this process and to experience the same pain points that our target users face when they are looking to buy a flat. This in turn helped us figure out what features we should develop to tackle these problems. We learnt to discard our preconceived notions of what we thought our users were looking for, and listen to the users' needs instead. As a result, the final feature set of Housensei differs significantly from what we originally had in mind in our initial proposal.

We initially thought that our user interface was intuitive. However, through user testing, we found out that some things could be tweaked and improved to be made more accessible. We realised that it is natural for us developers to think that our UI is intuitive because we were the ones who created it, but our thoughts while building the UI are sometimes not translated onto the screen, and hence are lost to the user. Through user testing, we learnt how to rely on feedback given by real users who would actually use our app to improve the UI.

Progress meetings were always a blessing to us, as there would always be some points and questions raised by Prof Soo that we failed to consider. In one such meeting, Prof scolded us for prioritising what we want to build (we were bored of CRUD apps) over the idea itself. We were "putting the cart before the horse" and we should have been focusing on coming up with a great app idea instead of filtering away ideas that involved heavy CRUD.

As STePS approached, we shifted our focus to getting our app in the hands of as many users as possible. By this time, our core feature set was in place and mostly completed, only requiring some polishing to perfection. It was also around this time that we saw the amazing apps that other teams had built via the

creative ways that they used to market their apps. Compared to some of these apps, our target users consisted of not just the NUS community but also a larger demographic of Singaporean adults who are interested in the HDB property market. To increase the effectiveness of our marketing strategy, we identified the platforms that most of our target users use to be social media sites like Facebook and Instagram, and forums such as HardwareZone and Reddit. We learnt how to craft our posts on each individual platform so that they are more effective and better received by the communities of the respective sites.

Finally, it was STePS day. We had written an engaging script designed as a conversation between a troubled property buyer and a Housensei developer to introduce the problems with HDB property market research and how Housensei tackles them. Although our team had experience presenting during STePS from CS3217, we still found that it was a great platform to facilitate confidence when pitching our idea to the public. It was also a chance to get more eyes on Housensei, and indeed, we saw our user count increase on the day itself.

As we write this reflection, the Final Project and CS3216 is coming to an end. Despite the fact that we have been paying out of our pockets to maintain Housensei, we hope to be able to continue making it available to the public as it would be a shame to see our hard work go to waste. This has been a rough but rewarding 8 weeks, and we are all glad that we took the first step almost one year ago by applying for CS3217. We would like to thank Prof Soo and the teaching team for their invaluable time, effort and feedback. Farewell, CS3216!