Deliverable 5: Final Report

The University of New South Wales

SENG2021 2019 T1

BEAMS

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Introduction

This report is the final update of the project development of BEAMS. This report aims to provide a clear explanation of the purpose of BEAMS, detail the user requirements, and provide details to implementation and a reflection of the project by the team.

Purpose of BEAMS

BEAMS is a suburb analysis tool implemented to make researching suburbs easier for any user, including young families, students and investors, seeking to purchase or rent property.

The BEAMS website presents relevant statistical and demographic data through various graphical tools optimised for the average property buyer. Its graphical interface is intuative and abstracts the information necessary to the user when suburb hunting. Unlike existing websites/tools used to evaluate properties in different areas, our application focuses on allowing the user to make an objective judgement of suburbs based on facts, rather than properties, and thus removes the commercial factors and biases associated with agents 'selling' a property.

It's intended use is as the first step in research before making any housing decision. BEAMS ensures that users find a suburb that fits their needs, before looking at properties.

Value of BEAMS and problems addressed

BEAMS' value is in its simplicity. It transforms the complicated demographic, market and infrastructure (quantitative) data of a suburb into a visually pleasing suburb profile that is easy to interpret. The data is expressed in visual graphics with helpful tips in common day to day language, free of jargon and numerical figures along the way, making the user experience incredibly intuitive and easy to use for an wide audience with varying financial skill. BEAMS allow users to make personal judgements and find a suburb that suits their needs.

Before BEAMS was created, there were a large number of websites that displayed either demographical data, infrastructure data or housing market trends. The information presented was hard to interpret and not cohesive and often, users had to navigate multiple sites in order to get information about a suburb. With the introduction of BEAMS, the user is able to save time and have a more enjoyable user experience without the hassle of researching individual information. BEAMS integrates demographics, property trends, schools, local news and a map for the convenience of the user.

Furthermore, BEAMS' comparison feature enables a user to compare suburbs allowing for easy comparing between two suburbs. This saves time, and again, the user does not have to navigate to multiple different platforms to access data.

Updated requirements and user stories

The key requirements and features of BEAMS include:
User is able to search areas by suburb name.

- Easy to use autocomplete search bar

There should be a clear written and visual summary of the suburb.

- Suburb Highlights including, but not limited to, Family Friendly, Low Crime Rate, Transport Friendly, Health Care Friendly, School Friendly and Advantaged Education
- A radar chart summarising the suburbs Safety, Affordability, Socio-Economic Status and Education Standard

There should be a clear graphical representation for housing market data.

- Graphical analysis of housing market trends for both renting and purchasing including max, median and lowest price

Website should show suburb area on a map.

- User can view an interactive map of suburb and surrounding area

News filtered by suburb should be visible on the suburb page.

- Local News tailored to the suburb

There should be a suburb demographic overview visible on the suburb page.

- Demographic data about the suburb including Age Group Distribution, Cultural Diversity, Nature of Occupancy and Commute Methods.

User is able to see a list of all schools within the area.

- List of schools within the area and information about them including name, age of students and gender

User must be able to compare two suburbs and see clear graphical representation of each one and their individual benefits.

- Comparison feature allows the combination of two suburbs into one page

User is able to see who created BEAMS and their roles.

- Developer page

Story point estimation
1 SP = 2 hrs

Priority scale
1 - Critical for MVP
2 - High
3 - Medium
4 - Low

Requirement 1: User is able to search areas by suburb name

Feature 1: User can search for suburb by name.

US ID	1.1.0
Priority	1
Estimate	2 SP
User Story **As a** user, **I want to** search for a suburb by its name **so that** I can find the most relevant search result for me.	
Given that I am at the search webpage **When** I type in a suburb name **Then** I can view my preferred suburb.	

Feature 2: User can search from any page on the website

US ID	1.2.0
Priority	1
Estimate	1 SP
User Story **As a** user, **I want to** search for a suburb by its name from any page of the website **so that** I can find the most relevant search result for me at any point in the user experience.	
Given that I am at any point on the BEAMS website **When** I type in a suburb name **Then** I can view my preferred suburb.	

Requirement 2: There should be a clear written and visual summary of the suburb.

Feature 1: User can view suburb highlights on the suburb page

US ID	2.1.0
Priority	1
Estimate	1 SP
User Story **As a** user, **I want to** view suburb highlights such as Family Friendly, Low Crime Rate, Transport Friendly, Health Care Friendly, Primary School Friendly, Secondary School Friendly, Advantaged Education, and Culturally Diverse **so that** I can quickly decide if a suburb would potentially meet my needs.	
Given that I have selected a suburb **When** I am navigated to the page **Then** I can view suburb highlights.	

Feature 2: User can view a radar chart on the suburb page

US ID	2.2.0
Priority	1
Estimate	2 SP
User Story **As a** user, **I want to** view a radar chart with Safety, Affordability, Socio-Economic Status and Education Standard as categories **so that** I can view information visually and quickly decide if a suburb would potentially meet my needs.	
Given that I have selected a suburb **When** I am navigated to the page **Then** I can view suburb highlights.	

Requirement 3: There should be clear graphical representation for housing market data.

Feature 1: User can view graphical representation of suburb's housing market purchasing trends after searching for the suburb.

US ID	3.1.0
Priority	1
Estimate	2 SP
User Story **As a** user, **I want** an easy to read, graphical representation of the low, median and high purchasing property price in the suburb I am researching **so that** I can identify trends and improve my decisions.	
Given that I have searched for my preferred suburb(s) **When** I click on my preferred suburb, **Then** I am shown a graphical representation of the low, median and high purchasing property price in the suburb.	

Feature 2: User can view graphical representation of suburb's housing market renting trends after searching for the suburb.

US ID	3.2.0
Priority	1
Estimate	2 SP
User Story **As a** user, **I want** an easy to read, graphical representation of the low, median and high property renting price in the suburb I am researching **so that** I can identify trends and improve my decisions.	
Given that I have searched for my preferred suburb(s) **When** I click on my preferred suburb, **Then** I am shown a graphical representation of the low, median and high property renting price in the suburb.	

Feature 3.3: User can access schools within the suburb and surrounding area and their data.

US ID	3.3.0
Priority	Critical for MVP
Estimate	2 SP
User Story **As a** user, **I want** to view schools within my preferred suburb(s) **so that** I can find the best suburb most appropriate to my lifestyle.	
Given that I am viewing a suburb profile page **When** I click on the education data tab **Then** I am shown an easy to understand representation of education data in the suburb.	

Feature 3.4: User can access data about available public transport in the area.

US ID	3.4.0
Priority	High
Estimate	2 SP
User Story **As a** user, **I want** to access data about public transport in my preferred suburb(s) **so that** I can find the best suburb most appropriate to my lifestyle.	
Given that I am viewing a suburb profile page **When** I click on the public transport data tab **Then** I am shown an easy to understand representation of different public transport options in the suburb.	

Requirement 4: Website should show suburb area on a map.

Feature 1: User can view an interactive map of suburb and surrounding area

US ID	4.1.0
Priority	2
Estimate	3 SP
User Story **As a** user, **I want** to view the suburb area on an interactive map **so that** I can have a visual idea of the area geographically and so that I can view surrounding suburbs.	
Given that I am on the suburb's page **Then** I am shown a map with the suburb's area outlined.	

Requirement 5: News filtered by suburb should be visible on the suburb page

Feature 1: User can view the news relevant to a suburb on the suburb page.

US ID	5.1.0
Priority	3
Estimate	1 SP
User Story **As a** user, **I want** to view recent news headlines relevant to a suburb **so that** I can be aware of the local community's culture, achievements and/or hazards.	
Given that I have searched for my preferred suburb **When** I click on the suburb's profile page. **Then** I am shown recent news headlines specific to the suburb and surrounding area.	

Feature 2: User can expand the news relevant to a suburb on the suburb page.

US ID	5.1.1
Priority	3
Estimate	1 SP
User Story **As a** user, **I want** to expand recent news relevant to a suburb **so that** I can further my understanding of recent events within the region.	
Given that I am on the suburb's profile, **When** I click on the news headline that interests me, **Then** I am redirected to the headline's source website.	

Requirement 6: There should be a suburb demographics section including Age Group of Population, Cultural Diversity, Nature of Occupancy and Commute Methods.

Feature 1: User can access data about the age group of the suburb.

US ID	6.1.0
Priority	1
Estimate	2 SP
User Story **As a** user, **I want** to access the age group distribution in my preferred suburb **so that** I can find the suburb most appropriate to my age group and my needs.	
Given that I am viewing a suburb profile page **When** I am in the demographics Age Group of Population section **Then** I am shown an easy to understand representation of age group distribution in the suburb.	

Feature 2: User can access data about the cultural diversity in the suburb.

US ID	6.2.0
Priority	2
Estimate	2 SP
User Story **As a** user, **I want** to access the cultural distribution in my preferred suburb **so that** I can find the suburb most appropriate to my needs.	
Given that I am viewing a suburb profile page **When** I am in the demographics Cultural Diversity section **Then** I am shown an easy to understand representation of cultural diversity in the suburb.	

Feature 3: User can access data about the nature of occupancy in the suburb.

US ID	6.3.0
Priority	2
Estimate	2 SP
User Story **As a** user, **I want** to access data about the number of renters, mortgages and home owners in the suburb I am researching **so that** I can find the best suburb most appropriate to me.	
Given that I am viewing a suburb profile page **When** I am in the demographics Nature of Occupancy section **Then** I am shown an easy to understand representation of the percentage of renters, buyers and those with a mortgage in the suburb.	

Feature 4: User can access data about commute methods in the suburb.

US ID	6.4.0
Priority	2
Estimate	2 SP
User Story **As a** user, **I want** to access data about transport methods in my preferred suburb **so that** I can find the best suburb most appropriate to my needs.	
Given that I am viewing a suburb profile page **When** I am in the demographics Commute Methods section **Then** I am shown an easy to understand representation of the percentage of those who drive or those with different methods of public transport in the suburb.	

Requirement 7: There should be a list of all schools within the suburb.

Feature 1: User can access schools within the suburb and their data.

US ID	7.1.0
Priority	1
Estimate	2 SP
User Story **As a** user, **I want** to view schools and information about them such as name, type, grades, and gender within my selected suburb **so that** I can find the best suburb most appropriate to my lifestyle.	
Given that I am viewing a suburb profile page **When** I click on the schools data tab **Then** I am shown an easy to understand representation of education data in the suburb.	

Requirement 8: User must be able to compare two suburbs and see clear graphical representation of each one and their individual benefits.

Feature 1: User can search for second suburb to compare with the one that is currently selected.

US ID	8.1.0
Priority	1
Estimate	2 SP
User Story **As a** user, **I want** to search for a second suburb **so that** I can compare two suburbs I am interested in and make a better-informed decision.	
Given that I am viewing a suburb profile page **When** I click on the compare search bar **Then** I am able to search for a second suburb and select it.	

Feature 2: User can view individual suburb highlights on combined page.

US ID	8.2.0
Priority	1
Estimate	2 SP
User Story **As a** user, **I want** to view individual suburb highlights on the combined page **so that** I can easily compare the features of the two suburbs.	
Given that I am viewing a combined suburb profile page **Then** I am able to view individual suburb highlights. (See requirement 2, feature 1)	

Feature 3: User can view combined suburb radar chart, demographics and schools.

US ID	8.3.0
Priority	1
Estimate	2 SP
User Story **As a** user, **I want** to view a combined suburb radar chart **so that** I can visually compare two suburbs I am interested in and make a better informed decision.	
Given that I am viewing a suburb profile page **When** I select a second suburb to compare with **Then** I am able to view the suburbs' radar charts overlaid on one another.	

US ID	8.3.1
Priority	1
Estimate	2 SP
User Story **As a** user, **I want** to view a combined suburb demographics charts **so that** I can visually compare two suburbs demographics that I am interested in and make a better-informed decision.	
Given that I am viewing a combined suburb profile page **Then** I am able to view the suburbs' demographics side-by-side.	

US ID	8.3.2
Priority	1
Estimate	2 SP
User Story **As a** user, **I want** to view a combined schools tab **so that** I can visually compare two suburbs' schools.	
Given that I am viewing a combined suburb profile page **When** I select the schools tab **Then** I am able to view the suburbs' schools side-by-side and their relevant information.	

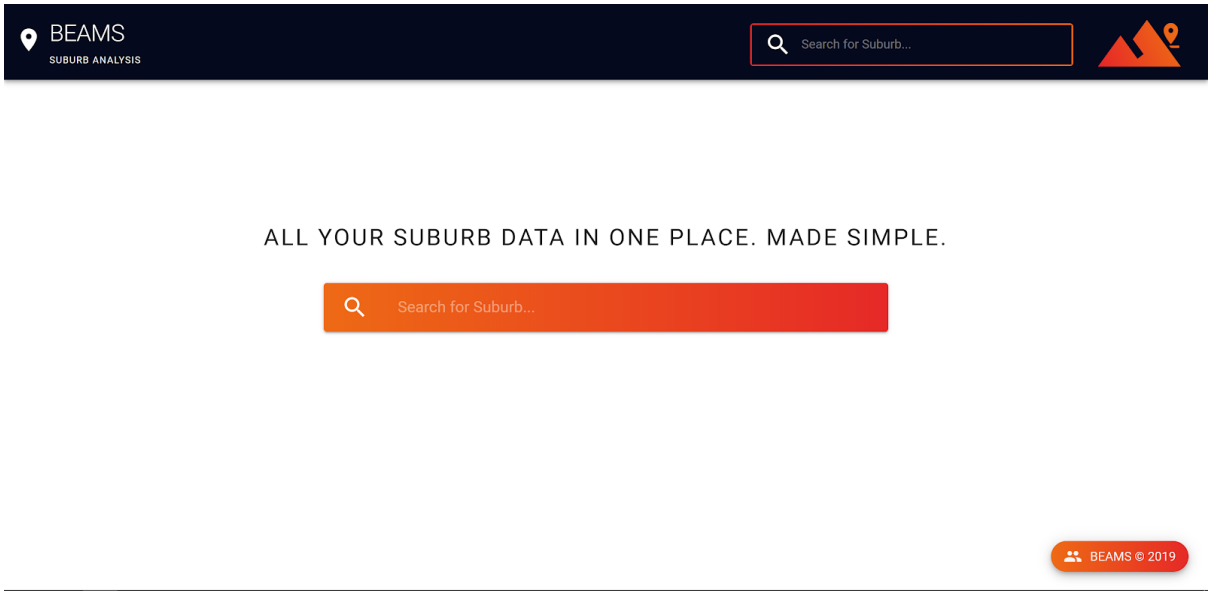
Requirement 9: User is able to see who created BEAMS and their roles.

Feature 1: User can view all developers of BEAMS and access relevant information

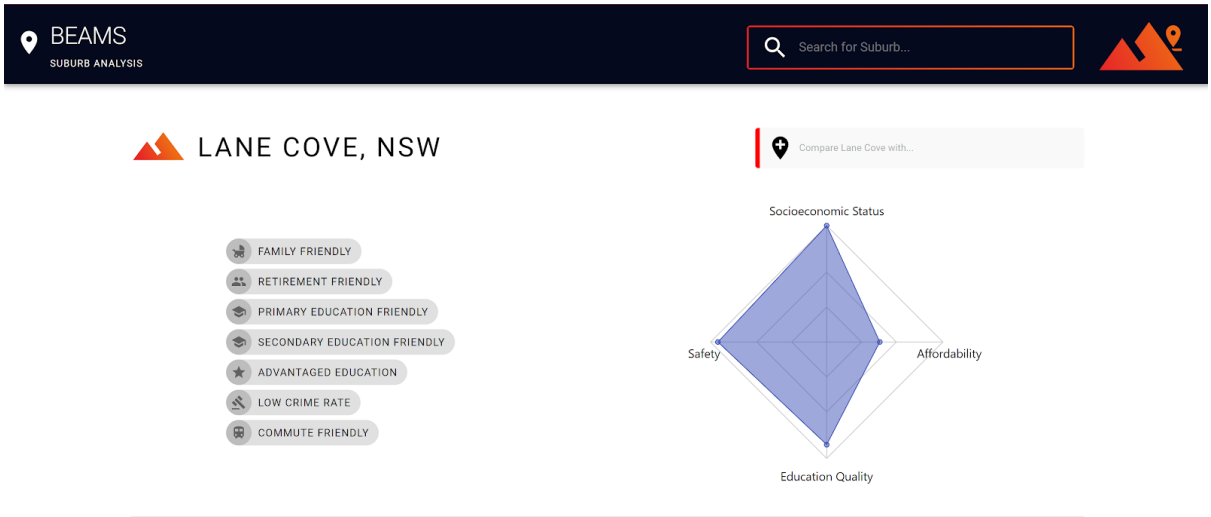
US ID	9.1.0
Priority	1
Estimate	2 SP
User Story **As a** user, **I want** to view the developers of BEAMS and their roles **so that** I can contact them if I have questions.	
Given that I am on the home page **When** I click on the BEAMS button in the bottom right **Then** I am shown the developer's page.	

Interface Screenshots

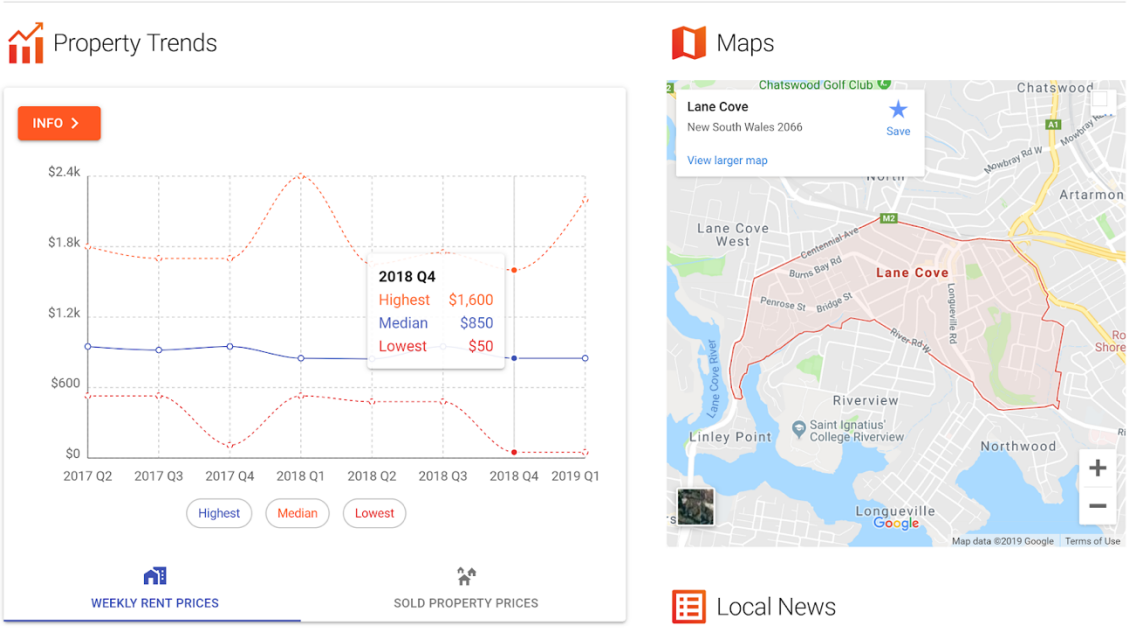
Home Page



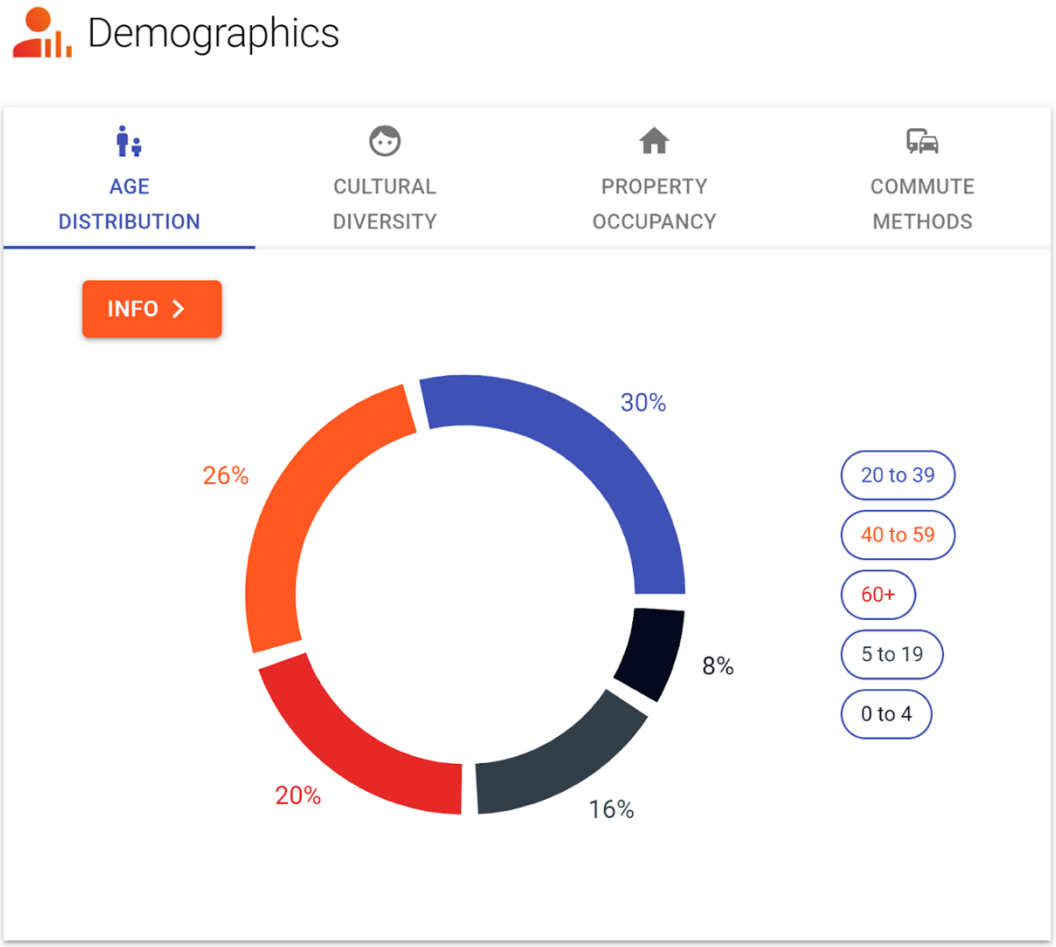
Highlights and Radar Chart



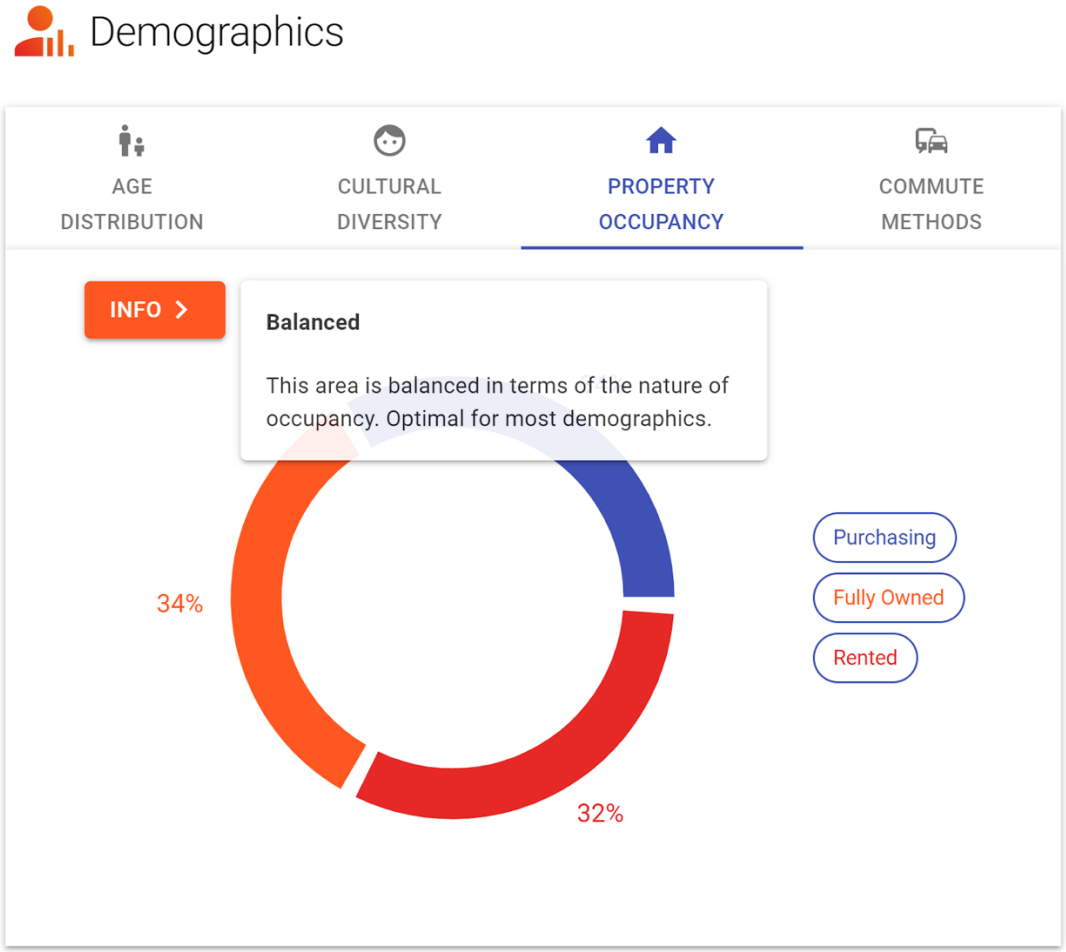
Suburb Property Trends and Map



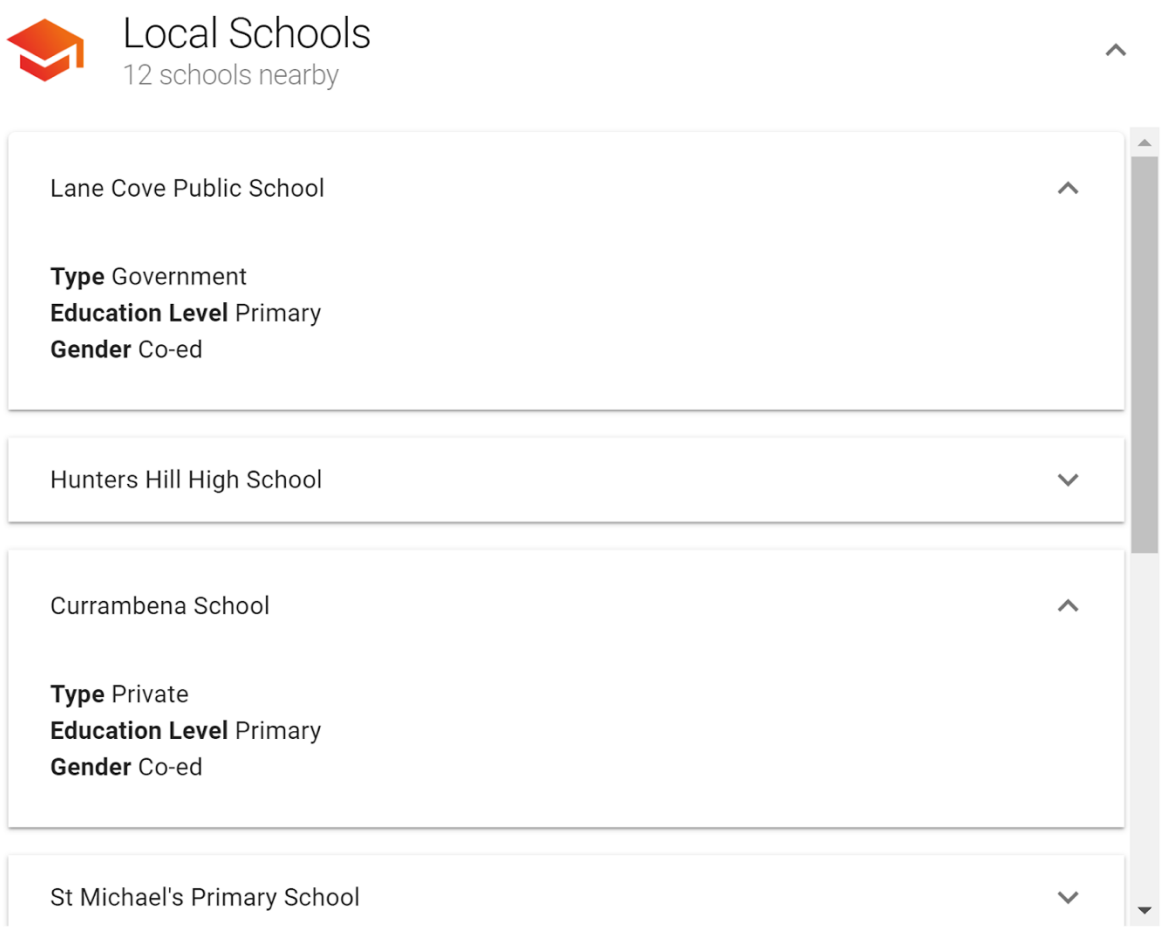
Suburb Demographics



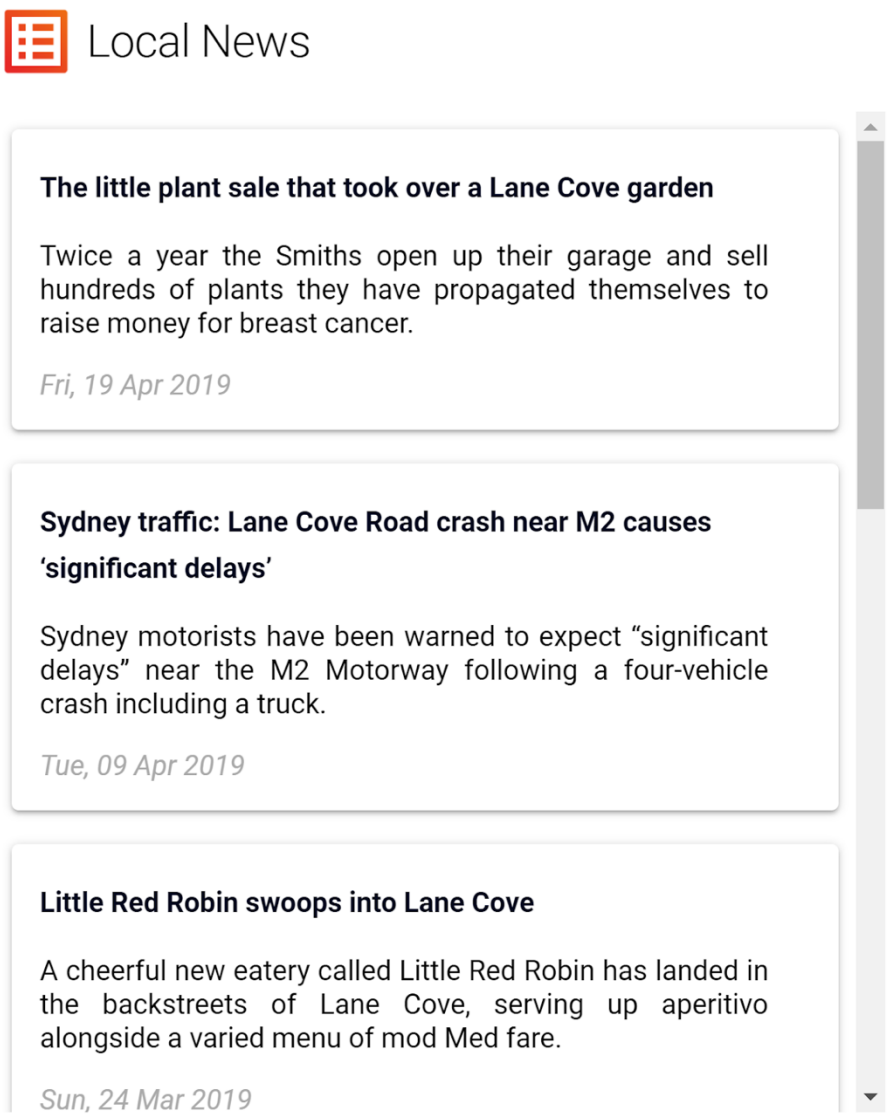
Suburb Demographics with Info Button Clicked



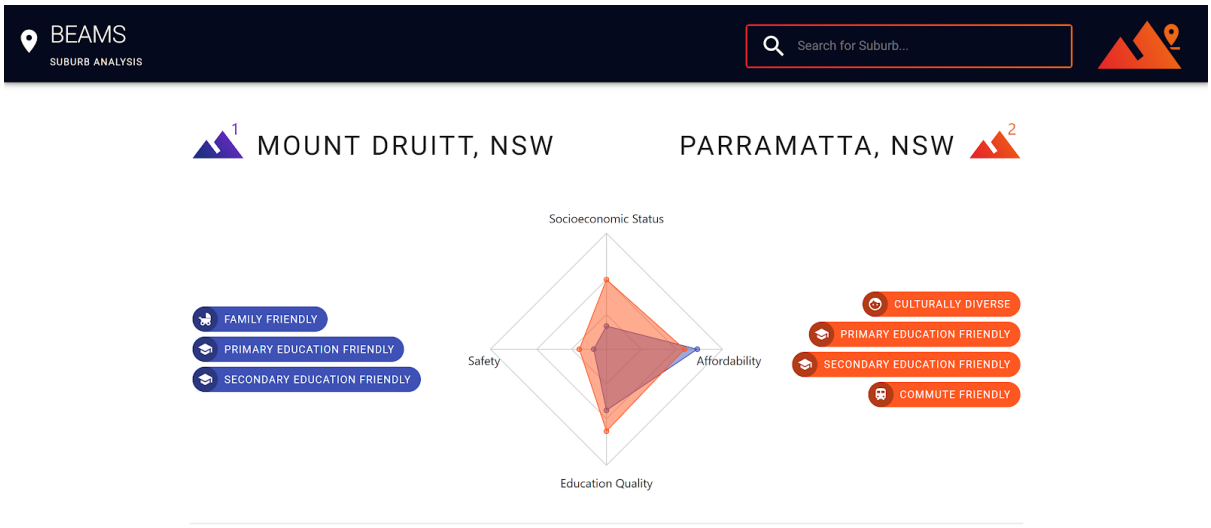
Suburb Schools



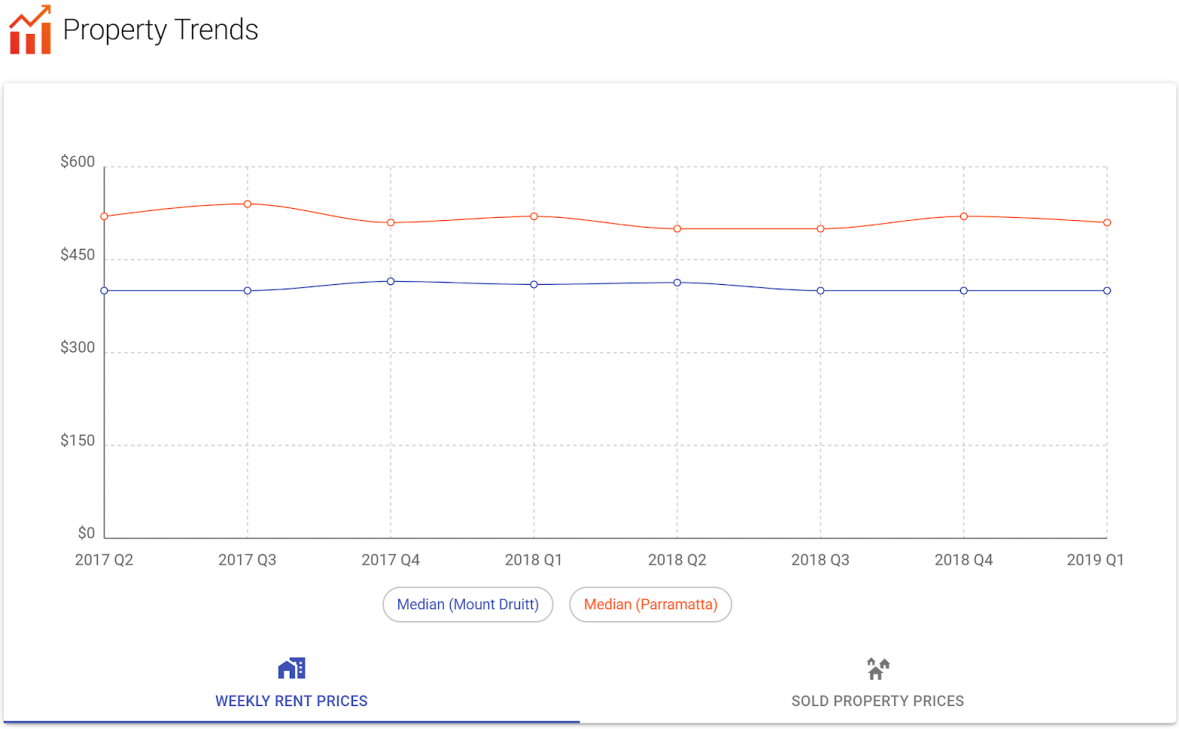
Suburb Local News



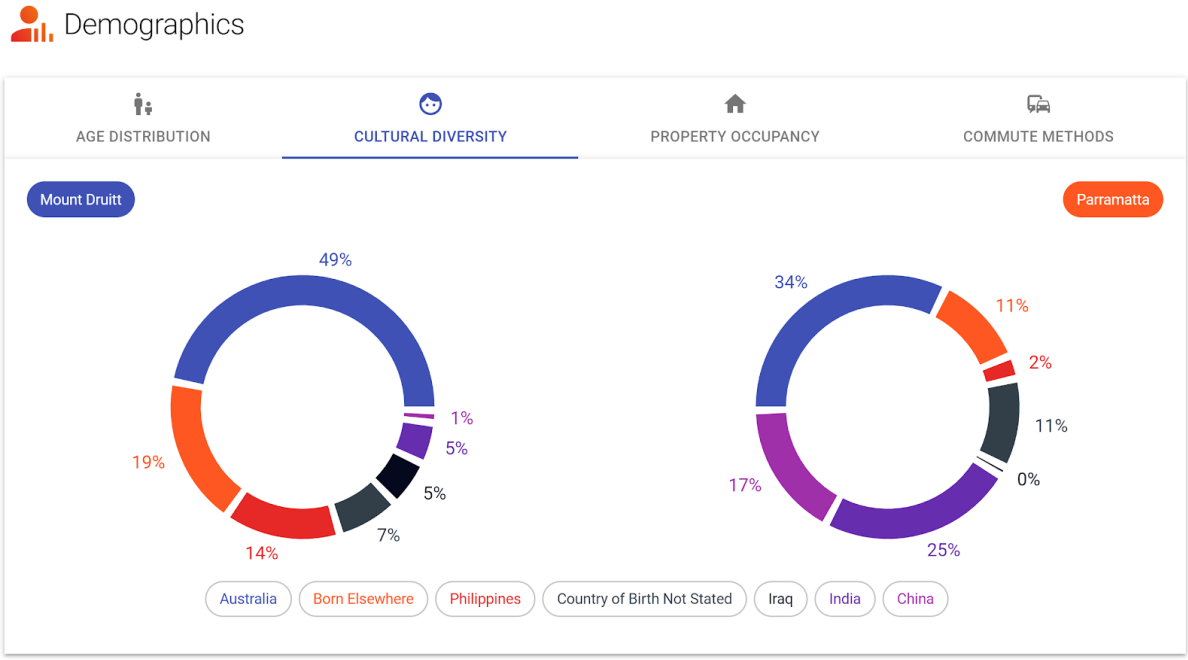
Comparison Page Radar Chart and Highlights



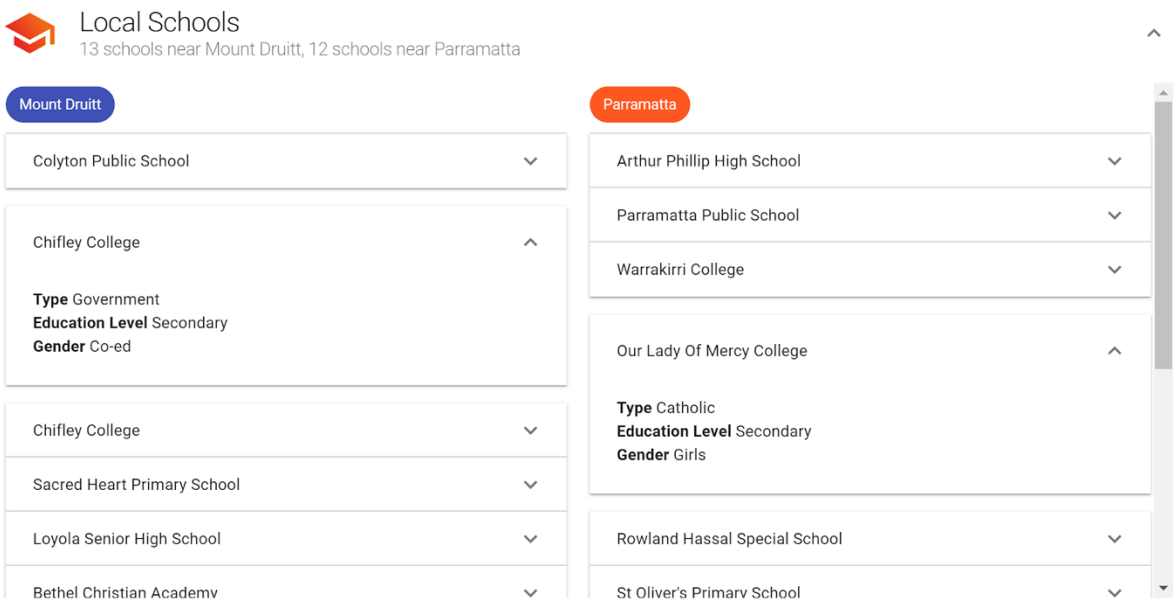
Comparison Page Property Trends



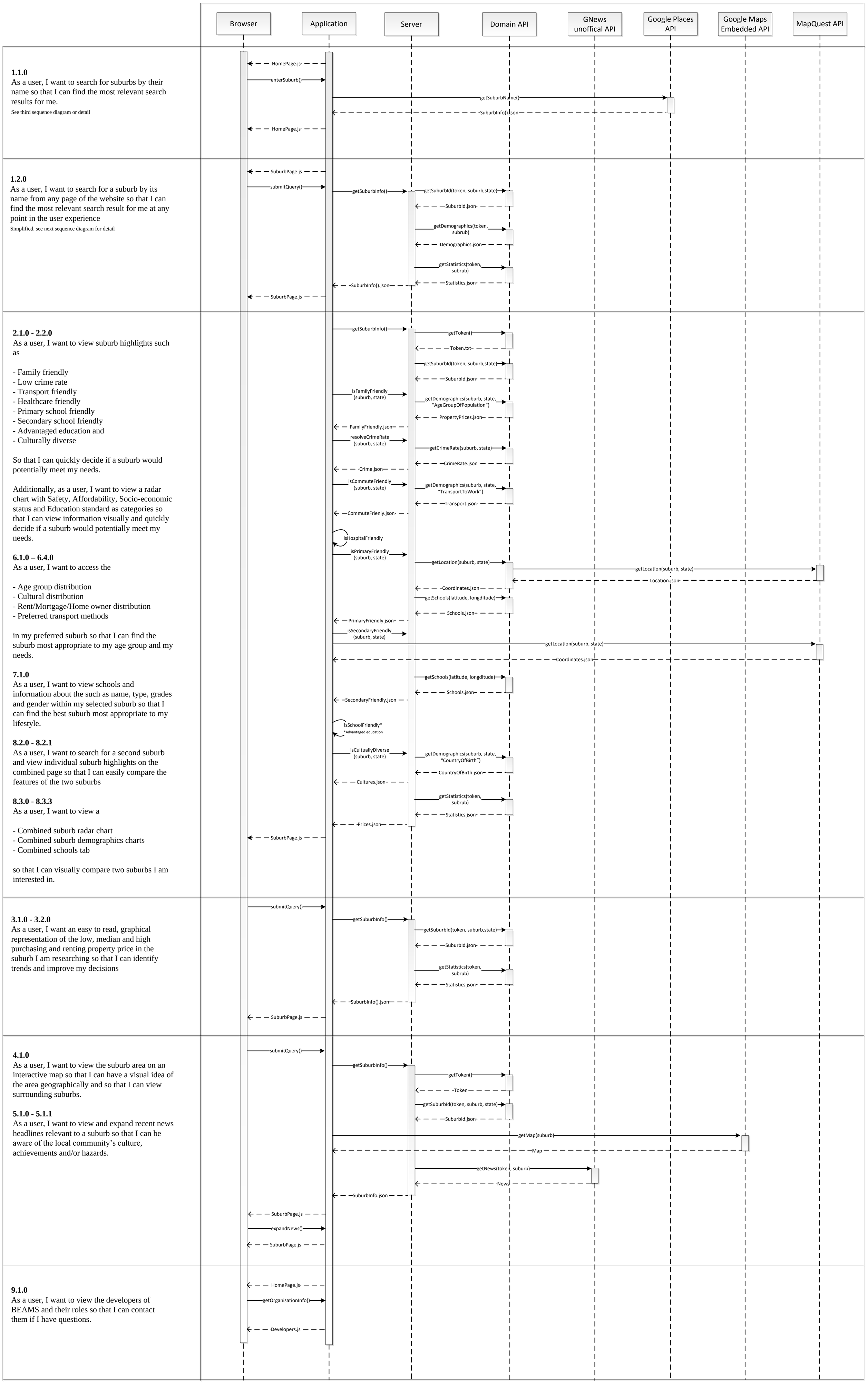
Comparison Page Demographics



Comparison Page Schools



Sequence Diagram



1.1.0
As a user, I want to search for suburbs by their name so that I can find the most relevant search results for me.

See third sequence diagram or detail

1.2.0
As a user, I want to search for a suburb by its name from any page of the website so that I can find the most relevant search result for me at any point in the user experience

Simplified, see next sequence diagram for detail

2.1.0 - 2.2.0
As a user, I want to view suburb highlights such as

- Family friendly
- Low crime rate
- Transport friendly
- Healthcare friendly
- Primary school friendly
- Secondary school friendly
- Advantaged education and
- Culturally diverse

So that I can quickly decide if a suburb would potentially meet my needs.

Additionally, as a user, I want to view a radar chart with Safety, Affordability, Socio-economic status and Education standard as categories so that I can view information visually and quickly decide if a suburb would potentially meet my needs.

6.1.0 – 6.4.0
As a user, I want to access the

- Age group distribution
- Cultural distribution
- Rent/Mortgage/Home owner distribution
- Preferred transport methods

in my preferred suburb so that I can find the suburb most appropriate to my needs.

7.1.0
As a user, I want to view schools and information about the such as name, type, grades and gender within my selected suburb so that I can find the best suburb most appropriate to my lifestyle.

8.2.0 - 8.2.1
As a user, I want to search for a second suburb and view individual suburb highlights on the combined page so that I can easily compare the features of the two suburbs

8.3.0 - 8.3.3
As a user, I want to view a

- Combined suburb radar chart
- Combined suburb demographics charts
- Combined schools tab

so that I can visually compare two suburbs I am interested in.

3.1.0 - 3.2.0
As a user, I want an easy to read, graphical representation of the low, median and high purchasing and renting property price in the suburb I am researching so that I can identify trends and improve my decisions

4.1.0
As a user, I want to view the suburb area on an interactive map so that I can have a visual idea of the area geographically and so that I can view surrounding suburbs.

5.1.0 - 5.1.1
As a user, I want to view and expand recent news headlines relevant to a suburb so that I can be aware of the local community's culture, achievements and/or hazards.

9.1.0
As a user, I want to view the developers of BEAMS and their roles so that I can contact them if I have questions.

Interface Design

Design was made with simplicity in mind. Design is done with Materials UI.

Software Architecture

BEAMS has both client-side and server-side rendering meaning there is integration and implementation of multiple languages and frameworks.

Server-side is implemented on NodeJS with Express Framework allowing for safe access to API endpoints. NodeJS is a Javascript runtime environment that allowed BEAMS to securely initiate communication with API endpoints, and Express.js is a node.js framework that provided a set of flexible and easy-to-use features for servers. These technologies were crucial in allowing communication between endpoints securely without revealing client secret and client id data to users.

BEAMS's client-side is implemented through React, a JavaScript library that allows developers to create interactive user interfaces for web applications. The React infrastructure is comprised of reusable, composable, and stateful components, allowing for seamless integration and modification of the codebase to be used in the BEAMS application. Acknowledging that the development team had minimal experience with frameworks for web-apps at the start of the project, the decision to use React was appropriate due to its shallow learning curve. There is also an abundance of supporting resources to utilise with this framework, including detailed documentation, a range of easy-to-use, accessible online libraries, and forums which include resolutions to common roadblocks. This meant that the team could learn and research good software development patterns with relative ease.

External Data Sources

BEAMS will require access to APIs related to geographic, demographic and infrastructure data, which will be employed in representing relevant data across different mediums. The APIs used are Google Places, Google Maps, Domain.com, Geocoder API, DeepAI API and GNews unofficial API. In conjunction with this, BEAMS also manipulated csv data from NSW, VIC and SA Crime Data, as well as My Hospitals Data published by the Australian Government.

- **Google Places API and Google Maps API**
  This API was used for the autocomplete search bar feature and the map feature on the suburb page.

- **Domain.com API**
  The domain.com API was used throughout the website and is the main API for the BEAMS website. The endpoints used were Address Locators, Demographics, Schools and Suburb Performance Statistics. These were necessary for the Property Trends Feature, Demographics Feature and the Schools Feature.

- **MapQuest API**
  This API provided geographical location services that was used to return latitude and longitude, given a suburb and suburb state, which are provided by domain.com API. The latitude and longitude would later be used to as one of the parameters needed to display the list of local schools for each suburb.

- **GNews unofficial API**
  This API produced a json object with information about numerous news articles related to a specific query, which is usually the suburb being searched by the user.

Deployment

BEAMS has been deployed on Digital Ocean this is due to the fact that it is easy to use and has a shallow learning curve.

Benefits of Design and Implementation

The architectural choices of BEAMS have many key benefits, including a rigorous but simple learning experience, flexibility and security. The end goal of BEAMS was to provide users with access to an interface that allows them to easily browse and understand the real estate market with reference to specific suburbs without any requirement to have a deep understanding on complex statistical data.

The architectural choices made in preparation for this project aided in achieving this goal, including our range of frameworks - React, Node.js, and Express - which allowed for a cohesive implementation of functionality and features. The use of CSS along with Material UI in conjunction with React provided greater enhancement of the Web App for the client while maintaining a minimalistic but intuitive interface that coincided with the documented objectives designed for this project.

This minimalistic choice of design was combined with a focus useability to create a seamless user-friendly experience. This motivation behind the overall design is clearly evidenced through the many ‘info’ buttons that are presented above all graphs and information modules on the website. This small, but significant design feature, and many more throughout the website, have created the perfect balance between simplicity and useability, successfully implementing our design choice of a minimalistic but rigorous design that featured a very easy learning experience for the user.

Responsibilities and Organisation

All members contributed to BEAMS and responsibilities were split with individuals choosing what they wanted to contribute.

Responsibilities were split as follows:

Mozamel Anwary	• Graphs for Property Trends • Graphs for Demographics • Material UI design for website • Radar Chart design and data manipulation • Local News refactoring • Information button on property trends and demographics
Bei Chen	• Developer Page and its routing • Application hosting on Digital Ocean • Mock pricing graph with britecharts-react
Paul Grace	• Local News • Reaching viability and creating mock of Sentiment Analysis on local news with DeepAI • User stories and requirements
Sumayyah Ho	• Highlight tags and manipulation of data • Information button on bottom of page
Mariya Shmalko	• Backend and server set up with NodeJS and Express • Calls to Domain.com and Authorisation associated with it • Routing of website • Search bar and autocomplete functionality • Map of suburb • Demographics API calls • Family friendly, low crime rate, advantaged education and healthcare friendly highlight tags • Data manipulation for safety rating and education rating on radar chart

Reflection

Overall, the team believes that the project has been a success. It is a minimalistic and visually pleasing implementation that brings complex market data and demographic statistics to the user in easy-to-understand methods.

Issues or Problems

There were few hurdles in the development of BEAMS. The ones that were encountered were mainly due to lack of experience in web-app development.

Initially, the team decided that server-side would not be needed and began to implement all features client-side. However, upon further reading of the documentation of Domain.com's API, it became evident that a server would be required for authorisation purposes. This meant that the team's progress on the Domain.com API's had to be refactored and implemented through server-side, causing a small delay in development.

What BEAMS Team would change going into the future

The team believes that the project was a success, however there are a few things that could change in order to streamline the development process. This includes better knowledge of the API's and their documentation.

Had the team initially been more familiar with the Domain.com API endpoints, the authorisation issue with Domain.com would not have been encountered and the team could have implemented everything from server-side making code cleaner.