



MSc in Computing - Team Project

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Chapter 1

Introduction

1.1 Proposed Hypothesis

Our project's goal is to provide an easy-to-use Geographical Information Service in Dublin City. In our preliminary research, we couldn't find a singular system that allowed users to gain a general overview of public amenities, for example, parking, bike infrastructure, or public transport. In Ireland and the United Kingdom, the prevalence of proper digitised records in county administrations varies wildly (Lynn et al., 2023). Some make use of state-of-the-art geographical information systems (GIS) while others rely on spreadsheets which are manually kept up to date. (McGuirk and MacLaran, 2001) A system that would allow users to quickly inspect a combined dataset grounded in automatically generated, real-world data could accelerate processes like planning permissions, urban development, or resource allocation. Prior to user evaluation, exploratory work was conducted in the forms of a market research survey to answer key demographic & product questions:

1. Who is our primary target user?
2. What kind of amenity data do they access and how?
3. What devices/tools do they primarily use?
4. Are they satisfied with those tools?
5. Would they consider Magpie useful in filling the gaps in their toolset?

Responses from the survey further allowed us to confirm our target demographic (figure 1.1), find out the proportion of users using amenity data for their work (figure 1.2), what type of amenity data they require access to (figure 1.3) and why current tools are unsatisfactory (figure 1.4). These responses also cemented the need

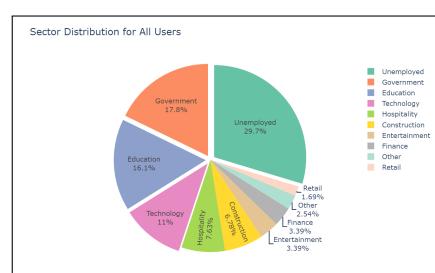


Figure 1.1: Target user sectors

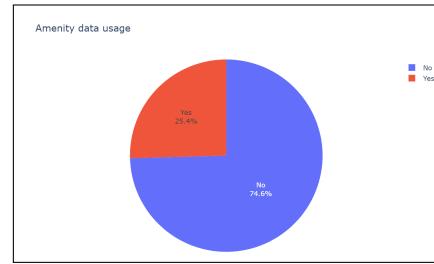


Figure 1.2: Amenity Access distribution

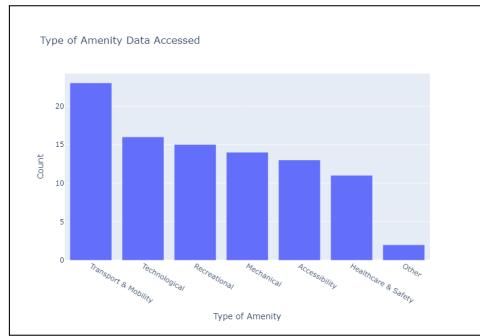


Figure 1.3: Current amenity data accessed



Figure 1.4: Current tools & satisfaction rate

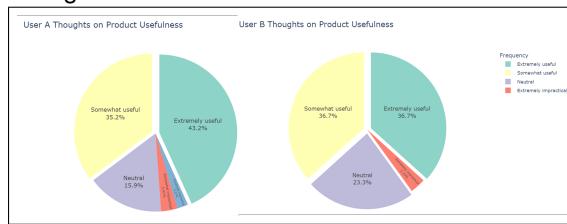


Figure 1.5: Magpie potential

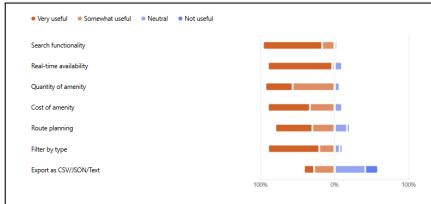


Figure 1.6: Additional features rating

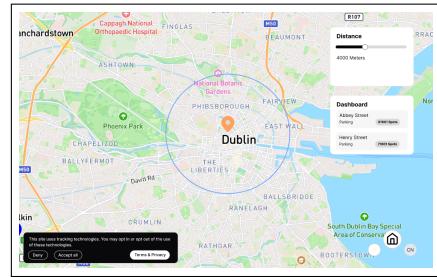


Figure 1.7: Version 1 of high fidelity prototype

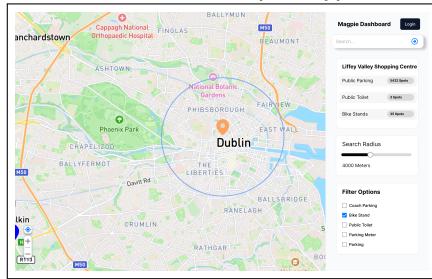


Figure 1.8: Version 2 of high-fidelity prototype

of Magpie (figure 1.5) for both casual users (User A) & professionals who require amenity data (User B).

The survey also helped us implement additional features (figure 1.6, 1.7 & 1.8) prior to the user evaluation such as a dashboard with search functionality and filters.

Magpie has remedied the first challenge of fragmented information on amenities, and through this user evaluation, we hope to address the second challenge which is making the access to this information easy, quick & accessible.

Chapter 2

Experimental Methods

The goal of the user evaluation is to gain feedback from real users, learn if Magpie works as expected and assess how user-friendly it is. We will be using 2 main methods to collect both qualitative data through open-ended questions, and quantitative data from multiple choice questions from which we will derive insights to improve the Magpie user experience.

2.1 Usability Testing

2.1.1 Casual Think-Aloud Protocol

1. Objective: Obtain quick feedback on frontend features during the development & implementation process
2. Conditions: Oral feedback, written notes
3. Methodology:
 - (a) Request feedback from users in the immediate circle
 - (b) Work together with the user through the app and the feature we want to test
 - (c) Observe workflow of the user, discuss freely on their manner of interaction with the feature
 - (d) Build on this feedback to make changes or implement the new feature
4. Baseline & Evaluation metrics: No baseline; user experience is evaluated "casually", meaning informally & subjectively at each person's discretion. This method serves as the "Step 0" of usability testing in helping us implement "Draft 1" of new features.

2.1.2 Uncontrolled (Remote)

1. Objective: Evaluate user experience in an uncontrolled environment, assess overall functioning of Magpie & identify any potential usability issues
2. Conditions: Online followed up by survey
3. Methodology:
 - (a) Share the link to Magpie online to wide user-base to request their participation in testing Magpie
 - (b) Send them survey to rate their experience

User Experience -
Magpie

How was your experience using Magpie? Please let us know below with this short questionnaire

* Required

1. What device did you use to browse through Magpie? *

2. How smooth was the sign up/log in process? *

3. How clear was the tutorial? *

4. How did you find the filters? *

5. How was your experience with the interface? *

6. What was the best thing about the application and why? *

7. What was the worst thing about the application and why? *

8. What would change about the sign up/log in page? *

9. What would you change about the dashboard? *

10. What was your overall impression of Magpie? *

11. Do you have any additional feedback/ comments on the application or your experience using it?

Figure 2.1: User Experience survey

- (c) Analyse the responses & present the results
4. **Baseline & Evaluation metrics:** No baseline; user experience will be evaluated through a 10 question satisfaction survey (figure 2.1) to collect quantitative data only. Minimum number of responses is 20 to produce valuable insights.

2.1.3 Controlled (Remote)

1. **Objective:** Analyze how users interact with Magpie in a controlled environment guided by specific instructions and tasks to complete & identify any potential usability issues
2. **Conditions:** Online through videoconference tools (Zoom/GoogleMeet/Teams)
3. **Methodology:**
 - (a) Reach out to casual users who left their contact email in the market research survey & request their participation
 - (b) Schedule the test session
 - (c) Conduct the test session
 - (d) Collect qualitative data from users through open-ended questions pre-during-post test
 - (e) Collect quantitative data from users through user experience survey post-test
 - (f) Analyse responses & present results
4. **Baseline & Evaluation metrics:** User experience will be evaluated through a range of metrics shown below:
 - (a) Task Success Rate
 - (b) Time on Task
 - (c) Difficulty of Task
 - (d) Errors

These will measure how the users are working through a series of pre-defined tasks (Table 2.1). These are the most common usability metrics and they tend to have moderate correlation with each other to suggest an overlap (Sauro et.al 2009). Averaging them together allows us to generate a Single Usability Metric (SUM) which summarizes the user experience running through those tasks. These metrics will be measured by filling score cards and through observation & discussion with the users. In addition, quantitative data will be collected through a user experience survey shown in figure 2.1.

Task	Expected Completion	Target Time	Difficulty (1-5)	Typical Errors
Load Magpie application	User sees login page	5s	1	Network timeout browser compatibility
Access Terms and Privacy	User views policy page	10s	1	None expected
Return to login	User returns to main login	5s	1	Navigation confusion
Sign up new account	Complete registration	2m	2	Invalid email format password requirements
Complete onboarding	Finish all tutorial steps	3m	2	Skipping steps, confusion about progression
Place cursor and set 250m radius	Radius circle visible at location	30s	3	Incorrect radius size wrong location
Zoom to road name level	Street names visible	20s	2	Over/under zooming
Zoom out to full radius	Complete circle visible	15s	2	Losing circle location
New location with 400m radius	Larger radius at new spot	30s	3	Radius adjustment issues
Select parking meter filter	Parking meters visible	15s	2	Filter selection confusion
Remove parking meter filter	Filter removed	10s	1	Filter deselection issues
Add toilets and WiFi filters	Both amenities shown	20s	2	Multiple filter confusion
New location with 100m radius	Smaller radius at new location	25s	3	Precise radius adjustment
Exit onboarding at step 3	Tutorial closed	10s	1	Exit button not found
Logout	Return to login page	10s	1	Menu navigation issues

Table 2.1: Magpie User Testing Protocol

2.1.4 Field-test (Remote)

1. Objective: Analyze how users interact with Magpie in a controlled environment guided by their own tasks for their day-to-day work & identify any potential usability issues
2. Conditions: Online through videoconference tools (Zoom/GoogleMeet/Teams)
3. Methodology:
 - (a) Reach out to professional users who left their contact email in the market research survey & request their participation

- (b) Schedule the test session
 - (c) Conduct the test session
 - (d) Collect qualitative data from users through open-ended questions pre-
during-post test
 - (e) Collect quantitative data through user experience survey post-test
 - (f) Analyse responses & present results
4. Baseline & Evaluation metrics: No baseline; user experience will be evaluated on their feedback through the user experience survey in figure 2.1, complemented by observational analysis.

2.2 Expert Review

We requested an expert review from UI/UX professional Andrea Curley. The goal of this review is to evaluate the user interface of Magpie, rate its user-friendliness in regards to UI/UX general guidelines and the application's compliance with the EAA (European Accessibility Act).

The expert review will be conducted online through a videoconference meeting on Teams and will take the following form:

1. Presentation of Magpie
2. Free-roaming of the application by Professor Curley
3. Questionnaire
4. Discussion & end of review

The questionnaire includes questions on visual design, information architecture, data quality & integration, technical performance, compliance and overall assessment of Magpie as shown in Table 2.3.

Table 2.2: Expert Review Questionnaire

Question	Question type	Answer type
How user friendly is the log-in/sign up page?	Closed	Multiple choice
How user-friendly is the on-boarding process	Closed	Multiple choice
How effective is the visual hierarchy of the information on the dashboard?	Closed	Multiple choice
Rate the clarity of the map visualization	Closed	Multiple choice
How intuitive is the organization of amenity data categories?	Closed	Multiple choice
Rate the following features from Worst (1) to Best (5) = Onboarding, Radius scaling, filter options completeness, profile menu	Closed	Scale
How comprehensive is the amenity data coverage for Dublin city?	Closed	Multiple choice
How valuable do you think this tool would be for the following use cases - 1: Not valuable at all, 5: Extremely valuable = Urban planning, Resource allocation, Planning permissions, Event planning, Education, Travel planning	Closed	Scale
Any additional comments on why this tool would be useful/impractical for the above use cases?	Open-ended	Text
Evaluate the following technical aspects from Worst (1) to Best (5) = Loading speed, System responsiveness, Data update frequency, Filter functionality, Radius selection	Closed	Scale
Rate the application's compliance with the items below from Worst (1) to Best (5) = Accessibility, GIS data standards, GDPR	Closed	Scale
Any additional comments regarding our application?	Open-ended	Text

Chapter 3

Results

3.1 Usability testing

3.1.1 Casual Think-Aloud Protocol

Onboarding feature implementation

Onboarding feature was tested with two users, one casual and the other professional. The professional user had little issues with the onboarding feature, and found it clear and went through each step smoothly without questions. The casual user attempted to click on the highlighted user interface elements during the tutorial, which is not possible. They expressed that they would've liked to interact with the highlighted elements.

Due to the limitation of the feature, we are not able to make this interaction possible. However, a deeper black was added to the screen overlay to better indicate that elements are not clickable. Figure 3.1 shows the before and figure 3.2 the after.

In addition, Gifs were also added to the onboarding elements to indicate what each button does. The onboarding feature was tested again with the same users and they both found it more intuitive

Avatar implementation

In the early development stage, we collected feedback from roommates and colleagues who pointed out that the avatar should display correctly on different devices and have the function of changing pictures such as uploading or selecting. At the same time, some people also reported that according to their experience, they may encounter difficulties such as inflexible image cropping and slow upload speed.

Based on this feedback, we adjusted the default avatar to make it responsive on different devices and are currently developing the "add/upload profile picture". We will also pay attention to the concerns mentioned throughout the development of the profile feature.

Dashboard Implementation

5 users were provided unrestricted access to the dashboard and encouraged to interact naturally with the system while providing verbal feedback. This approach allowed us to observe authentic user behavior and identify potential usability issues.

Map Interface: Users quickly figured out how to move around and zoom in and out without needing instructions. However, users less familiar with digital maps mentioned they'd prefer having traditional '+' and '-' buttons for zooming rather than

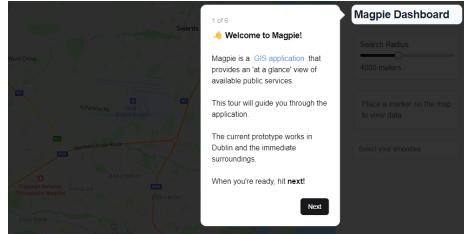


Figure 3.1: Onboarding before overlay change

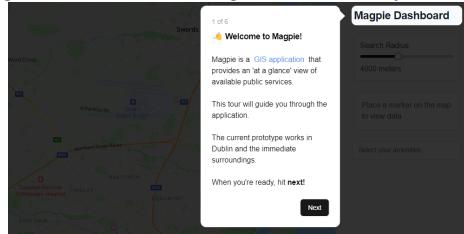


Figure 3.2: Onboarding after overlay change



Figure 3.3: First version of avatar/profile button

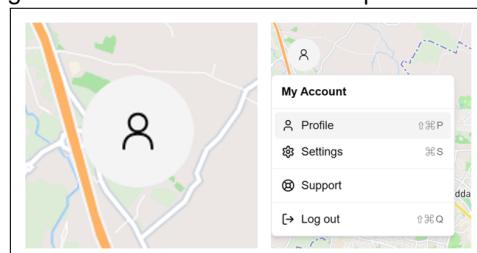


Figure 3.4: Second version of avatar/profile button

relying on the mouse wheel. Some also found it tricky to keep track of where they were in relation to the wider city area, suggesting that a small overview map in the corner would help them stay oriented. A few users also mentioned that when they selected an area, they weren't always sure if their selection had registered properly, indicating we could make the visual feedback more obvious when an area is selected.

Radius Control: Users found the radius selection tool intuitive to use. When they moved the slider, they appreciated seeing the circle size change immediately on the map, giving them instant feedback about their selection. However, several users mentioned it would be helpful to type in specific radius values when they needed exact measurements. Some also suggested having quick-select buttons for commonly used distances, like 100m, 250m, and 500m, which would save time for frequent searches. A few users noted that the circle outline could be hard to see in certain areas of the map, and recommended making it more visible, perhaps with a bolder or more contrasting color.

Amenities Filter: This part of the dashboard received mixed feedback. Most users found the basic selection and deselection process straightforward, though three users specifically mentioned they initially missed the scrollable nature of the list. Two users suggested grouping similar amenities together, particularly noting how parking-related options (Parking, Parking Meter, Accessible Parking) could be consolidated under one category.

All users successfully used the filter, but four out of five mentioned that a search function would be helpful when looking for specific amenities in the list. The most common praise was for the clear 'x' button to remove selections, while the most frequent criticism was the lack of visual hierarchy and categorization in the list. One user specifically noted that larger icons on the map would improve visibility and recognition of different amenity types.

Map Legend Dashboard: All users appreciated the clear display of amenity counts and consistent labeling format (Spots, Locations, etc.), but three noted confusion about zero values staying visible in the list. Two users specifically mentioned that adding icons to the dashboard would help quick identification, while all users noted the helpful distinction between different unit types (Spots vs. Locations vs. Points). The most significant improvement request was for better visual hierarchy and the ability to collapse categories to reduce scrolling.

3.1.2 Uncontrolled (Remote)

In Progress

3.1.3 Controlled (Remote)

In Progress

3.1.4 Field-test (Remote)

In Progress

3.2 Expert review

The review provided very valuable insights on Magpie's workflow, user interface and technical components. These were the main takeaways:

Landing Page: Upon loading Magpie, Professor Curley was directly taken to the mapview, which was not supposed to happen. After the review, we investigated the cause of this event and uncovered a bug in the authentication which we have been working on. Following this event, she suggested creating a landing page or some sort of introduction to ease the user into discovering Magpie.

Onboarding: Due to the bug explained above, the onboarding did not automatically start as it should have upon login. Nevertheless, Professor Curley said that the user may want to intuitively press on the elements being highlighted during the tutorial, as she tried to do. This adds to the feedback received during casual testing for the implementation of this feature. Unfortunately, due to a technical limitations we are not able to solve it, only provide make certain changes to dissuade the user of doing so.

In addition, Professor Curley suggested there should be an option to exit the tutorial at any time for users who don't want to sit through it. Lastly, the tutorial should be more visually striking and engaging in order to leave a lasting impression on the user.

Dashboard & Map: Currently, the hierarchy of items on the dashboard does not make sense to the average, and is not intuitive to use. All the amenities are displayed when only one is selected (as shown in figure 3.3) and their count displays zero, which the user might interpret as there are zero other amenities in the area in addition to the one I selected.

The icons on the map are not visible enough, and zooming in & out on the map may not be intuitive to the range of users and devices. Adding zoom buttons could help bridge that gap.

Currently, Professor Curley noted that there is a disconnect between the map and the dashboard whereas they should be looked as one. She suggested adding amenity icons to the dashboard to help bridge that gap.

Filters: If there are no amenities found in the radius of search, a message should pop up to tell the user so. Currently, it is not very clear if there are amenities present in the chosen area especially due to the small size & faded color of the icons.

Log in/sign up: When trying to log in with credentials that don't exist, the system should return a proper error such as "username doesn't exist". Log out and account sign up went smoothly. Professor Curley questioned the benefits of logging for Magpie, to which we stated: Magpie was conceived with the idea of providing a service to working professionals; therefore logging in will allow the implementation of further features such as safeguarding their previous searches, storing exported reports, connecting with other members of your organization and much more.

Overall: To resume, Professor Curley found our interface sleek and minimalist. However, she suggested that if we want to remain with this style, we need to ensure there is as little room as possible for ambiguity and confusion. The user needs to find it easy to move from one feature to another and understand the triggers. Currently, Magpie looks so sleek that the user may not be able to see what they want.

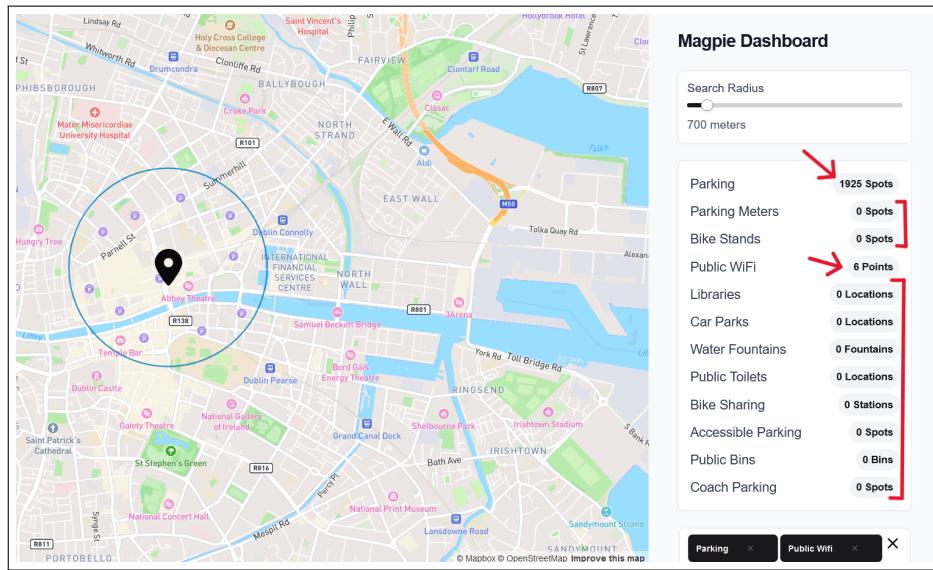


Figure 3.5: Current dashboard & map when 2 amenities are selected

Survey response Below are the answers to the expert review survey in table 3.1. The number next to each multiple choice answer refers to the rating, 1 being the worst and 5 being the best. The response to the survey help complement the oral feedback received during the expert review and provide some quantitative data as a baseline for the next evaluation. The two open-ended questions, to which she asked us to elaborate further, will help us review future open-ended questions and ensure they give enough information for the user to answer.

Login

Enter your username or email below to login to your account

Username/Email

Password [Forgot your password?](#)

Login

Login failed: {"error": {"errorCode":1402,"errorMsg":"Wrong username or password"},"response":null}

Don't have an account? [Sign up](#)

By clicking continue, you agree to our [Terms of Service](#) and [Privacy Policy](#).

Figure 3.6: Current error when inputting non-existent username and password

Table 3.1: Expert Review Questionnaire Answers

Question	Answer
How user friendly is the log-in/sign up page?	Good (4)
How user-friendly is the on-boarding process	Neutral (3)
How effective is the visual hierarchy of the information on the dashboard?	Somewhat effective (4)
Rate the clarity of the map visualization	Average (3)
How intuitive is the organization of amenity data categories?	Neutral (3)
Rate the following features from Worst (1) to Best (5)	Onboarding: 3, Radius scaling: 4, filter options completeness: 3, profile menu: 1
How comprehensive is the amenity data coverage for Dublin city?	Somewhat comprehensive (4)
How valuable do you think this tool would be for the following use cases - 1: Not valuable at all, 5: Extremely valuable	Urban planning: 4, Resource allocation: 2, Planning permissions: 4, Event planning: 4, Education: 2, Travel planning: 3
Any additional comments on why this tool would be useful/impractical for the above use cases?	For each of those user groups, it needs to be signposted more, how they would use them. There is too much left to trying to figure it out yourself. It possibly is very useful for all but needs highlighting by you.
Evaluate the following technical aspects from Worst (1) to Best (5)	Loading speed: 3, System responsiveness: 3, Data update frequency: 1, Filter functionality: 3, Radius selection: 4
Rate the application's compliance with the items below from Worst (1) to Best (5)	Accessibility: 2, GIS data standards: 3, GDPR: 4
Any additional comments regarding our application?	Is loading speed and system responsiveness the same? What does data update frequency mean?

Chapter 4

Conclusion

4.1 Next steps

4.1.1 Implemented changes

- Fixed authentication bug to ensure user lands on the login page = remedies brusk introduction to Magpie by landing directly on the map
- Implementing custom icons with new colors & larger size = remedies unclear icons when choosing amenities to display on the map as seen in figure 4.1.

4.1.2 Planned changes

- Rearrange dashboard to improve workflow and make it easier for the user to navigate the features = remedies confusing workflow of the dashboard
- Add amenity icons to the dashboard to help user intuition = remedies disconnect between the map and the dashboard
- Add an escape button to the onboarding = remedies locked in the tutorial
- Add more features to the radius control to enhance user experience when interacting with it = extra feature
- Consolidate certain filter items for easier selection = extra feature
- Enhance radius circle format = extra feature

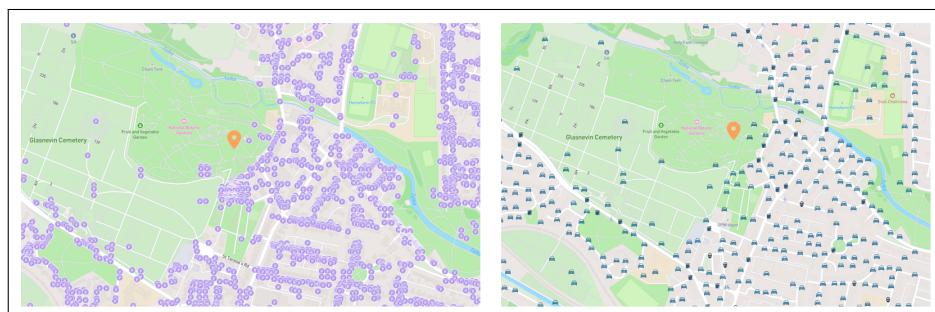


Figure 4.1: Before and after icon changes

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