Addressed Changes

From our mentor, one source of feedback that we got from our Proof of Concept was that paths seem to persist on the map even after clicking through different marks. This was not intended and we fixed that error so that when a user now clicks on two other points, the old path will disappear. This removes confusion and cluttering on the map.

Another source of feedback we got from our Proof of Concept was that there seems to be an arrowhead at the end of a path, where the arrowhead seems to be very large even when the path is short. This was first intended to emphasize what direction of the path the user was trying to take, but we decided it was not necessary and further cluttered the path. As a result, we removed the arrow completely to keep a more simplistic approach. Instead, we denote the start and end of the path by the color of the marker that is placed at these respective locations.

From our Proof of Concept, other changes we made now include adding on the concepts of Commenting and Rating, which was not present before. We also integrated the addition of Blue Bike station stops to make it more clear and accessible where a user can even find a bike to use, along with Google authentication. We addressed the feedback received in the very very beginning when we presented our idea regarding having saved paths, which we address later in this document.

Heuristics

1. **Visibility of system status**

The visibility of the system status can be clearly seen through the marks currently on the map. If the user is in the current process of planning a trip, there will be 2 markers (red and blue indicating start and end) and paths of different colors in between these 2 markers indicating the different paths. If there is just a single mark or 2 markers without paths in between, it indicates that the user is currently marking that something is happening on a path or at an intersection. We give the user to drag this marker around. If the map is blank, it means that nothing is currently going on right now. Through the different colors and possible options on what is displayed on the map, we allow the user to stay informed about what is going on.

2. **Match between system and the real world**

One way we match the system to the real world is through the use of a map to guide the user in planning their paths. This map has been a standard, whether it be a physical map or Google/Apple maps, to help people navigate. We believe that using this concept to now “plan” a trip reduces friction for the user to become more familiar with our platform as they are already familiar with a map from other common situations.

We also ensure that we speak the user’s language through the use of common icons, icon images and phrases that our users will understand. The button corresponding to planning a trip has a pin on a map icon, with the words Plan Trip right next to it. This icon is already commonly used throughout the travel industry to indicate planning, which is why we use it as users will already be familiar with it. If they are not, we indicate the action of the button itself with the words Plan Trip, which should clearly communicate what this button will do when pressed.

To create a mark on the map, users can enter street addresses names to get location on the map.

Users can also toggle to different views of the map such as the satellite view or an option to allow 3D rendering. This map view closely matches the view of locations in the real world and hence improves the overall user’s experience while navigating through the app.

3. **User control and freedom**

We ensure that the back arrow always appears on the white popup on the right side when the user is performing an action, so that the user can easily go back to the home screen or their previous action on the white popup without a hassle. For example, when a user goes to apply a filter on their search for valid marks, to potentially filter by a minimum rating or sort by rating

instead, there is the back arrow at the top to allow the user to return to their previous action. In addition to this, at this stage, at the bottom we have two larger buttons that say Cancel and Apply. The easy access to these buttons allow user freedom when applying the filter, as it is unpleasant for a user to be stuck looking at marks with a filter they don't know how to remove.

We have added a feature that allows a user to drag a marker on the map and place it at any desired location. A user has the freedom to always be able to correct the location of the already placed marker. This feature saves a user from a 2-step process of deleting a mark and creating a new mark in a different position.

4. **Consistency and standards**

One standard that we ensure to follow is the common authentication process when creating a user. How we go about doing this is through Google authentication. Most users will have a Google account that they can use. We can see this sort of authentication on many other platforms as users are so familiar with Google. Thus, we decided to use this because it will be low friction for the user to join our platform, which will allow us to easily convert visitors to users, and also because the user will understand how to easily do this because it is a common standard.

Other ways we implement consistency with norms from other platforms include the usage of common icons on our buttons. For example, our add mark button has the plus icon sign, which is a set norm that means adding something new to the platform. In this case, the user would be adding a new mark to the system. We also understand that the users of our platforms, bikers in Cambridge, will probably be familiar with the Blue Bikes system, as this is one of the most popular forms of transportation in Cambridge. As a result, we decided to also integrate Blue Bikes data into this platform. When a user clicks on the BlueBikes button, valid Blue Bike stations will pop up and the user will be able to hover over the stations and get a quick glimpse of the information of each of these stations, such as the current number of bikes, docks, and the name of the station.

5. **Error prevention**

One way we incorporate this is when a user who isn't logged into the program attempts to rate a mark or perform an action that they are not allowed to when not logged in. When this happens, a popup appears, graying out the rest of the screen and presenting the user the option to either log in or cancel (and thus prevent them from performing this action). This prevents the problem of spam users and our issue of not being able to detect which user rated a mark, as every mark that has been rated is rated through a valid user. This popup with words telling the user why this popup has occurred allows our platform to prevent errors through these motions (either accidental or intentional) and allows us to also convey what the user can do next to prevent this error from happening again.

6. **Recognition rather than recall**

One way we do this is through the buttons itself at the top left. The icons can be confusing at points. Instead of having a manual or having the user recall what they've seen on another common platform, we ensure to have a quick 2 word description of what that button is supposed to do (such as Plan Trip) so that the user won't forget what the button does.

Another way we implement this is through the white popup on the right. When a user enters a new view, such as planning a path and seeing all the marks, on the top of the popup, in bold, Marks in area shows up. This gives users a constant reminder as to what view they are on so that they won't forget while scrolling through or playing around with this view.

7. **Flexibility and efficiency of use**

We want to ensure that users who commonly use our platform can have tailored use cases. Thus, one thing we decided to implement was adding the functionality of the saved path. We decided to add this because if there is a consistent and expert user of a platform that always takes the same path, we want them to be able to easily access and plan this path without having to go through the process of clicking on a start and end location every time, as that might get annoying. Thus, we allow a user to click on a path and save it. This will also be displayed on their profile under saved paths. This will allow a user who consistently goes on one path to either create a path through the usual way (clicking on the start and end points) or go to their saved paths and easily choose a path they consistently go on.

8. **Aesthetic and minimalist design**

One way that we try to keep our platform as aesthetic as possible is through the distinguishing of paths from one location to another. When we display the different paths, they are also different colors so that the user knows that there is a difference among all of these paths. Instead of having a more clunky way of distinguishing the paths, such as a name or label on the paths, which can get very messy, we decided to use color as that is simple and keeps the number of things on this platform to a minimum. Displaying the paths is an essential component of our platform, and by also adding a color onto these paths, it distinguishes itself from the white/tan map in the background and allows a much easier user experience.

9. **Help users recognize, diagnose, and recover from errors**

Going back to point 5, we further elaborate this. One way we help users recognize the error is through the popup, which prevents the user from completing the action they were not allowed to complete. This is also a diagnosis as it shows the user that the action they just completed is not allowed. To recover from this error, we give suggestions for how the user can recover. For example, in this popup, we easily give them the option to authenticate with Google, which allows them to log in/generate an account and thus resolve this error and perform the action they weren't able to before.

10. **Help and documentation**

This heuristic is not fully applicable to our application at the moment, but we hope that given time, we can also add this more. Currently, we believe that our system functions without it as our buttons (that indicate Plan Trip, Add Mark, and Bluebikes) are self sufficient in describing the main parts of our system. The other parts such as commenting, replying, starring/rating, etc. are also fairly standard across all forms of social media so we do not feel as if those actions require documentation.

For the final submission, we consider creating an FAQ page to help where users can find explanations on how to use different features of the map. In addition we want to have the search bar concept where a user can search for a keyword (such as a feature name) and be directed to a page that has instructions on how to use that feature.

Updated Ethical Protocol Analysis

Identify Stakeholders (Anyone or anything that can be affected by your project)

- Our Users
- The government/local municipality
- Restaurants/Property owners
- Third party software (Open Street Maps, Leaflet, Google, Bluebikes)
- Cyclists

Preliminary Design Choices

For our preliminary design choices, some of the questions we discussed are below:

- Who can post markings? (our users ?)
- Who can see markings ? (anyone ?)
- How are users rated, that's a design choices
- How are markings made?
- How do we sort posts?
- Who has access to what?
- How is the user authenticated / verified?
- What determines the validity/relevancy of a mark?
- How is the user a credible source of information?

We also want our users to be able to have selective access to features as well as a seamless login through third-party authentication.

Envision Possible Futures (Guiding Questions)

When envisioning possible futures, we aim to think about the best case, worst case, and potential complaints.

In regards to the best case scenario, we would like our app to be adopted by the local municipality. This would increase the number of users on our platform and more potential data and funding. The app will hopefully facilitate awareness of various traffic related issues in the community which will eventually speed up government response in fixing these issues. Examples of this increased government response would include the construction of wider bike lanes, new bike lanes where restaurants have impeded on old ones, and the blocking of bike lanes near dangerous construction.

In regards to the worst case scenario, our app may be taken over by users who misuse the app through spamming of invalid posts. Currently, our app gives users the power to add marks without validating. Through spamming, our app will not be trustworthy and will lose reliability. Our app also heavily relies on the crowd. If no one is on our platform or no one is engaged, resulting in no posts, then our app will not have any functionality. If our app crashes, this is another worst case scenario as our users will not be able to access any information in this time period.

Some anticipated complaints we have from our users is that the ability to choose a location on a map may not be accurate enough.

Identify values at play

Fairness

- Every user interacts with the app equally. User's rating/credibility in the app solely depends on the marks that the user creates and therefore no user is treated unequally in that sense. Moreover, only users who are authenticated can interact with the platform

Transparency:

- We are committed to be transparent about the way in which we use our user data. We are not using user data in any malicious way such as selling it to advertisers.

Safety

- We are also committed to ensuring that our app is safe for all users. Safety is also defined in regulating misinformation on the state or conditions of road networks/
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First Decision Selective access to features

1. Our Users

Process lens: Authenticated Users and non-registered users will understand the reasons behind the selective access to features. Authenticated users already have a valid identity therefore can be easily held accountable on our platform. That's why only authenticated users are able to "write" to our platform, i.e. make marks, comment on marks, rate marks. However, non-registered users can benefit from the marks that authenticated users have published. This also upholds our value of **fairness** that certain responsibility/privileges can only be given to people who are capable of being held accountable when they fail to uphold them.

Outcome lens: The best case scenario for users with the decision is that unregistered platform users can reap the fruits of authenticated user's labor in marking

areas. The best case for authenticated users is exclusivity of the platform i.e. there is **safety** in that posts by users on the platform are more reliable. The worst case scenario for non-authenticated users is the lack of authenticated users who can mark roads, intersections on the platform.

2. The government/local municipality

Process lens: The government is explicitly left out in the design decision. There's no portal/window that they can interact with the platform from an administration point of view. So they can interact with the platform as authenticated users with ordinary profiles or salvage the features such as planning meant for non-authenticated users. However, this may compromise our fairness values as they could have a greater impact in the distribution of the application, and can be more informative on the conditions of road networks.

Outcome lens: The best outcome for the government is that they can rely on validity of marks that are done by authenticated users.

3. Bluebikes

Process lens: BlueBikes are included with incorporated features such as the searching of Bluebikes stations. This is fair, as they get to become an integral part of the platform by providing much needed transit services to our users.

Outcome lens: Best case scenario is that more Cambridge citizens are aware of Bluebikes as the feature to search for bluebikes is available to both authenticated and non-authenticated users. As a result, Bluebikes can have increased revenue in terms of bikes rented for trips. Worst case scenario for blue bikes is that the platform has no users, therefore they won't be able to benefit

4. Property Owners

Process lens: They are being included in the design decision. However, since we are going to be displaying images of their properties e.g. a restaurant blocking bike lane, people may have negative sentiments towards a certain restaurant. Moreover, since the planning feature is available to all users, negative reviews towards a restaurant may be magnified.

Outcome: Worst case scenario/Best Scenario : Restaurant may get publicity, bad or good publicity.

Update for MVP

- All decisions in selective access to features are maintained/implemented on the MVP.

Second Decision **Adding tags, ratings, to marks**

- Our Users

  Process lens: We made this feature to explicitly include the voice of our users and provide clarity to our users. This upholds our value of **transparency.** Our users understand that to obtain credibility, they must put content in marks that are reliable.

  Outcome lens: The worst case scenario for our users is that the tags are misleading and our users do not find an optimal path for their situation. The best case scenario for our users is that the tags filter marks properly and correctly for our user's situation.

- The government/local municipality

  Process lens: We made this feature universal for all users to see, in particular the government, to increase the impact of **safety** that our app can have to the Cambridge community.

  Outcome lens: The worst case scenario for the government is that the tags, in particular negative ones, indicate the need for action, but the importance of an issue is miscaled and energy allocated into fixing the issue is disproportionate. The best case scenario for the government is that the tags .

- Property Owners/ e.g. restaurant

  Process lens. We made this feature universal for all users to see, including the property owners, to increase the quality of the users to these restaurants.

  Outcome lens: The worst case scenario for the restaurant is that the tags, in particular negative ones, push traffic away from that certain location, reducing the amount of customers coming to that restaurant. The best case scenario for the restaurant is that because of positive tags, more bikers come and restaurants have increased users.

  Update for MVP

  - Users can rate the marks - which signifies the mark's credibility and also contributes to a specific user's overall credibility. However, we are not yet rendering the other users' credibility ratings. Therefore the MVP lacks **transparency** in that regard. It would be beneficial to have a way of seeing others users ratings so as to judge whether a post from a user is credible. However, for now, rating is only available for view to a user's self.

- A nice to have for the final milestone is a mini profile display on hover on a person's name which displays their rating.

Third Decision Implementing third-party authentication

- Our Users

  Process lens: This is meant for our users because we can't handle any personal information about them. This is safe and private because we don't handle any sensitive information therefore users can rely on us. This is a part of our transparency. We included our users Authenticated Users and non-registered users will unders

  Outcome lens: The best case scenario is that the users have a fast way to authenticate rather than creating an account and password. The worst case scenario is that the Google authentication API is broken or no longer in use, through upcoming restrictions.

  The government/local municipality

  Process lens: They are not included in authentication because they cannot create an account. This is potentially unfair because they will not have an equal say in the matters pertaining to the overall Cambridge community.

  Outcome lens: The best case scenarios and the worst case scenarios don't necessarily apply in this design decision because they cannot create an account.

  Property Owners

  Process lens: Both restaurants and property owners can enjoy that users are authenticated by a more reliable source that is not us.

  Outcome lens: The best case scenarios and the worst case scenarios don't necessarily apply in this design decision because they cannot create an account.

Update for MVP

There are three attributes that we use from Google Authentication services, namely, the user's full name, the user's email and their Google profile picture. The main assumption is that when the user logs in to the platform via Google authentication they are consenting to some of their information being utilized. However, we do not yet inform the user what information we will be utilizing, nor do we give them an option to decline proceeding with Google authentication if they review terms and conditions. Therefore for our MVP, we are lacking in transparency in this regard.

How does our implementation of authentication fair against our values and stakeholders?

1. We do not display the user's email to other users. This is **safe** because we do not want to risk a situation where our users are attacked or spammed in their personal email
2. Displaying of the user's full name. This is not **safe** because a search of a user's full name on public search engines may make a person easily discoverable. We may need to consider
3. We render the user's profile picture. This is not **safe** because a person is easily identifiable.

Despite the above reservation in safety, displaying the user's full name and profile picture upholds the platform's wellbeing and other users' safety. A user who engages with the platform with malicious intent risks their credibility and can be easily identified and excluded from the platform.

Alternative authentication design for the final submission:

With this design, we were making an assumption that all our users have google accounts, which is not the case. Also, Google authentication only works if the user allows third-party cookies in the browser settings. Therefore users who have disabled cookies will be able to create an account or sign in into the application. For the final submission, we are considering a design where users will be able to authenticate by using either Google authentication or by creating an account using their email and password. We will also consider placing a settings option where users can update different attributes of their account, for example, the username. We will further evaluate the pros and cons based on our values and stackholders.

Fourth Decision Map styling options and Map Control

We decided to add 3 interchangeable styles to the map to allow users to have different representations of geographical features. The styles are dark, streets-view, and satellite. The initial map is rendered in 3D, but the map control functionality allows the user to tilt the map flat to a 2D plane. The streets-view map is important because it offers explicit highlighting of different road types for example, highways, bike lanes etc. The dark mode enables users to contrast the color routes to a dark background for better route definition. The satellite representation helps users recognise streets and other features as they would interact with them in real life.The maps can also be rendered in the 3D so as to allow users to better view locations by increasing familiarity with depth and height.

Process lens: All stakeholders were incorporated into our decisions. The platform is predicated on every stakeholder's interaction with the map therefore the decision was made with the intention of bringing the best possible outcome to all stakeholders.

1. Our Users

Outcome lens: The best case scenario is that users get an accurate representation of geographical features. The worst case scenario is the reverse where the map might be outdated and may have misleading information.

2. The government/local municipality

Outcome lens: The best case scenario is that features are easily identifiable, therefore if there's a problem such as a prolonged road blockage, they can quickly help out if they ever interact with the platform.

3. Bluebikes

Outcome lens: The worst case scenario is that the map still has bike station locations that are inactive. The satellite map style is not in real time, therefore the bike station status (number of bikes available by visual count on the map) may not correspond to the actual number of bikes on the map popup coming from the real time blue bike station data.

4. Property Owners

Outcome: The worst case scenario is that the satellite map representation of the property is outdated. This could also be damaging to their business if they have rebranded.

Justice lens: All the outcomes were distributed fairly for our users

Design Decisions

One marking per post

Originally, for our marking concept, a user could bundle several marks in one post i.e. make some marks on the map and post them as one batch. However, we find that the transition between each mark may be confusing for the user, therefore one mark per post would maintain clarity. Therefore, the user can keep track of what they meant to mark more consistently.

Use of Mapbox instead of designing our own routing system

This decision came after observing the inefficiency of our routing algorithms based on a 6.009 dataset and code. Our server hosting the code would crash multiple times. Consequently, we decided to adopt Mapbox API to help with our platform to enhance functionality such as optimized routing, geocoding, and searching.

Alternative: Use Google maps API. However, Mapbox provides more map functionality/ manipulation.

Allow users to saved trip plans

A user may want to save a trip plan that occurs frequently when they use the app. Suppose a user plans to bike from MIT Campus to Target everyday. They can easily go to their saved plans and up to date markings for that area surrounding MIT campus and Target. It saves the user time because they have to search for Target and the campus on the map.

Rating is implemented on a 5 star metric

We decided to implement a 5 star rating metric to follow a conventional rating mechanism that users can be able to understand. Most reviews on websites, even restaurants follow the same suite. A user gives a rating on a whole number basis [1,..5]. However, the rendered / cumulative rating per mark is to the nearest decimal places. We also display the number of ratings on a mark so that the user can get a better idea of the weight of ratings, that is, it is better to get ten 5 star ratings on a mark is better than getting one 5 star metric.

Alternatives considered : A ten star metric which increases the scope of rating - this may be too specific; it would take many ratings to distinguish whether a rating is good or bad. Another alternative could be upvoting or downvoting a mark, but which offers a count basis metric. However, we thought it would be better to give the user more expression on how much the mark was useful to them.

Editing a rating is a two step interaction

We decided to remove direct editing of a rating. Rather than have a button which says “Edit Rating” and a user just rates the mark, the user has to delete the rating first and add a new one. This was to prevent the overuse or inappropriate use of rating making editing a tedious process, therefore this prompts a user to think about the validity of the mark before rating it as ‘editing’ it would be tedious.

Interactive Searches

On every input on a search bar, we render suggestions based on the current search input. We decided to implement two way geocontrol to allow users to also navigate to areas they are more familiar with by name. The search results are bound to the state of massachusetts. Interactive searches also contribute to a better user experience and the perceptual vision that emanates from geolocation suggestions is aesthetically pleasing.

Alternatives:

Considered bounding search results to Cambridge. However, we realized that the Bluebikes services also extend into Boston, therefore we needed to expand the scope of the search to somewhere in between city and country.

Users cannot edit their marks

We decided not to have users edit their own marks. This is because updates may cause confusion in that all comments and reply threads attached to a certain mark become incongruent to the modified mark content.

Alternatives : Allowing for mark editing, but deleting every comment and reply thread associated with it after the modification. However, this would require some notification system to notify all other users on the thread that their comments have been deleted. Therefore a user is more careful about the meaning of their content before they post the mark.

Difference between marking and planning pin functionality

Both marking and planning utilize two points, a start point and an endpoint. The points are red and blue respectively. However there's a difference in how users interact with marking points and planning points.

For planning points, the user clicks on the screen to place a start point and then clicks again to place an endpoint. However on marking, the start point is already on the map for the user. The user interacts with the marking start point by dragging it across the map to change the location. The user then clicks on the map to place a marking end point.

Alternative: We considered making the functionality consistent across marking and planning. However, we wanted the user to maintain the essence of a change of concept. Moreover, the clicking points on planning is more consistent with its purpose in that we want users to be able to widen their planning scope, and clicking is a faster alternative. The dragging is consistent with the marking purpose because we want short routes between places and dragging provides a slow effect in doing that which ensures routing accuracy.