Mobile GIS and Location Based Services – Individual Report

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1. Abstract

We are developing an Android mobile app called "MyHikingMapHK" that provides location-based services for hiking trails in Hong Kong. This report will introduce the app's layout, functions, and limitations. The app is inspired by the "MyMapHK" app developed by the Lands Department and aims to provide a useful tool for hikers to explore Hong Kong's extensive trail network.

2. Introduction

Hong Kong is renowned for its vast network of hiking trails, offering outdoor enthusiasts a diverse range of experiences. Inspired by the success of the "MyMapHK" mobile app, we have developed "MyHikingMapHK" to cater specifically to the needs of hikers. As location-based services (LBS) are central to our app's functionality, this project aligns with our field of interest in mobile GIS. The platform is designed to enhance the hiking experience of citizens and for people who like hiking.

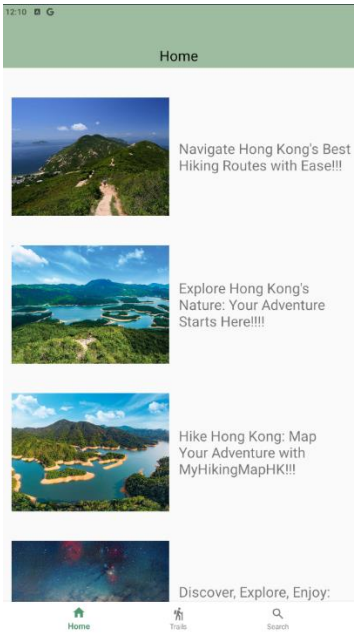
3. App Layout

The app has a simple and intuitive user interface (UI). As the user runs the app, a page with a navigation bar shows up, featuring the Home, Trails, and Search sections.

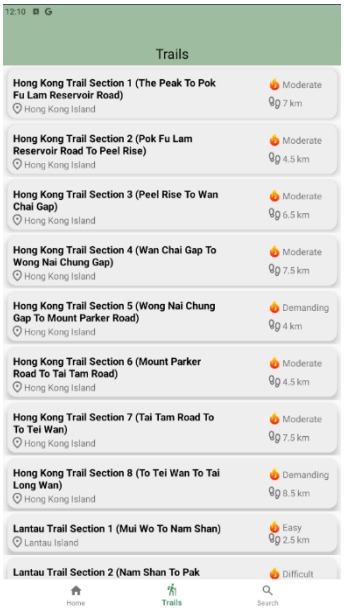
The Home page is the default landing page. Photos and texts are added to increase the users' interests.

The Trails section displays a list of all hiking trails in Hong Kong. The list items are designed to be minimalistic, balancing information and simplicity. Each item shows the trail name, length, difficulty, and region. The length, difficulty, and region have their own icon to make it more user-friendly. Only the text color of the trail name is in black, while others are in gray, to make strong contrast for the more important and less important information. Clicking on a trail item navigates the user to the trail's information page.

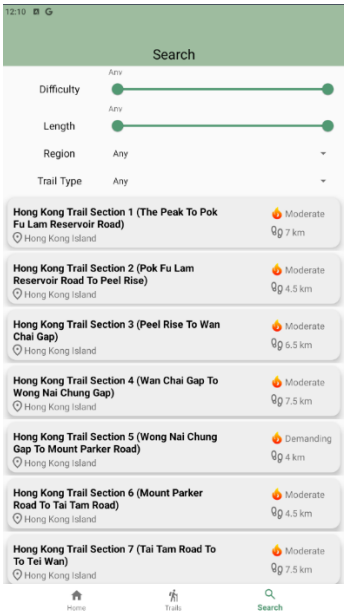
The Search function allows users to filter hiking trails based on various criteria. Users do not need to type in search terms; instead, the search interface provides sliders for length and difficulty, as well as dropdown boxes for region and trail type. Users can filter the difficulty and length using the range sliders, and the region and trail type using the dropdown menu. This approach ensures a clean and intuitive search experience. We make the search filter buttons small yet still easily clickable, so the search results can maximize their space displayed on the screen. This balances the contrasts of the UI.



The Home page



The Trails page, listing all the hiking trails in Hong Kong

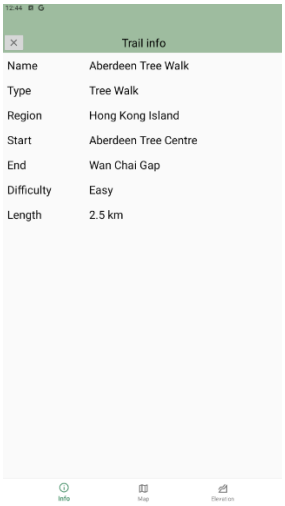


The Search page, users can search for hiking trails based on the preferences

The trail information page has a navigation bar with three sections: Info, Map, and Elevation. The Info section displays detailed details about the selected trail, such as the difficulty, length, region, starting point, and ending point. I believe it is appropriate to show only textual information, since it is encapsulated in a detailed page. The texts are made large enough for the users to view.

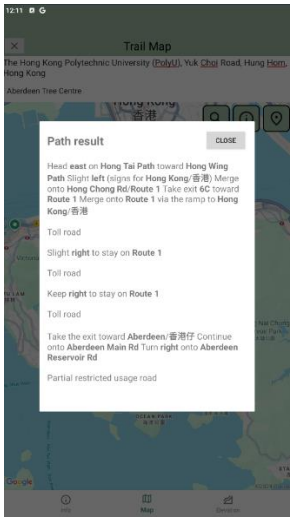
The Map section features an auto-complete text box for the starting point and a dropdown box to select either the starting or ending point of the trail. The majority of the page is dedicated to the map itself, with three buttons to perform actions such as searching, viewing path information, and getting the user's current location. These buttons use imagery icons to minimize the space they occupy and maintains the focus of the UI on the map. Also, it can maintain the simplicity of the app while giving users the functions needed.

The Elevation section shows an elevation profile that represents the elevation changes on the hiking trail from the starting point to the ending point. This can give the user an overview of the topography of the hiking trail intuitively.



The Info page showing the trail details

The Map page lets users search paths to the hiking trails



A path result pop-up dialog

The Elevation page shows the elevation profile of the hiking trail

4. App Functions

The key functions of the "MyHikingMapHK" app include:

- Viewing a comprehensive list of hiking trails in Hong Kong.
- Searching for hiking trails based on length, difficulty, region, and trail type.
- Accessing detailed information about a specific hiking trail, such as difficulty, length, region, starting point, and ending point.
- Visualizing the hiking trail on a map.
- Searching for a route to either the starting or ending point of the trail.
- Obtaining driving directions to the trail's destination.
- Utilizing the user's current location as the starting point for navigation.
- Viewing the elevation profile of the hiking trail.

5. Significance of the App

MyHikingMapHK can provide more specific details and custom visualizations of the hiking trails, even more than the general mapping purpose counterparts like Google Map. For example, our app enables users to choose the hiking trails based on their desires such as the difficulty, region, and distance, it also provides a path finding function and viewing the elevation profile. With the more detailed information from the application, it can also provide a better planning for the hikers using the app for the information. Our app can also support local tourism by attracting tourists who like hiking by providing more information about the hiking routes and how to get there. Moreover, MyHikingMapHK can also potentially promote recreation and healthy lifestyles. With the help of the details of the hiking trails, the citizens might be more encouraged to go hiking and thus promotes physical health.

6. Potential Profit Model of MyHikingMapHK

There are multiple ways the app could explore to gain profit. For example, should the app gain the reputation and the government’s attention, the app might receive government funding and sponsorship, for example promoting public services for hiking maps. The app could also display ads from collaboration with businesses such as Google AdMob. Our app could also offer advanced, exclusive features for a fee. These approaches can potentially bring profit to our app.

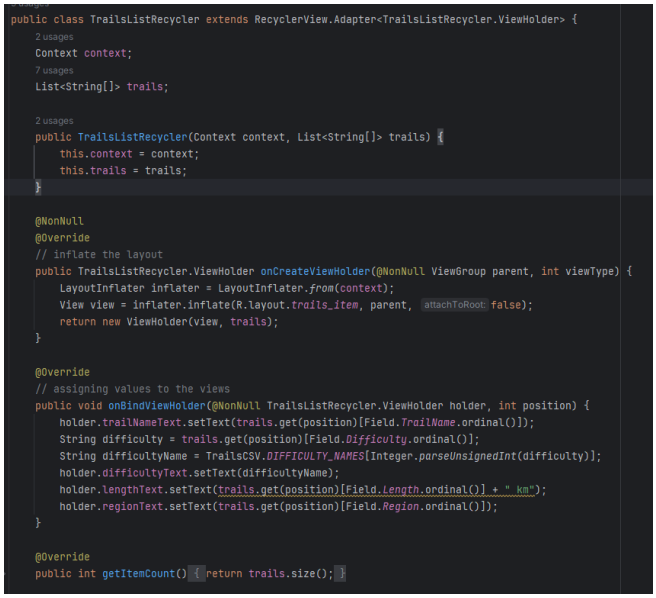
7. App Limitations

While the "MyHikingMapHK" app aims to provide a comprehensive and user-friendly hiking experience, there are some limitations that need to be addressed:

1. Offline functionality: The app currently requires an internet connection to access trail information and mapping services. Developing offline capabilities would enhance the app's usability in areas with poor connectivity.
2. Trail updates: Ensuring the app's trail data is up-to-date and accurate is crucial. Implementing a system for regular updates and user feedback would help maintain the app's relevance.
3. Advanced features: Incorporating additional features, such as tracking hikers' progress, providing weather updates, and integrating with fitness apps, could further enhance the app's utility for users.
4. Only one travel mode: the path search only searches for traveling by car, which might not provide useful information for the users looking for public transport alternatives.
5. Language barriers: Currently MyHikingMapHK only comes in English, this might cause difficulties for the users who do not know English.

8. Difficulties encountered

Most functions are not included in the Lab tutorials, therefore during the development of the app, some implementations are self-taught, by looking for the documentations online and YouTube tutorial videos. For example, the `RecyclerView` (scrollable buttons), `Spinner` (dropdown menu), `RangeSlider` (two-thumb slider).



```
public class TrailsListRecycler extends RecyclerView.Adapter<TrailsListRecycler.ViewHolder> {
    2 usages
    Context context;
    7 usages
    List<String[]> trails;

    2 usages
    public TrailsListRecycler(Context context, List<String[]> trails) {
        this.context = context;
        this.trails = trails;
    }

    @NonNull
    @Override
    // inflate the layout
    public TrailsListRecycler.ViewHolder onCreateViewHolder(@NonNull ViewGroup parent, int viewType) {
        LayoutInflater inflater = LayoutInflater.from(context);
        View view = inflater.inflate(R.layout.trails_item, parent,  attachToRoot: false);
        return new ViewHolder(view, trails);
    }

    @Override
    // assigning values to the views
    public void onBindViewHolder(@NonNull TrailsListRecycler.ViewHolder holder, int position) {
        holder.trailNameText.setText(trails.get(position)[Field.TrailName.ordinal()]);
        String difficulty = trails.get(position)[Field.Difficulty.ordinal()];
        String difficultyName = TrailsCSV.DIFFICULTY_NAMES[Integer.parseUnsignedInt(difficulty)];
        holder.difficultyText.setText(difficultyName);
        holder.lengthText.setText(trails.get(position)[Field.Length.ordinal()] + " km");
        holder.regionText.setText(trails.get(position)[Field.Region.ordinal()]);
    }

    @Override
    public int getItemCount() { return trails.size(); }
```

```
public static class ViewHolder extends RecyclerView.ViewHolder implements View.OnClickListener {
    // get views from layout file

    // Forward compatibility: we might update the fire icon
    1 usage
    ImageView difficultyImg;
    2 usages
    TextView trailNameText, regionText, lengthText, difficultyText;
    3 usages
    List<String[]> trails;
    1 usage
    public ViewHolder(@NonNull View itemView, List<String[]> trails) {
        super(itemView);

        difficultyImg = itemView.findViewById(R.id.iconTrailItemDifficulty);
        trailNameText = itemView.findViewById(R.id.textTrailItemTrailName);
        regionText = itemView.findViewById(R.id.textTrailItemRegion);
        lengthText = itemView.findViewById(R.id.textTrailItemLength);
        difficultyText = itemView.findViewById(R.id.textTrailItemDifficulty);
        this.trails = trails;

        CardView cardView = itemView.findViewById(R.id.cardTrailItem);
        cardView.setOnClickListener(v -> {
            int position = getAdapterPosition();
            if (position != RecyclerView.NO_POSITION) {
                Context context = v.getContext();
                String[] trailData = this.trails.get(position);
                Intent intent = new Intent(context, PageTrailDetails.class);
                intent.putExtra( name: "trailData", trailData);
                context.startActivity(intent);
            }
        });
    }

    @Override
    public void onClick(View v) {
        int position = getAdapterPosition();
        if (position != RecyclerView.NO_POSITION) {
            Context context = v.getContext();
            String[] trailData = trails.get(position);
            Intent intent = new Intent(context, PageTrailDetails.class);
            intent.putExtra( name: "trailData", trailData);
            context.startActivity(intent);
        }
    }
}
```

Screenshot of the recycler view implementation in `util/TrailsListRecycler`

Though some difficulties are encountered, we have eventually tackled some of the problems. For example, in our `RecyclerView` implementation, we made our own constructor that takes the necessary information, context and the trail info. `onCreateViewHolder` defines which view in the xml to inflate; `onBindViewHolder` defines how to modify the new view holder instance; the `ViewHolder`'s constructor grabs the views from the xml, and `onClick` sets the callback function of the view holder (or each button of the list).

MyHikingMapHK uses various data sources, and sometimes it could be difficult to find them. We looked for well-known data sources, especially with hiking trails. We eventually find some API sources that are used in the final product. For example, the trails info is obtained from the CSDI, the trail polyline is obtained from open ESRI, the map and the path search results are from Google Map API, and the trail elevation is from Trails Watch.

9. Conclusions

The "MyHikingMapHK" mobile app offers a convenient and intuitive solution for hikers in Hong Kong, leveraging location-based services to facilitate exploration of the region's extensive trail network. Though the app comes with limitations and room for improving the app's functionality, we believe we have delivered a valuable tool that enhances the hiking experience for both novice and experienced outdoor enthusiasts.