NPS2001D

Milestone 1

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Q1.

The real-world issue we have chosen to work on is accessibility for people with disabilities, primarily focusing on disabilities concerning mobility.

We believe this is an important problem as, despite having a large ageing population, many areas in Singapore are not mobility aid-friendly or accessible to those with disabilities (Krishnasamy, 2022). It is a common experience for a disabled person who wants to go to an event but misses out on it because the location is not accessible or they do not know how to get there with their mobility aids (Ang, 2024). Existing navigation apps such as Google Maps do not take into account the lack of accessibility options such as stairs, lack of ramps, and problematic pathway characteristics such as narrow pathways and uneven surfaces which may disrupt a disabled person's wayfinding ability and even compromise their safety (Kapsalis, 2022). This can negatively affect the quality of life of people with disabilities (Kapsalis et al, 2022). Hence, our app aims to provide a mapping system that takes into account the user's accessibility requirements so that they can properly plan their route and be aware of the travelling time.

Q2.

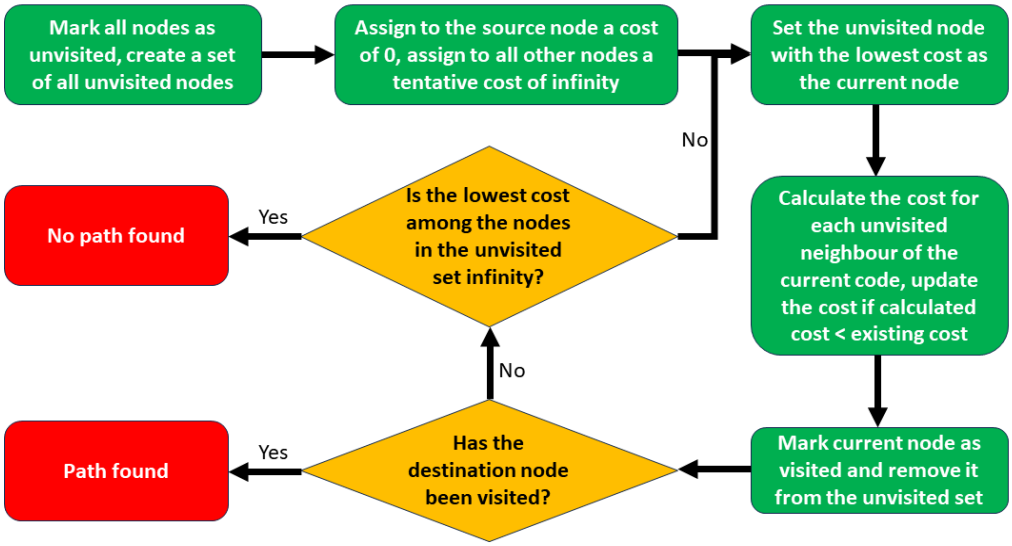
The disability-centric accessibility app aims to provide a convenient experience for individuals with diverse mobility needs.

Through personalised profiles, users can finely tailor their preferences, customising walking speed, identifying resting points, and selecting preferred routes. Leveraging real-time data, the app provides instant updates on current accessibility conditions, covering aspects such as elevator availability, sidewalk obstacles, door width, and the presence of slopes or ramps. This dynamic information would empower users to navigate the environment with confidence. The app also intends to offer turn-by-turn navigation, suggesting alternative routes optimised for accessibility based on user preferences and real-time conditions. Predictive time estimates take into account accessibility features and potential obstacles, enhancing planning accuracy for users with varying mobility requirements. In addition, integration with public transport includes comprehensive details on the accessibility of buses and subway stations, syncing with schedules and alerting users to disruptions. Moreover, the app would ensure seamless functionality in offline mode, allowing users to access maps without an internet connection. These approaches are aimed at addressing the unique challenges faced by individuals with mobility challenges, promoting inclusivity and independence in their daily journeys.

Q3.

Graph algorithms will enable the operation of our app. Dijkstra's algorithm is one such example of an algorithm in this class.

The operation of Dijkstra's algorithm is illustrated in the flowchart below:



In the context of our app, the source node represents the starting location, the destination node represents the destination and other nodes represent disability-friendly infrastructure available to the user. Finally, the cost represents the travelling distance.

Below is a list of resources, primarily websites, that explain the logic behind Dijkstra's algorithm and the A* algorithm (another graph algorithm). The resources are in layman's terms, although some prerequisite understanding of basic data structures, fundamental graph theory concepts and complexity analysis is required.

- https://blog.codechef.com/2021/08/30/the-algorithms-behind-the-working-of-google-maps-dijkstras-and-a-star-algorithm/
- https://www.geeksforgeeks.org/introduction-to-dijkstras-shortest-path-algorithm/
- https://brilliant.org/wiki/a-star-search/
- https://www1.bca.gov.sg/buildsg/universal-design/accessibility-fund/examples-of-basic-accessibility-facilities
- https://www.geeksforgeeks.org/a-search-algorithm/
- https://www.youtube.com/watch?v=pVfj6mxhdMw
- https://www.baeldung.com/cs/dijkstra

Q4.

Our app is designed for individuals with mobility challenges and diverse accessibility needs. Users are expected to utilise the app when commuting or planning their commute. This can include daily commuting, leisure activities, travel planning, work-related travel, and even emergencies. The primary target demographics include people with mobility challenges and their caregivers, particularly the elderly. Potential issues to address involve ensuring the accuracy of real-time data, creating an intuitive and accessible user interface (e.g., user-friendly functions such as voice command), and prioritising data privacy and security.

References

1. https://www.todayonline.com/singapore/strides-inclusive-spore-more-can-be-done-disabled-community-1977981
2. https://www.straitstimes.com/singapore/barrier-free-routes-for-wheelchair-users-to-be-shown-on-onemap-app-from-march-2024
3. https://www.tandfonline.com/doi/full/10.1080/17483107.2022.2111723