HandiMaps

Executive Summary

In a highly urbanised country with an ageing population, the elderly in Singapore face increasing mobility difficulties. About one-third of elderly people develop a fear of falling after a fall and this issue should be specifically addressed during rehabilitation (Vellas et al., 1997). Therefore, there is a growing need for a mobility solution which allows mobility impaired individuals to move around freely in urban areas.

The application HandiMaps was created to specifically target this growing problem. HandiMaps is a navigation tool that allow users with limited mobility to travel around conveniently by providing obstacle-free directions.

HandiMaps is currently in its beta version, with approximately 5000 users in Singapore and half of them have given suggestions to improve our navigation application. Thus, we hope that our budget request of SGD$50,000 would be approved so that HandiMaps can expand internationally within 6 months, while maintaining its functionality through other revenue means instead of charging it to our users.

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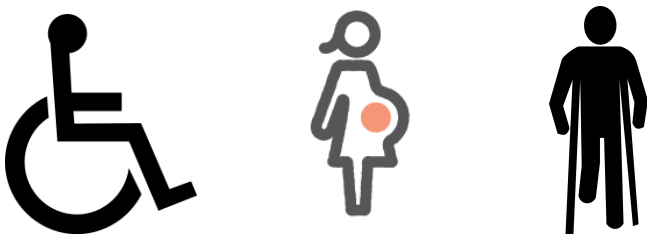
1. Introduction

In today's rapidly urbanising world, there is a rising need for assistive technology (LaPlante, 1992). When arranging urban and physical space, it is important to ensure that disabled people are not excluded from society, but rather they should share an equal place in society (Meshur, 2013). This is especially the case in East Asia, where one in five of the world's oldest countries will be in East Asia by 2060, compared to just one in 25 in 2010 (World Bank, 2016).

Therefore, our purpose is to bring convenience to physically challenged people when they are finding directions in urbanised, highly populated areas. As the ramps and lifts in an area are not considerations in traditional navigation applications, people with limited mobility may find it difficult to reach their destination while depending on the conventional navigation applications. As a result, they may be late for their activities or even worse, aggravate their injuries.

By factoring in mobility features such as ramps and elevators into the planned route, our users will be able to navigate more efficiently. Our users, the problem at hand and our solution, HandiMaps, will be elaborated in greater detail in the next few sections.

2. Target Group



Our target group are People with Limited Mobility (PLM).

This includes people with transport difficulties but might not regard themselves as being disabled, such as elderly with frail bodies, pregnant women, parents with small children, passengers with bulky luggages, visitors or tourists and people with temporary impairments such as a broken leg.

3. Problem

We are all physically disabled at some time in our lives. A child, a person with a broken leg, a parent with a pram, an elderly person, are all disabled in one way or another (UN Department of Economic and Social Affairs, 2004). In 2011, it was estimated that almost one billion of the world's population were disabled, and the number of people with disabilities is expected to grow even further (World Health Organisation (WHO), 2011). As people live longer due to better healthcare, more people survive to ages where they suffer from chronic diseases, which can lead to long-term disability and loss of independence (Guralnik et al, 1996). Hence, this growing group of people will have rising needs that will require our attention.

Figure 3.0: Wheelchair-bound person facing problem with scaling a flight of stairs.

One of the challenges that hinders the possible independence of the physically challenged and their use of public spaces is lack of attention to their physical and mobility needs (AIHRC, 2002). They face difficulties in overcoming physical barriers of disability, which includes inaccessible environments and, the lack of relevant assistive technology and services to aid mobility (WHO, 2001). For them, the lack of access to transportation is often cited as a reason to be discouraged from seeking work or prevented from accessing health care (WHO, 2011).

Although governments have improved infrastructure to improve accessibility, most people are unaware of the existence of these infrastructure. Pre-journey planning information is essential to enable PLM to check the accessibility of the available facilities and plan their route to ensure they are aware of any practical difficulties or physical obstructions that they may encounter during the journey (World Bank, 2013). However, such information is not always readily available and may involve detailed and laborious manual planning. As a result, they may sometimes take routes through potential hazards such as staircases and steep slopes. In the US, costs for falls to Medicare alone totaled over $31 billion in 2015 (CDC, 2016).

To tackle the problems mentioned above, our team developed HandiMaps with its features explained in the next section.

4. Solution & Features

HandiMaps

HandiMaps is a mobile navigation application that provides directions specifically for PLM. In order to allow them to navigate around independently, the directions provided will include routes with lifts, ramps, etc. HandiMaps also features wheelchair-friendly bus timings and wheelchair-friendly taxi/private transport bookings. HandiMaps hopes to alleviate the problem of uncertainty and inconvenience of travelling for the physically disabled/limited mobility by providing accessible and reliable routes at their fingertips.

4.1 Features and Benefits

Feature	Description	Benefits
Map with overview of accessible	• Main page shows all accessible infrastructure in area.	• Icons “have the capability to transcend language barriers” (Sanchez & McIntosh, 2008),

infrastructure	● Lifts, ramps, stairs and lifts are indicated by unique icons for the user to have an overview of all the accessible facilities in the area.	allowing all users to identify each accessible infrastructure easily. ● Availability of information means PLM no longer have to settle for less accessible routes, reducing falls, and hence reducing cost of falls to government and society.
Customized Directions Algorithm	● Users can get directions for the most accessible route/the shortest route with least obstacles (i.e. stairs, curbs, etc.). ● Clear and detailed directions with the actual route highlighted on the map for maximum visual aid. ● Algorithm takes into account user level of mobility. For example, a user who can climb a few steps would be given routes containing a few steps if they are shorter.	● Saves time for PLM who use HandiMaps to navigate. ● Increased convenience for PLM to get around, encouraging them to get out of their houses and integrate into society. ● Minimise chances of falls when PLM have to climb tall/uneven stairs or steep slopes.
Wheelchair-friendly bus services and timings	● Buses listed only includes wheelchair friendly bus services. ● Bus timings will also be reflected.	● Users will be able to know when the next wheelchair accessible bus is arriving.
Wheelchair-friendly private taxis/ transport booking	● Users can book a wheelchair-friendly taxi or private transport services.	● Availability of private and public transport options caters to users with various transport preferences. ● Greater exposure for the niche private transportation market.
Multiple Languages	● HandiMaps is available on both Android and iOS platforms in multiple languages.	● Caters to different ethnic groups to convey directions as clearly as possible.

Table 4.0: HandiMap's features and their respective descriptions and benefits.

Please refer to Appendix 9.1 for the full interface and screenshots of HandiMaps.

4.2 Other Benefits

The integration of HandiMaps' features also provide other benefits for the user and the society. Such benefits include constructive feedback to governmental agencies and building developers on the movements and needs of PLM.

As HandiMaps gains more users, more data would be collected via their app usage. This data includes information such as the user's level of mobility or geographical information such as the number of PLM's in each area and the most frequently used routes. These can be used by government authorities for better urban and transport planning, or by any other association for the disabled (e.g. bus routes for buses equipped with wheelchair accessibility).

4.3 Summary of Features

HandiMaps aims to allow its users to get around seamlessly. A typical user's trip using HandiMaps would follow the following flow chart:

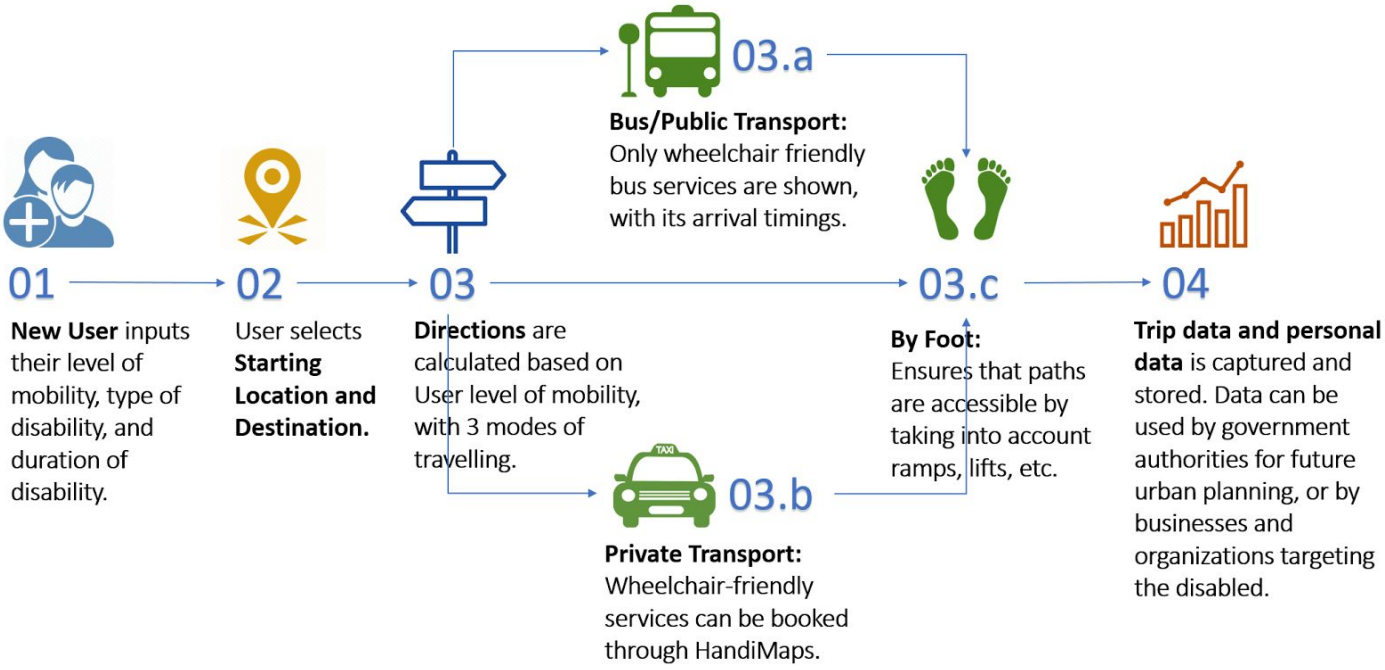


Figure 4.1: Flow chart and summary of HandiMap's features

As shown in Figure 4.1 above, the integration of all the features adds convenience for users to get around in an accessible manner, and makes available data that is valuable to various organizations.

5. Market Research

5.1 Target Market

Having seen an overwhelming response in its Beta launch in Singapore (refer to Appendix 9.2), HandiMaps hopes to expand to the international market after its official launch on the Android and Apple applications market. In its next stage, HandiMaps is targetting 3 main Asian cities: Seoul, Hong Kong, and Tokyo. These 3 cities have a reputation for being more accessible, and have a rapid aging population (World Bank, 2015), which means there will be an even greater need for HandiMaps in future.

However, some older generations may have difficulties picking up new technology, or may not own any mobile devices. Therefore, HandiMaps is designed with an interface that is user-friendly, so that the older generation will be able to use it with ease and confidence. Furthermore, with increasing integration of technology into our lives, all 3 cities boast high smartphone penetration rates (Forrester, 2015). This makes them ideal locations to launch HandiMaps, since it more likely that PLM users would have access to smartphones and the internet.

5.2 Competitor Analysis

Main Competitors	**Description**	**Competitor Analysis**
Ireland-based Access Earth 	They provide detailed information of the terrain including the access information of each landmark. For example, they allow users to search an area of interest and find places that are step free, having wide main entryway or with in-room accessibility etc.	Despite allowing users to source for places within an area, it did not provide any navigation options for users to reach from point to point. The application is also web-based, which will be inconvenient for those who only have their mobiles, which is usually the case when they are in a mobility predicament.

New York based AXSMaps 	AXS Maps is available to use on both web and mobile, and it provides a greater range of facilities mapping as compared to Access Earth, which is more general and only detailed for tourist locations. AXS Maps provide two options for users to comment on about the location: having ramps and having wheelchair accessible toilets or not.	The application did not entail navigation options as well, and their accessibility options and labels are very limited. The number of users using the application is also very low (only 44 reviews on GooglePlay). Furthermore, there are almost no reviews for places in Singapore.
WheelMap 	WheelMap allow users to label places that are not only wheelchair accessible, but places with public transport, food, or sport facilities etc. as well.	The application allows users too much autonomy on the application, depending heavily on crowdsourced information which is inaccurate since anyone can label a place whatever they choose.
Google Maps 	Google Maps allow users to navigate to their destinations and they can even choose the mode of transport they will be using. Information such as traffic will be given as well and updated constantly even when on the go. Directions are given in real time as well.	The application did not factor in accessibility to its full extent since it is a general utility map. Thus, they will always choose the shortest path for the users regardless of the number of mobility obstacles there are, such as steps, narrow passageways, and steep slopes. Even though Google Maps allows users to identify buildings that are wheelchair accessible, it is not factored in their navigation algorithm and it is not specific enough to aid users, since any building with a lift is considered wheelchair accessible.

Table 5.0: Description and Analysis of Main Competitors

Therefore, while our competitors are largely dependent on information from sources such as crowdsourcing (which may result in highly inaccurate and outdated data), HandiMaps is poised

to be more reliable and accurate by liaising with government agencies as well as building owners.

HandiMaps is one step further ahead of our competitors as our algorithm takes into account the most accessible and faster route, something this is missing from our current competitors. This competitive advantage is patented and exclusively developed by our staff.

5.3 Revenue Strategies

Revenue Model	**Elaboration**
Data	Revenue earned by collecting valuable user data to map the demographics of the physically or mobility challenged in the area and selling it the government or interested governing bodies who may want to make appropriate changes within the area. Collect valuable terrain data to pinpoint areas that are lacking in accessibility and sell the data to the government monthly. This data can also be sold to companies who require information on the demographics or specific terrain information to do targeted advertising.
Commerce	Selling the software to automobile companies so that they can install it in their vehicles which will definitely promote better products since they considered the navigation options of a physically challenged driver. Allowing other internet data companies to use our algorithms via subscriptions where they are able to use it to collect their own data or improve their own navigation functions. (By patenting our software and renting it to the companies)
Affiliate Programs	Propose affiliate programs to taxi companies such as Uber and Grab by allowing our users to be redirected to their pages if they need a taxi or private car. These would increase the number of bookings for the companies as well as giving them valuable information on how many users require a wheelchair-friendly taxi.

Table 5.1: Revenue Strategies

After our international launch, we estimate that HandiMaps will be able to earn a net profit of SGD$100 000 annually via the above revenue strategies after deducting an estimated average of SGD$200 000 in maintenance and operation costs.

6. Future Plans

Our main plan for the future is to expand out of Singapore after gaining enough recognition and being able to earn sufficient profit from the application to develop it further. Thus, we decide to take the following steps based on our timeline, budget, and financing methods:

6.1 Timeline

Product

Beta Release Analysis	Official Launch (1 Month Later)	Universal Version Release (2 Months Later)	Official Launch to Asian Countries (3 Months Later)	Official Launch to the Rest of the World (6 Months Later)
• Further Differentiate Target Groups to provide more personalized navigation. • Users trying the Beta Version are allowed to input comments or recommendations every time they reached a destination, and they will be rewarded for doing so.	• Improve algorithm when sourcing navigation routes with existing user inputs and recommendations, coupled with government's aid in identifying more obstacles or handicapped-friendly areas. • Maps will be made available offline so that users can navigate with written directions instead to avoid obstacles in enclosed venues.	• Updating the navigation with various other languages, especially Malay, Chinese and Tamil. • Directions will be made more succinct and accurate even in other languages.	• Approval to obtain and exchange data with other Asian countries will be made first before launching the application into the country. • If approval from the government is not obtained, the application will made do with user-generated comments and well public satellite images (possible lias with Google Maps)	• As the user base should be high now, it will be easier to convince other countries' to allow the exchange of information to improve the lives of the physically challenged. • More languages will also be added to cater to the larger variety of customers.

6.2 Budget and Financing

Marketing & Financing

Beta Release Analysis	Official Launch (1 Month Later)	Universal Version Release (2 Months Later)	Official Launch to Asian Countries (3 Months Later)	Official Launch to the Rest of the World (6 Months Later)
• Sourcing interested angel investors & organizations	• Strong emphasis on our social cause and garner positive social media attention • Attract companies to join our cause by utilizing our navigation app	• Attract foreign companies to collaborate with us as well to promote our social cause	• Offer collection of urban terrain data for the governments at a price • Collaboration with local companies	• Product will be kept cost & advertisement-free • More joint proposals will be made to integrate our navigation systems

Budget

Beta Release Analysis	Official Launch (1 Month Later)	Universal Version Release (2 Months Later)	Official Launch to Asian Countries (3 Months Later)	Official Launch to the Rest of the World (6 Months Later)
• $10 000 (For data analysis and collection)	• $25 000 (Official Launch and Advertising to companies)	• $10 000 (For Foreign Advertising)	• $5000 (Reaching out to other countries and packaging of data)	• $0 (Cost imbued in the previous stage)

7. Team Credentials

Software Engineer, Developer of HandiMaps

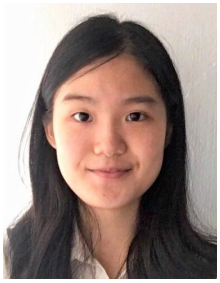
Mr Leng Kenn Siang was an application developer with Google for 10 years before venturing out to start Accenture with his ex schoolmates. Mr Leng was involved in the development of multiple apps such as GoogleMaps and Google Calendars.

1st Honours Master of Computing in Computer Engineering from Massachusetts Institute of Technology (MIT).

Director of Planning and Design, Project Manager of HandiMaps

Mr Jin Dong Yang was a civil servant with the Urban Redevelopment Authority before leaving to pursue the creation of applications beneficial to society. His contacts with urban planners and building owners has helped significantly in the creation of HandiMaps.

1st Honours Master of Design in Urban Design from Cambridge University.



Medical Consultant, Assistant Project Manager of HandiMaps

Dr Lim Wen Qing is a private medical practitioner with a personal interest in improving the health and safety of the general public. Her expertise in the severity of injuries and physical limitations has helped to make HandiMaps more personalised to each user's needs.

1st Honours M.D. degree from Harvard University.

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8. Conclusion

The subtle discrimination of People with Limited Mobility (PLM) should not be a problem left unresolved in today's era. We are confident that through HandiMaps, PLM would not only be given an immediate solution to their daily mobility issues, it will also raise awareness about their issue and encourage follow-up actions to improve their lives. HandiMaps would definitely be a worthy investment as the social cause it is advocating would affect millions of lives around the world, and it has been a market that few companies ever tapped on. We are confident of the positive effects of HandiMaps after its successful launch in Singapore.

We hope that with our budget request of SGD$50 000, we will be able to make a difference in every PLM's lives within 6 months, with our projected annual profits of 100 000 SGD an additional benefit that our application will reap.

9. References

AccessEarth. (2016). Access earth - know more. Do more. Live more. Retrieved from Access Earth, http://access.earth/index.php

Accessibility for the Disabled - Introduction. (2017). United Nations. Retrieved from http://www.un.org/esa/socdev/enable/designm/intro.htm

Asia Pacific Will Have 2 Billion Smartphone Users By 2019. (2015). *Forrester*. Retrieved from https://www.forrester.com/Asia+Pacific+Will+Have+2+Billion+Smartphone+Users+By+2019/-/E-PRE8244

AXS MAP. (2015). AXS Map. Retrieved from AXS Map, http://www.axsmap.com/

Center for Disease Control and Prevention. (2016, August 19). Costs of falls among older adults. Retrieved from https://www.cdc.gov/homeandrecreationalsafety/falls/fallcost.html

Guralnik, J. M., Fried, L. P., & Salive, M. E. (1996). Disability as a public health outcome in the aging population. Annual review of public health, 17(1), 25-46.

LaPlante, M. P. (1992). Assistive technology devices and home accessibility features: prevalence, payment, need, and trends. Advance data from vital and health statistics.

Meshur, H. F. A. (2013). Accessibility for people with disabilities in urban spaces: A Case Study of Ankara Turkey. International Journal of Architectural Research. Archnet-I1AR, 7(2), 43-60.

Petronzio, M. (2016, December 12). Google maps now finally tells you when a business is wheelchair accessible. Retrieved from Mashable, http://mashable.com/2016/12/16/google-maps-wheelchair-accessible-locations/#bIPXReftZOqp

Rapid Aging in East Asia and Pacific Will Shrink Workforce and Increase Public Spending. (2015). *World Bank*. Retrieved 12 March 2017, from http://www.worldbank.org/

Sanchez, J., & McIntosh, A. (2008). Creating visual experiences with flex 3.0 (developer’s library series). United States: Addison-Wesley Educational Publishers.

Singapore Disability Websites. (2013). Disabled People's Association Singapore. Retrieved from http://www.dpa.org.sg/resources/singapore-disability-websites/

Study on the Situation of Physical Accessibility of Persons with Disabilities to Public Places. (2002, June). . Retrieved from http://www.aihrc.org.af/

Tham, I. (2016, January 20). Majority of Singapore seniors are web savvy, says global study. The Straits Times. Retrieved from http://www.straitstimes.com/singapore/majority-of-singapore-seniors-are-web-savvy-says-global-study

Vellas, B. J., Wayne, S. J., Romero, L. J., Baumgartner, R. N., & Garry, P. J. (1997). Fear of falling and restriction of mobility in elderly fallers. Age and ageing, 26(3), 189-193.

World Bank,. (2016). *Live Long and Prosper: Aging in East Asia and Pacific* (1st ed.). Washington (D.C.): World Bank.

World Bank Sustainable Development Department,. (2013). Improving Accessibility to Transport for People with Limited Mobility (PLM). World Bank. Retrieved from worldbank.org/curated/en/575221468278939280/pdf/Accessibility0Report0Final.pdf

World Health Organization,. (2001). International classification of functioning, disability and health (p. 214). Geneva: World Health Organization.

World Health Organization,. (2011). Summary World Report on Disability. World Health Organization. Retrieved from http://apps.who.int/iris/bitstream/10665/70670/1/WHO_NMH_VIP_11.01_eng.pdf

10. Appendix

10.1 HandiMaps Interface

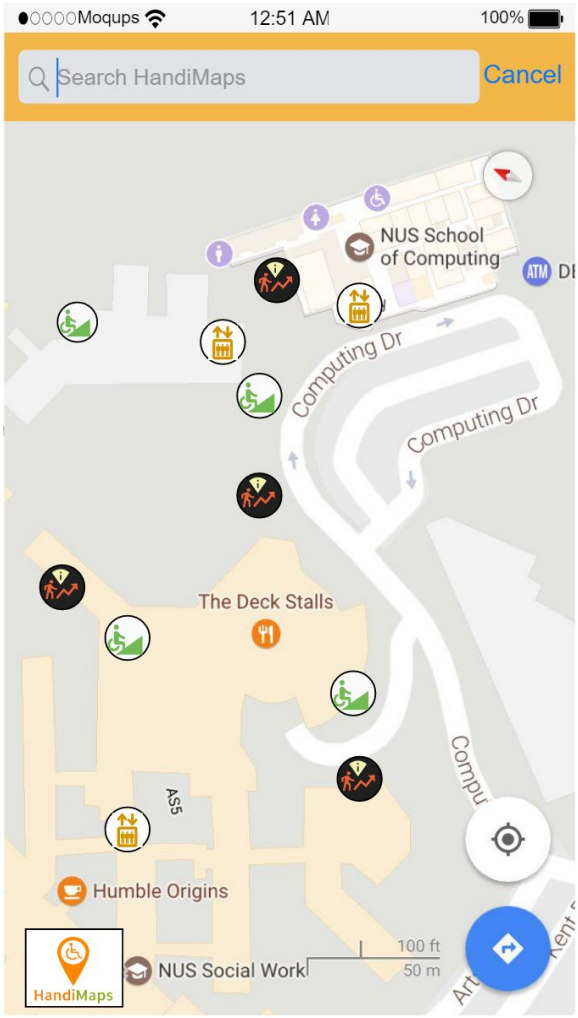

Figure 10.0: HandiMaps' map with icons representing lifts, ramps, and stairs

The home page for HandiMaps is a map with details such as ramps and stairs as shown in Figure 10.0. There is also a simple search bar at the top for users to key in their intended destination.

Figure 10.1: HandiMaps walking directions

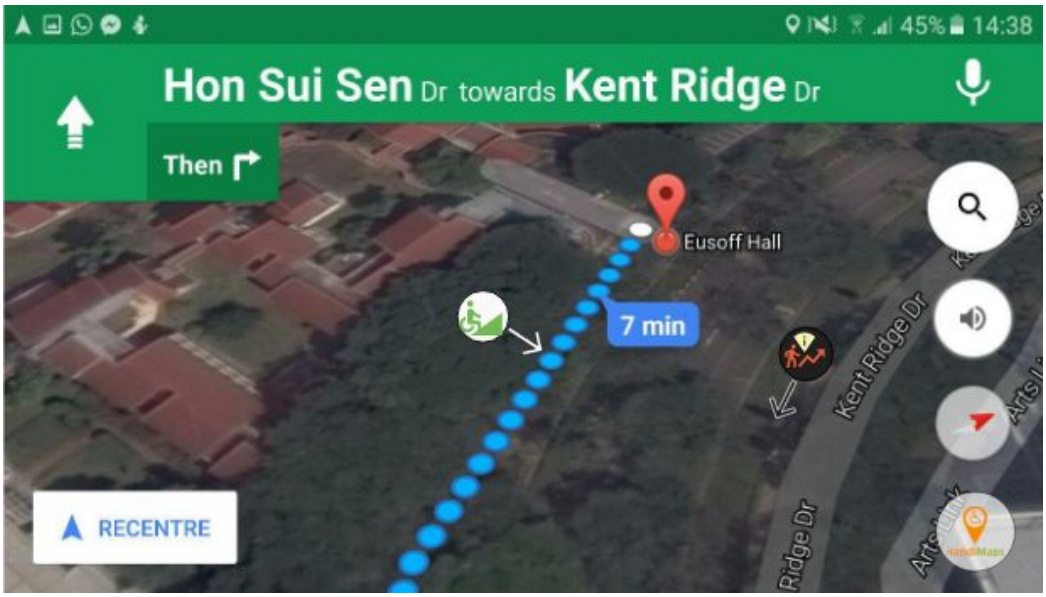

Figure 10.2: HandiMaps' walking directions

When navigating to a particular destination, our HandiMaps algorithm will choose the routes with ramp/lifts instead of routes with hazards such as stairs as shown in Figure 10.1 and 10.2. These accessibility infrastructures are also highlighted on the map so that users will be aware of where and when they will encounter them.

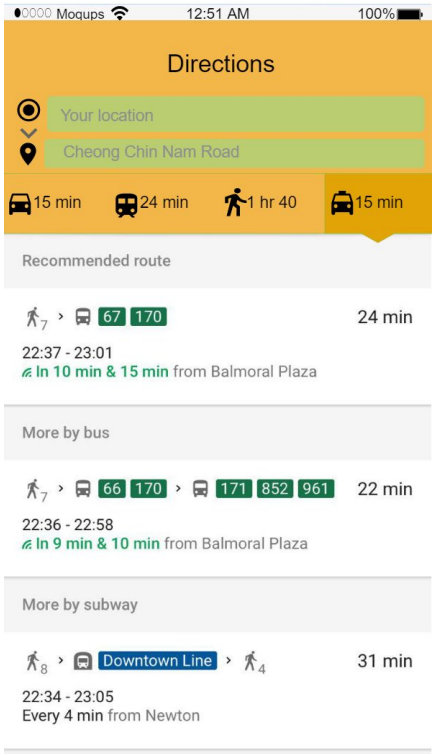

Figure 10.3: HandiMaps' public transport directions

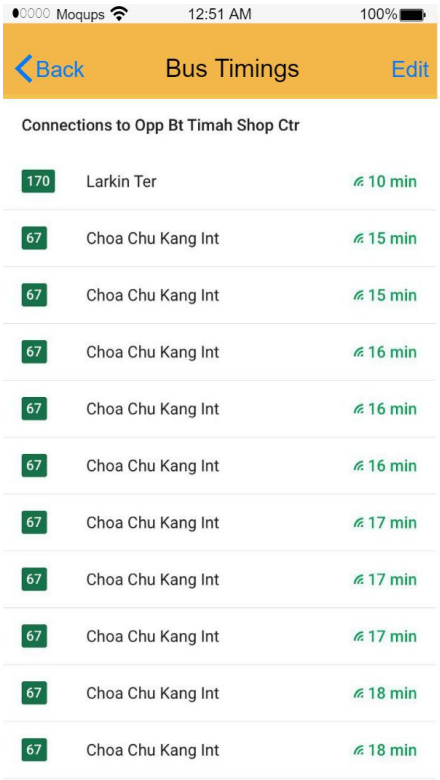

Figure 10.4: HandiMaps' bus timings

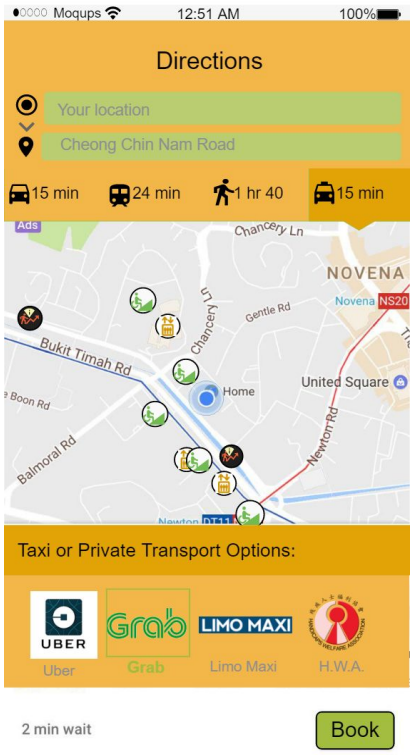

Figure 10.5: HandiMaps' private transport or taxi booking

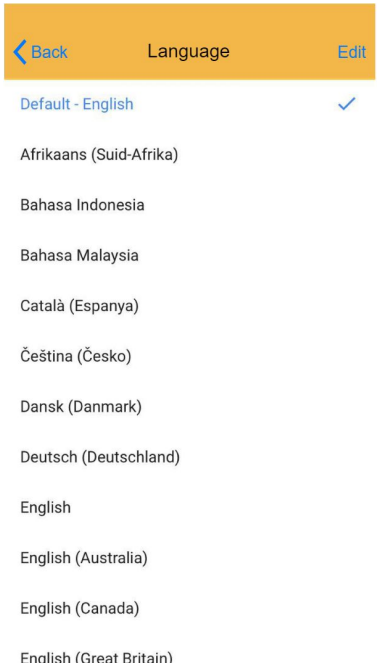

Figure 10.6: HandiMaps' Multi-language options

Figures 10.3 to 10.6 above highlights the information regarding transport services suitable for PLM provided through HandiMaps. Users can choose from a wide variety of transportation means (e.g. handicap friendly buses, private transport etc.) in order to get around.

10.2 App Store Reviews

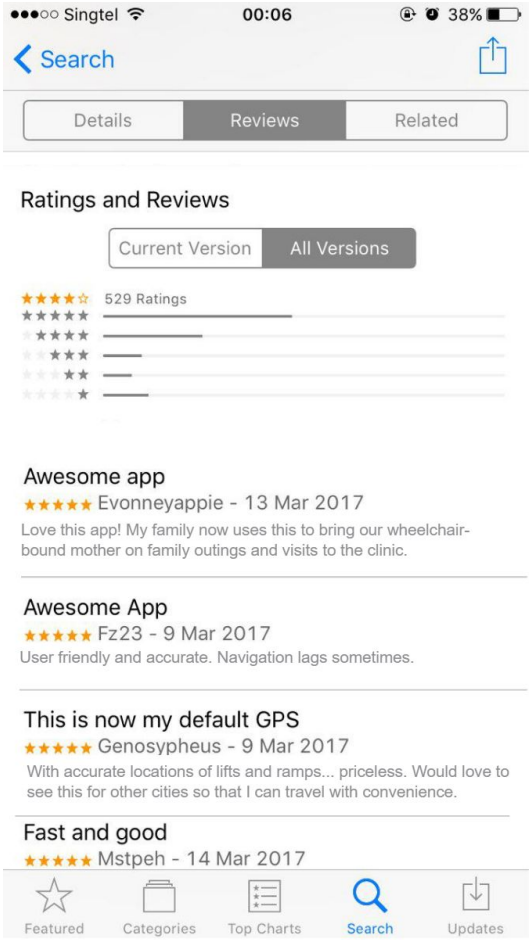

Figure 10.7: Screenshot of HandiMaps' ratings and customer reviews on the App Store.

The response from our Beta version release in Singapore proved to be highly positive, with an average rating of 4.2/5 as shown in Figure 10.7 above.

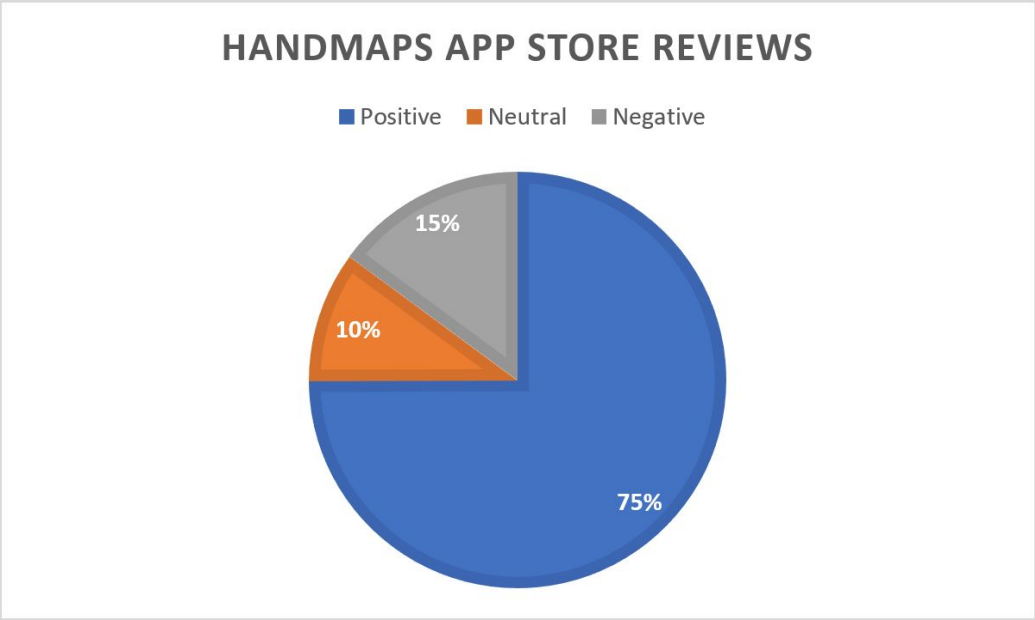

Figure 10.8: Breakdown of sentiment analysis of HandiMaps' customer reviews on App Store

Our team also conducted a sentiment analysis on the reviews, and found that about 75% of reviews were positive, as shown in Figure 10.8 above.

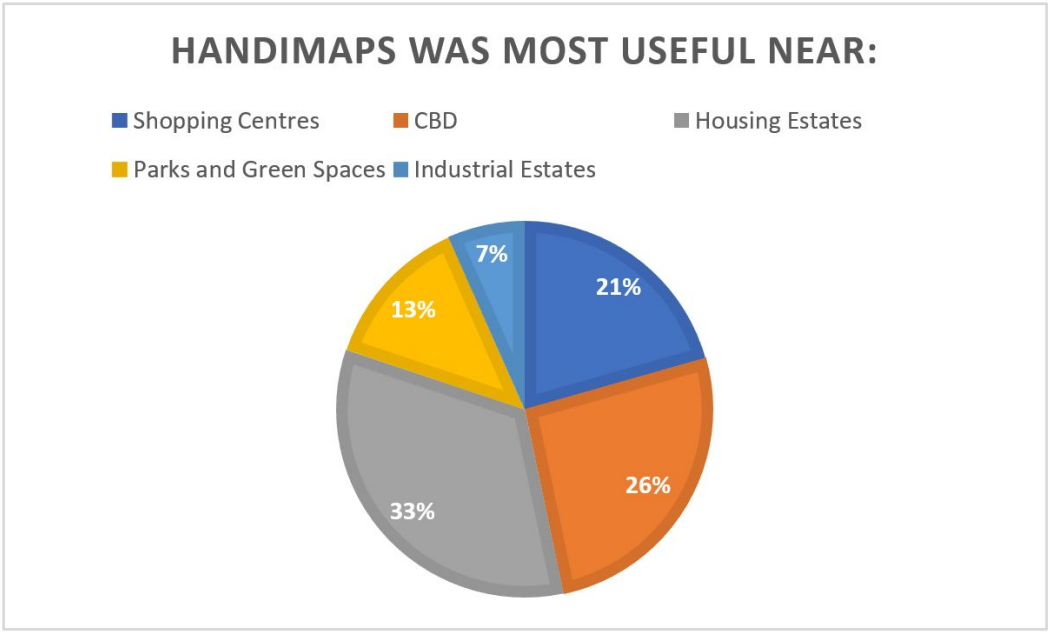

Figure 10.9: Survey results of areas in which users find HandiMaps most useful

Our team also conducted a short in-app survey, which found that more users (80%) have found the application useful in more populated areas (i.e. areas near shopping centres, CBD, and housing estates), as illustrated in Figure 10.9 above.