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for Seniors in Singapore

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Empowering Silver Shoppers:
Improving the Unmanned Convenience Store Experience
for Seniors in Singapore

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1 Introduction

The Unmanned Convenience Store (UCS) is a pioneering retail concept enabling customers to shop autonomously, eliminating the need for on-site personnel through automated payment solutions (Lundin & Paridon, 2022, p. 3). The focus of our project is the “just-walk-out” model, where customers select items, exit the store, and receive seamless mobile application-based billing.

The global UCS market, valued at \$67.48 million in 2021, is expected to skyrocket to \$1,640.32 million by 2028 due to technological advancements, especially in cameras and sensors (The Insight Partners, 2020).

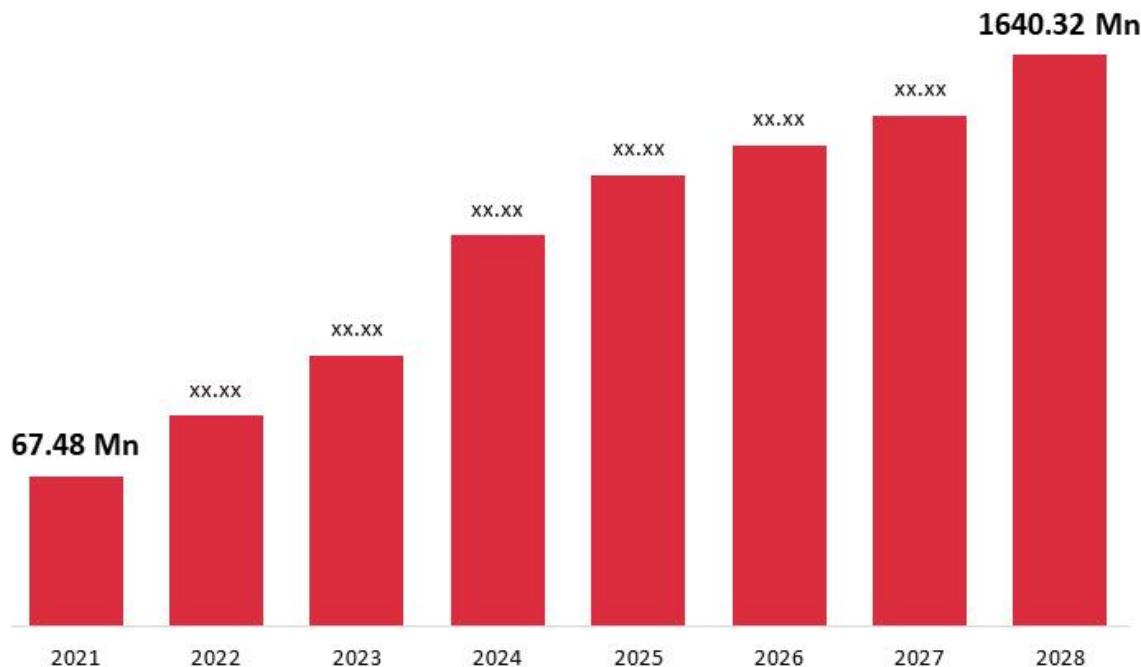


Figure 1. Projected trend of growth of global unmanned store market (Source: Extrapolate, 2022)

Singapore is poised to align with its smart city vision by adopting UCSs. Its tech-savvy population and innovation ecosystem create an ideal environment for these 24/7 accessible, highly convenient stores.

During the COVID-19 pandemic, UCSs surged in popularity due to their perceived safety benefits with reduced physical contact (Singapore Business Review, 2022). However, the elderly, a growing demographic in Singapore, remain underserved due to unique needs and technological adoption challenges (PMO, 2023). Neglecting this demographic signifies a missed business opportunity and the denial of benefits UCSs can bring to seniors.

Our project aims to benefit seniors in Singapore by improving the impact of digitalisation of Pick & GO UCSs, by having Pick & GO introduce ShopPal and Pick & GO Quest: Shopping Expedition to enhance the user-friendliness of UCSs for seniors.

2 Analysis of Target Situation

This section analyses the target situation of our project: the willingness of seniors to shop at Pick & GO UCSs.

2.1 Actions by Pick & GO

This section explores the actions by Pick & GO to digitalise their stores.

2.1.1 Implement security measures

The complete digitalisation of unmanned stores, necessitates the implementation of advanced security measures to effectively monitor customer behaviour and prevent theft and vandalism (Rash & Maguire, 2016). Security measures include:

- **Surveillance cameras.**

Cameras monitor the store's interior (Beh, 2021, p. 6).

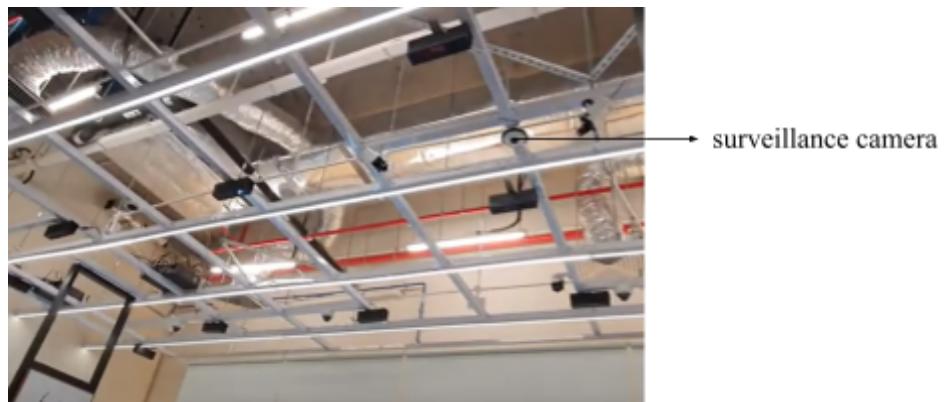


Figure 2. Surveillance cameras in Pick & GO (Source: Pick & GO, 2018)

- **Gantry gates.**

Restricted entry to only registered customers (Beh, 2021, p. 6). To enter the store, customers either have to scan the QR code on the Pick & GO mobile application, or go through facial recognition scanning (Enterprise Singapore, 2020).

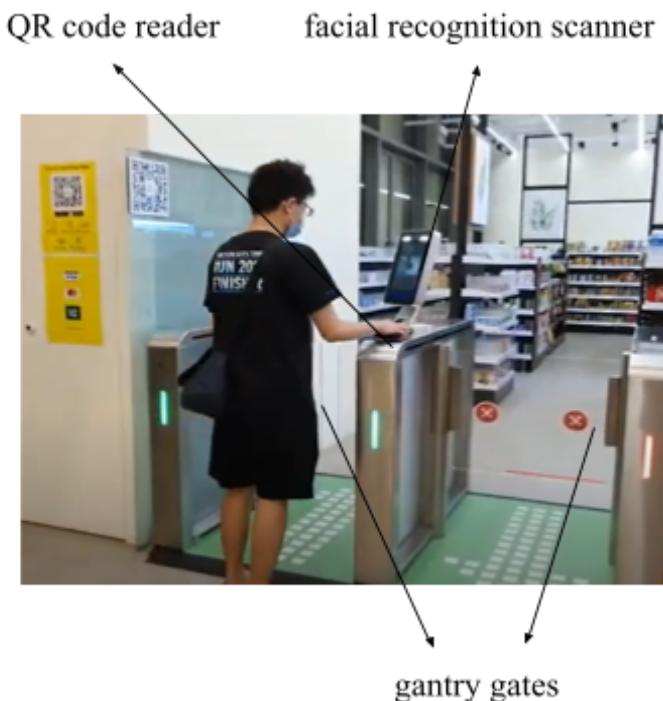


Figure 3. Gantry gates in Pick & GO (Source: Pick & GO, 2018)

2.1.2 Establish a digital payment system

Pick & GO sets up a digital payment system to digitalise the checkout process, eliminating the need for staff. The system involves:

- **Computer vision.**

Cameras installed on the ceiling of the store are equipped with image recognition technology powered by an Artificial Intelligence (AI) system to identify and track the movement of products. Products picked up by customers are added to their shopping carts on the mobile application (Pick & GO, 2018).

- **Sensors.**

Weight sensors are installed on product shelves to detect when customers pick up or return products on shelves (Pick & GO, 2018).

- **Mobile application.**

In 2019, Pick & GO launched the “Pick & GO CS” mobile application for customers to make payments.



Figure 4. Pick & GO application logo (Source: Pick & GO, 2018)

1. Customers register an account and add a payment method by linking their bank account to the mobile application's electronic wallet.

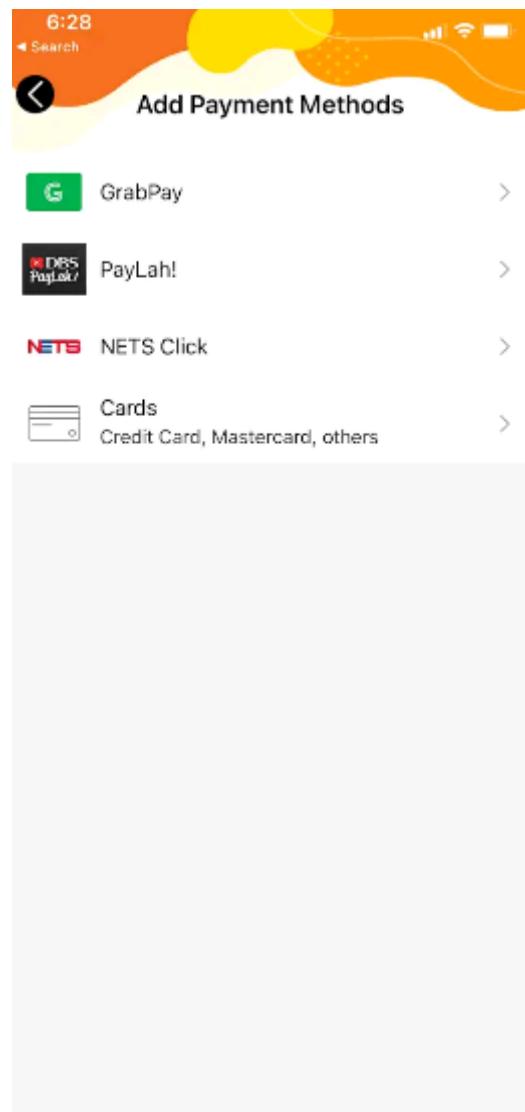


Figure 5. Add a payment method in Pick & GO application (Source: Pick & GO, 2018)

2. Customers have their QR code on the mobile application scanned by a QR code reader located at the gantry gates.

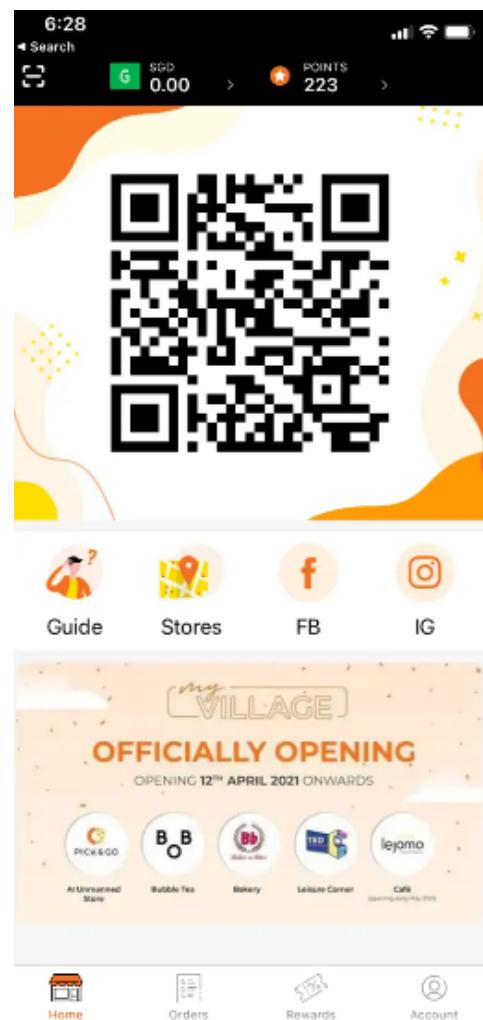


Figure 6. QR code in Pick & GO application (Source: Pick & GO, 2018)

3. Customers pick up products when shopping. The products are added to their virtual shopping cart on the mobile application.

4. Customers are automatically charged after exiting the store, where the payment is automatically deducted from their e-wallets. Customers can check the e-receipts of their purchases on the mobile application.

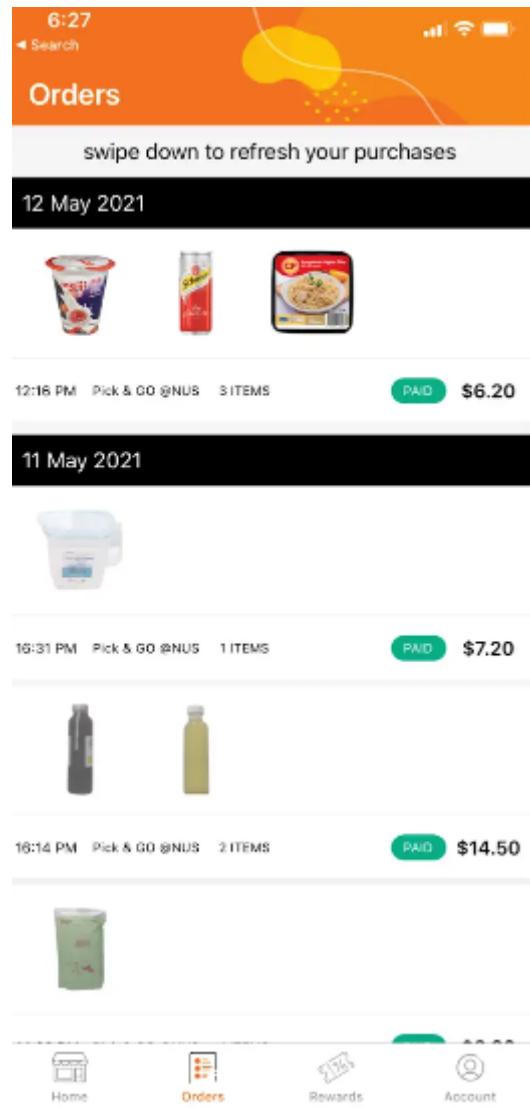


Figure 7. Past purchases on Pick & GO application (Source: Pick & GO, 2018)

2.1.3 Analyse consumer behaviour

UCS operators collect customer data such as purchase history, demographic information, and footage of their shopping patterns and behaviours, and analyse using AI and intelligent analytics, to gain valuable insights into customers' behavioural data. (Freedman, 2023) (Sharma, 2019).

Please refer to Annex 5 (page 60) for a flowchart showing the steps to navigate a Pick & GO UCS.

2.2 Positive Outcomes

This section explores the positive outcomes of Pick & GO UCSSs.

2.2.1 Increased convenience for customers

Pick & GO eliminates the hassle of waiting in long queues, a source of frustration for 89% of Singaporeans (Jaswal & Wong, 2018). Customers enjoy seamless, queue-free shopping as payment is automatic upon leaving (SMU, 2022).

This 24/7 service, sans staff, suits seniors who prefer early morning shopping, aligning with their lifestyle (Ang et al., 2020).

2.2.2 Higher profit for store operators

Pick & GO enhances operational efficiency by automating checkouts, thus reducing labour costs, which is crucial for Singapore's labour-shortage retail sector (Denuwara et al., 2021, p. 7) (Polacco & Backes, 2018) (Loh, 2020). Lower operational costs enable competitive pricing, increasing profits (Jairo R. Coronado-Hernandez et al., 2021).

Integrating AI and analytics allows retailers to analyse customer shopping habits, optimising product offerings, allowing UCSSs to stock up on products that cater more towards the needs of the elderly, ensuring higher profits due to increased sales (Priya, 2019).

2.3 Negative Outcomes

Consumers have several barriers that hamper their desire to adopt an innovation such as UCSs (Ram & Sheth, 1989).

2.3.1 Lack of familiarity

Everett M. Rogers (1983) theorised that innovations perceived as complex tend to experience slower adoption rates. This phenomenon is grounded in the idea that intricate innovations necessitate users to acquire new skills (Rogers, 1983, p. 15). For less technologically inclined seniors, this complexity can lead to discomfort and unfamiliarity when interacting with UCSs. Such psychological barriers can impede their comprehension of the technology-driven shopping process, potentially causing frustration and dissatisfaction, thus contributing to a negative shopping experience.

2.3.2 Lack of human interaction

Pick & GO UCSs may compromise customers' shopping experience due to the lack of human staff. The lack of human touch can hinder the resolution of certain situations, such as customer grievances or technical difficulties, especially for seniors who value social interactions while shopping (HUI Research, 2021).

Please refer to Annex 1 (page 56) for diagrammatic representation of links between above actions and impacts.

2.4 Characteristics of Target Audience

This section explores the characteristics of the target audience of our project: **seniors in Singapore.**

2.4.1 Experience physical limitations

Seniors with diminished strength struggle to carry heavy shopping bags or items (Walston, 2012). Singaporean seniors using trolleys to carry heavy loads to minimise strain on their bodies is a common phenomenon (Tripadvisor, 2016).

Seniors facing memory challenges may struggle to recall their shopping intentions, leading to unintended omissions in their purchases (Smith & Robinson, 2023). Bruce and Young (1986) found that older adults' difficulty recognising new faces might relate to their decision-making processes and context retrieval, which explains seniors' inclination towards familiar figures (Bartletti & Fulton, 1991, pp. 229-238).

2.4.2 Value human interaction

Most seniors in Singapore prefer human cashiers at stores, hence seniors may perceive UCS as impersonal due to absence of interactions with store personnel (IMDA, 2018). Seniors value personal touch and relatable experiences (Lee & Coughlin, 2015).

2.4.3 Apprehensive towards digital technology

Many seniors resist adopting digital technologies due to negative perceptions, disinterest, and a lack of awareness about the benefits of technology (IMDA, 2018) (Perdana, 2021) (Brown, 2021). Privacy and security concerns, along with negative media portrayals, also fuel their hesitation (IMDA, 2018) (Perdana, 2021) (Brown, 2021). Some seniors prefer to abstain from technology, perceiving it as unnecessary (Toh, 2017).

2.4.4 Receptive towards game-based activities

Seniors have shown a fondness for gaming, with research suggesting potential benefits from gamification and game-based interventions (Koivisto & Malik, 2020). Cardona et al. proposed a model revealing motivations among seniors who play games.

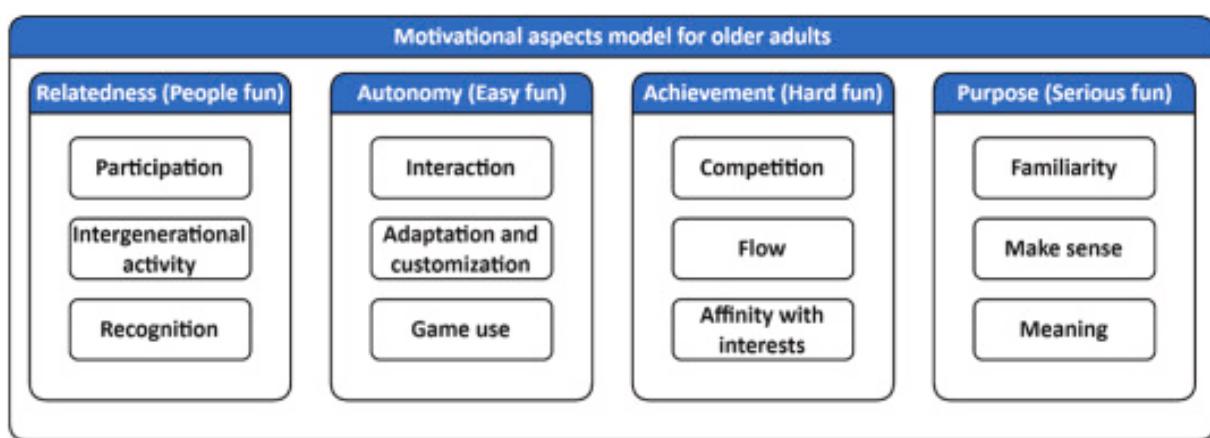


Figure 8. Motivational aspects model for older adults towards games (Source: Cardona et al., n.d.)

Seniors may find academic motivation and satisfaction in achieving goals and overcoming challenges in games, which boosts their self-esteem, providing a sense of

accomplishment. Purpose motivation extends beyond entertainment to include practical benefits, adding value to the gaming experience (Cardona et al., n.d.).

3 Details of Suggested Interventions

Our team proposes two interventions, **ShopPal** and **Pick & GO Quest: Shopping Expedition** which would be implemented by **Pick & GO**, aimed at addressing the challenges faced by seniors in UCSs and enhancing their overall experience.



Figure 9. Logo of Pick & GO (Source: Pick & GO, 2018)

Please refer to Annex 2 (page 57) and Annex 3 (page 58) for illustrations showing how impacts analysed earlier are improved by the above interventions.

3.1 ShopPal

To address the lack of human interaction for seniors while shopping at UCSSs and provide assistance in place of human staff, we propose the introduction of ShopPal, an interactive shopping companion.

3.1.1 Design of ShopPal

The design of ShopPal is illustrated below.



Figure 10. Design of ShopPal – Back view

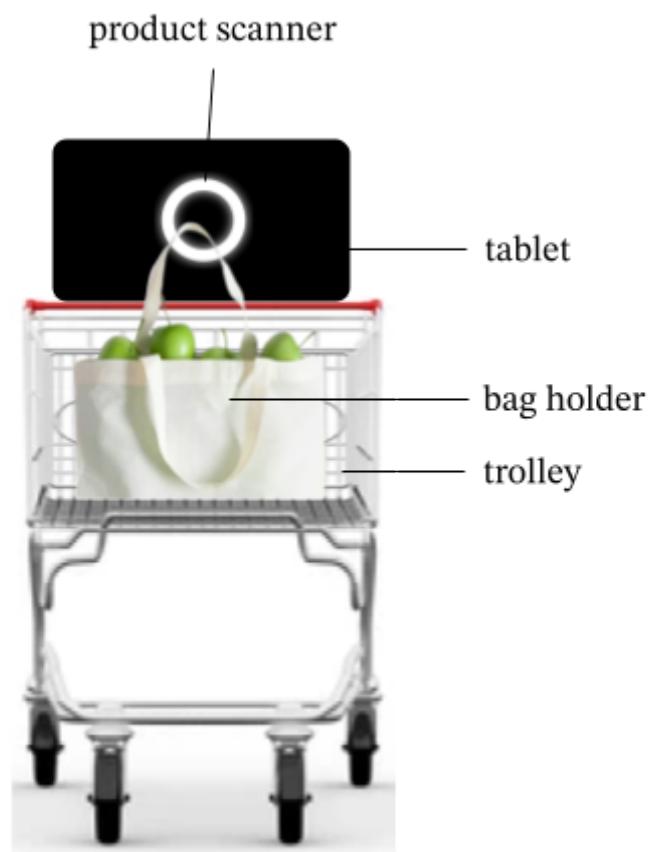


Figure 11. Design of ShopPal – Front view



Figure 12. Design of ShopPal – Top view

ShopPal consists of the following components:

- **Trolley.**

The use of trolleys leverages seniors' familiarity with trolleys from traditional supermarkets, ensuring a seamless transition to Pick & GO without altering their shopping routine, enhancing their convenience and comfort.

The trolleys are shallow, reducing bending and strain for seniors. Trolleys have swivel wheels for better manoeuvrability, aiding seniors with mobility issues or limited strength.

The trolleys provide bag holders for customers to place their recycling bags, reducing strain on senior customers by allowing them to simultaneously bag their purchases while shopping, thus eliminating the physical strain that comes from transferring their purchases from the trolley to their bags.

- **Tablet.**

The touch-screen AI-powered tablet serves as the interactive hub of ShopPal.

In terms of user interface, text and button sizes are kept large for easy readability, each icon is labelled with corresponding text for clarity, design is minimalistic by implementing progressive disclosure. This reduces cognitive load on seniors, making it easier for them to focus on their shopping tasks.

How to use:

1. Customers collect trolleys.
2. Customers scan the QR code displayed on the tablet using the Pick & GO CS mobile application to log into their account.

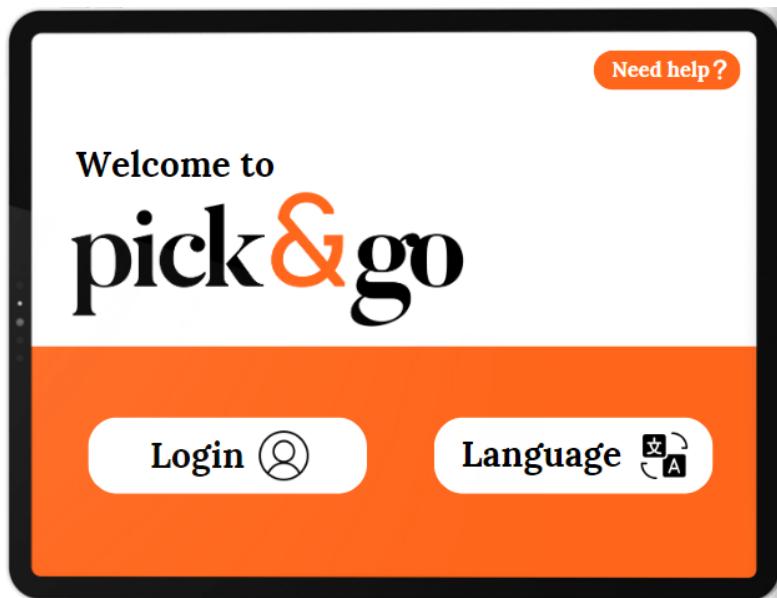


Figure 13. Home screen of ShopPal

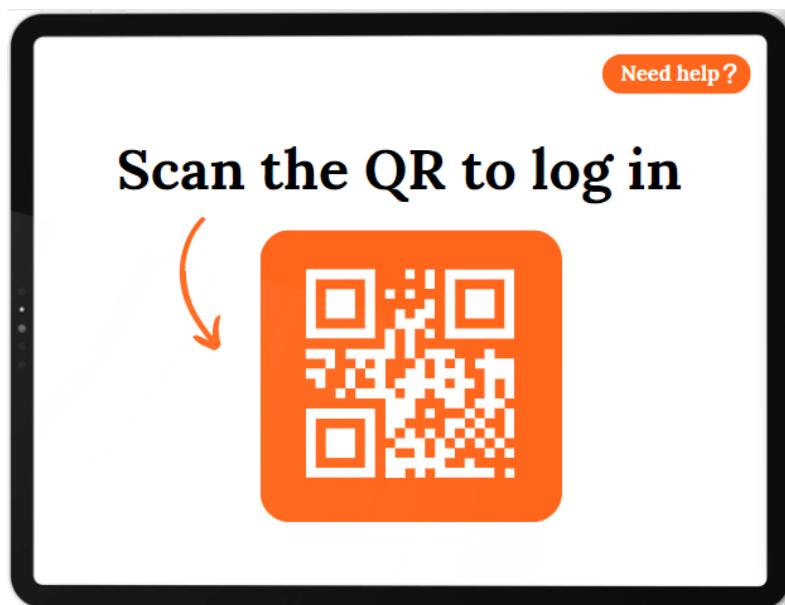


Figure 14. Methods of registration on ShopPal

3. After purchase is made, customers are automatically logged out of their accounts.
4. Customers return trolleys.

As an anti-theft mechanism, trolley wheels are equipped with an auto-lock system to prevent customers from pushing them out of the store.

Below is the modified store layout of a Pick & GO UCS, where a trolley collection and returning area is included.

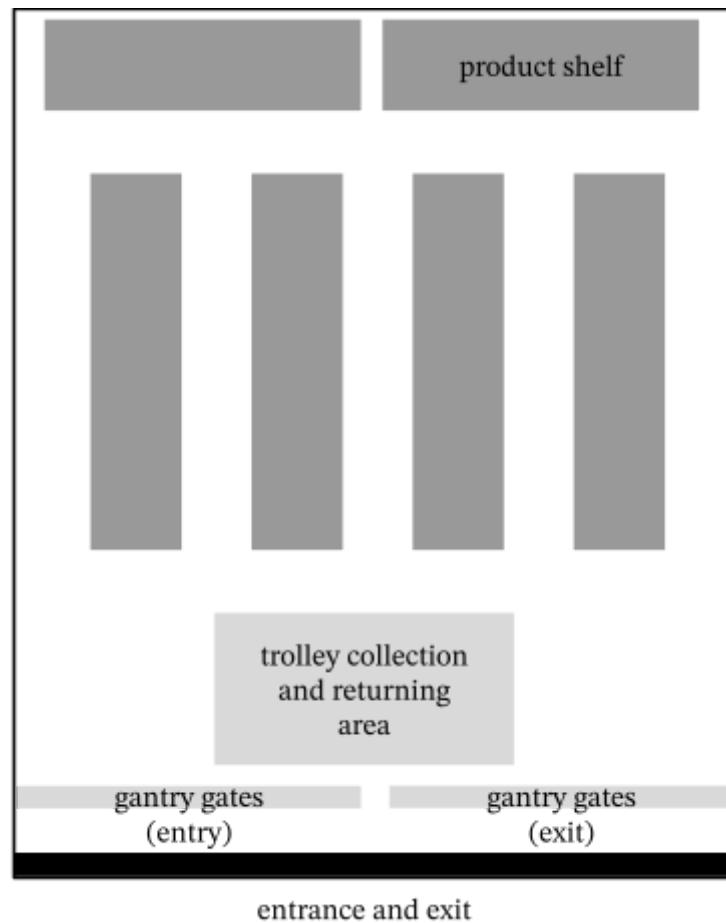


Figure 15. Store layout of Pick & GO UCS

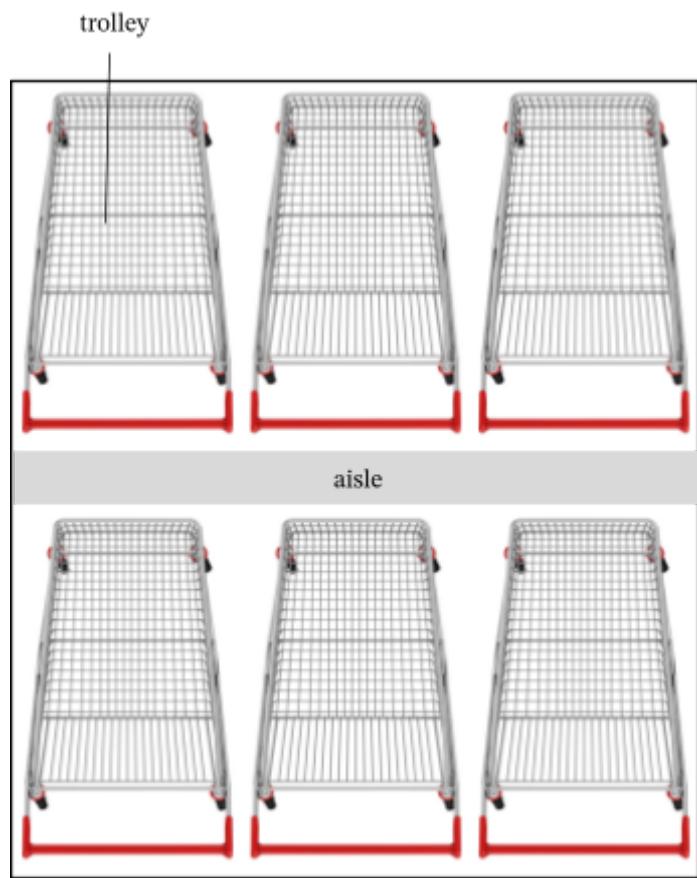


Figure 16. Trolley collection and returning area of Pick & GO UCS

3.1.2 Functions of ShopPal

This section outlines the functions of ShopPal.

3.1.2.1 Feature 1: Voice-activated Virtual Shopping Assistant

ShopPal harnesses speech recognition and Natural Language Processing (NLP) to enable customers to converse with the system, mirroring their interactions with store workers. NLP allows computers to understand human language and intent, enabling natural human-computer communication (IBM, n.d.). Seniors can converse with ShopPal like chatting with a store attendant, fulfilling their preference for personal interaction.

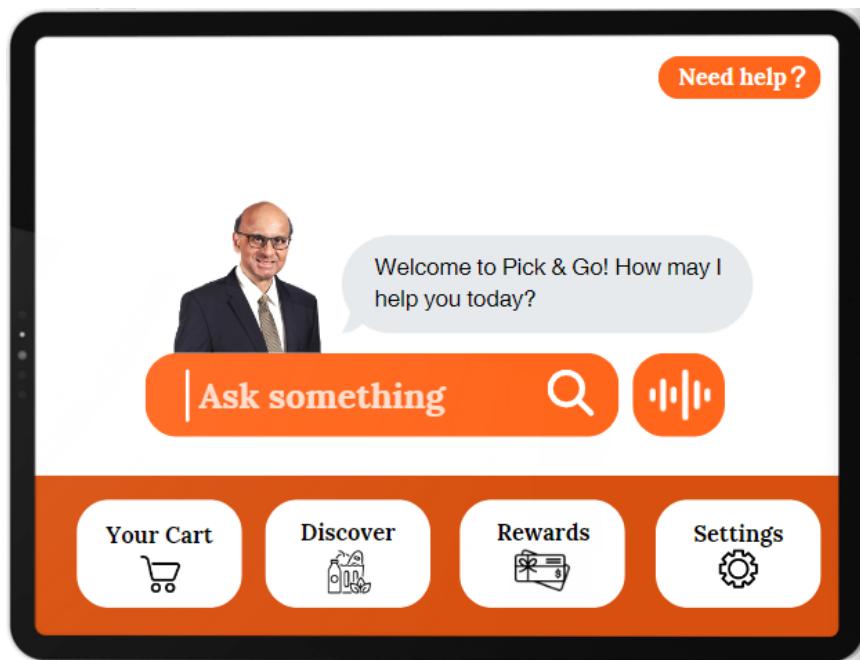


Figure 17. “Virtual Shopping Assistant” functionality on ShopPal

Customers can customise font size, language, voice accent, and speaking speed of the user interface through settings on the tablet.

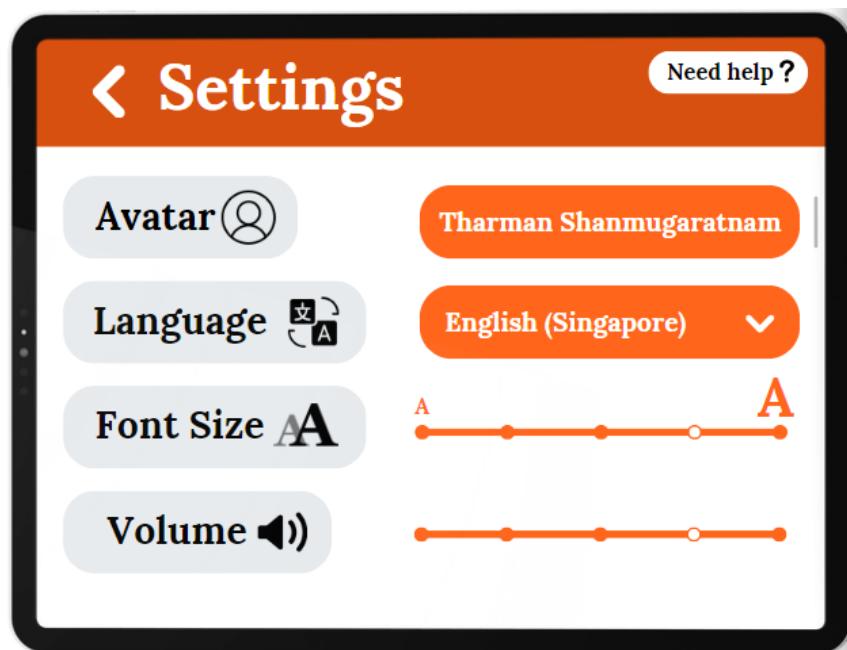


Figure 18. Settings of ShopPal

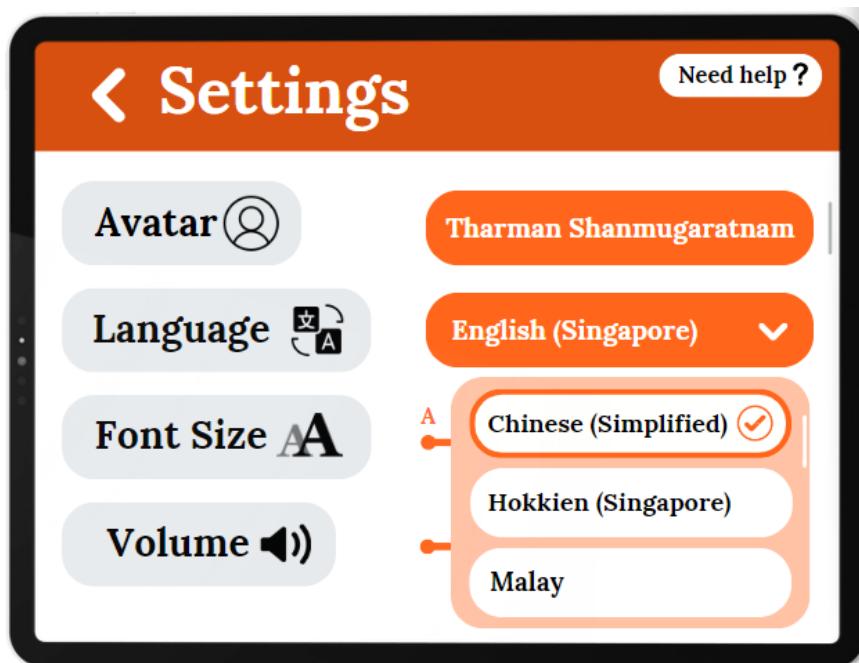


Figure 19. Language options under settings of ShopPal

Under settings, customers can also select familiar AI avatars for the virtual shopping assistant, such as local MPs and beloved celebrities, which mimic their chosen avatars' speech patterns, adding a sense of familiarity and assurance.

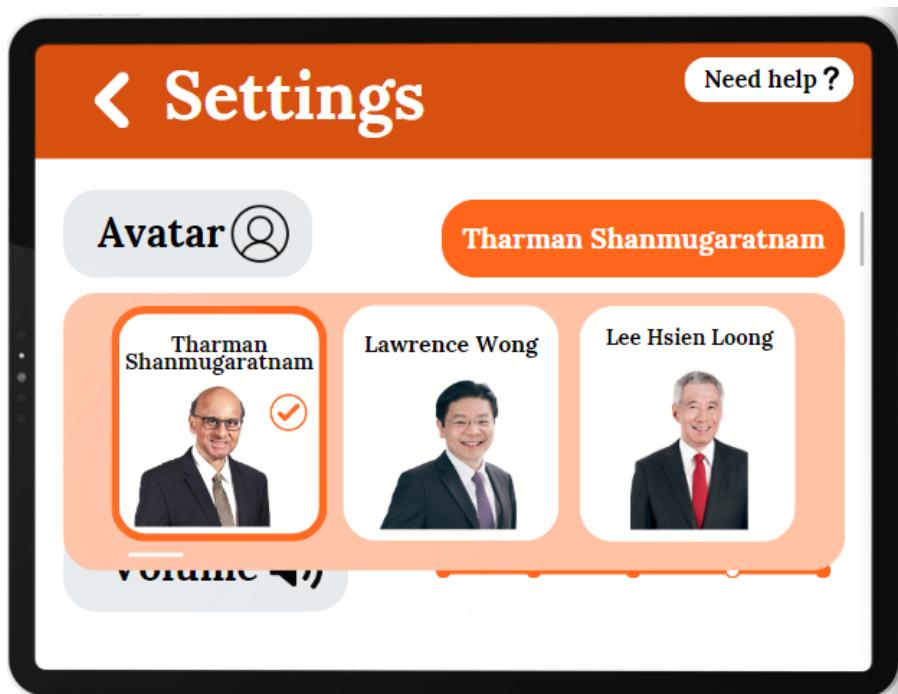


Figure 20. Avatar customisation under settings of ShopPal

These settings can also be customised on the Pick & GO CS mobile application before visiting the store. Once saved, these preferences are linked to their Pick & GO account and automatically applied during subsequent visits, enhancing user comfort and accessibility.



Figure 21. Customisable ShopPal settings on mobile application

Recognising that some seniors may face challenges in customising their ShopPal settings on the mobile application, Pick & GO could introduce a “**ShopPal Family Account**” feature, where family members or caregivers create a centralised Family Account linked to the senior’s ShopPal profile. Under this account, family members can directly manage seniors’ ShopPal settings on their behalf, thus addressing the usage barrier and making the shopping experience more accessible and enjoyable for seniors.

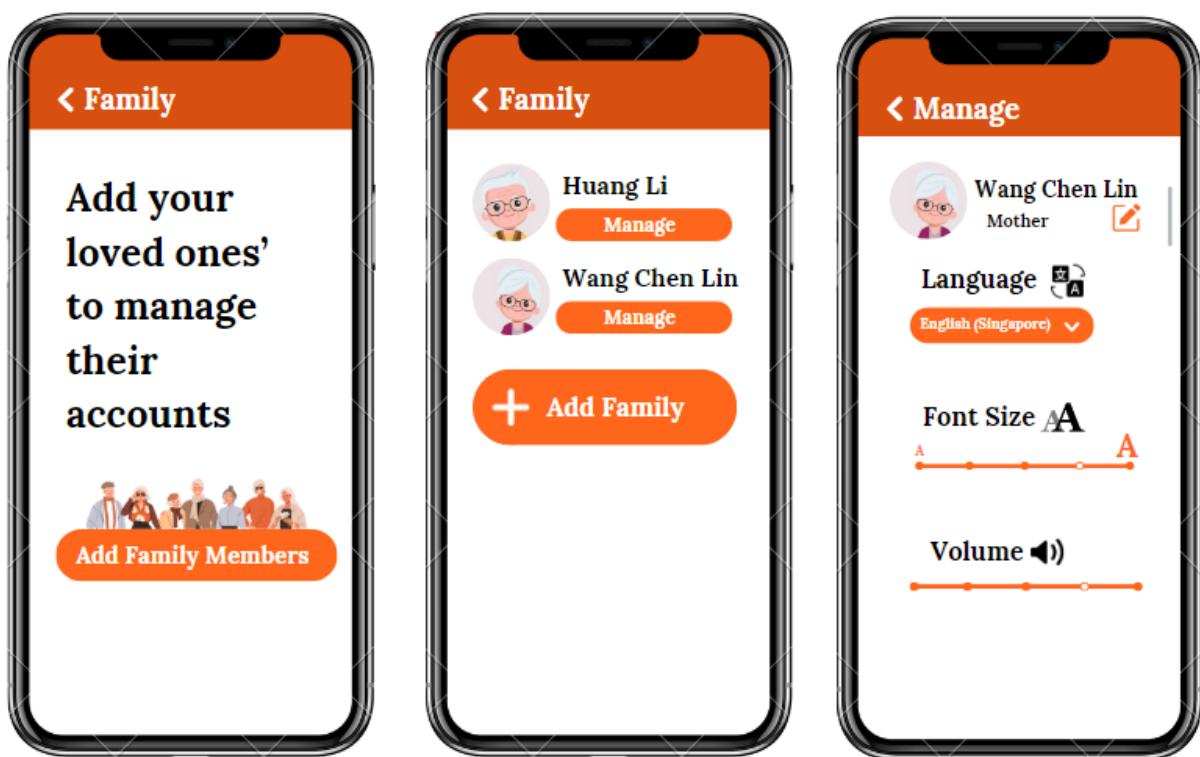


Figure 22. Manage family members’ settings on mobile application

3.1.2.2 Feature 2: Product Navigation

ShopPal employs voice commands and microphones to help customers find items using a pre-programmed database. This feature especially aids seniors by improving the ease of locating the product.

Customers input their request via search engine or voice command.

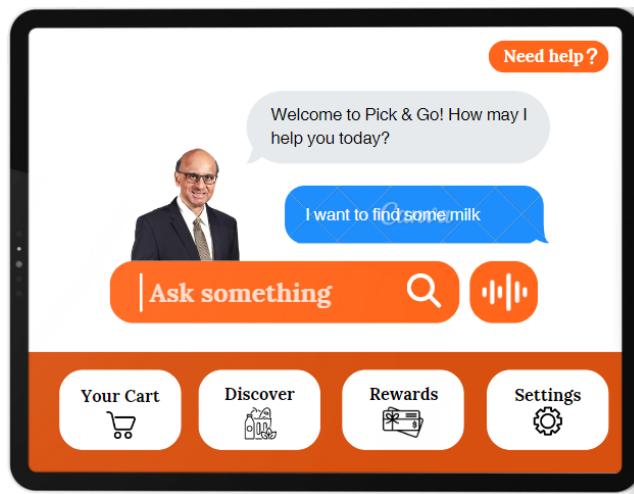


Figure 23. Product navigation: Customer inputs request

Customer's request is narrowed down to specific products.

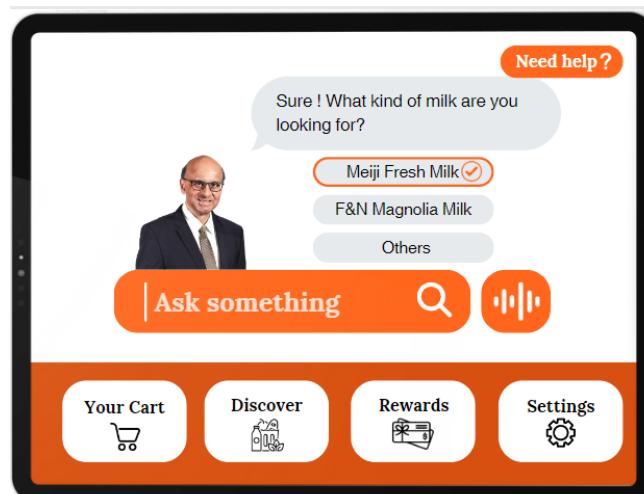


Figure 24. Product navigation: Request is narrowed down

Customer selects one of the products. A pop-up appears to confirm the customer's choice.

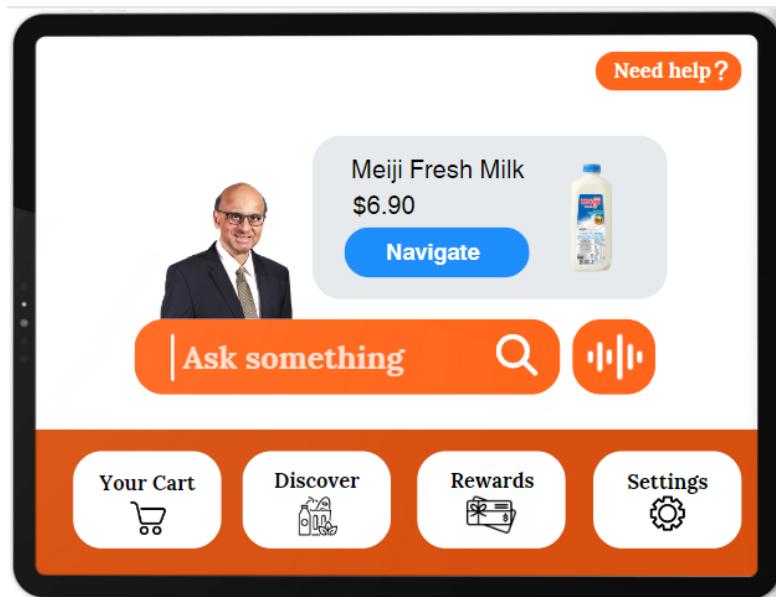


Figure 25. Product navigation: Pop-up to confirm selection

Product navigation begins. Arrows guide customers to the product.

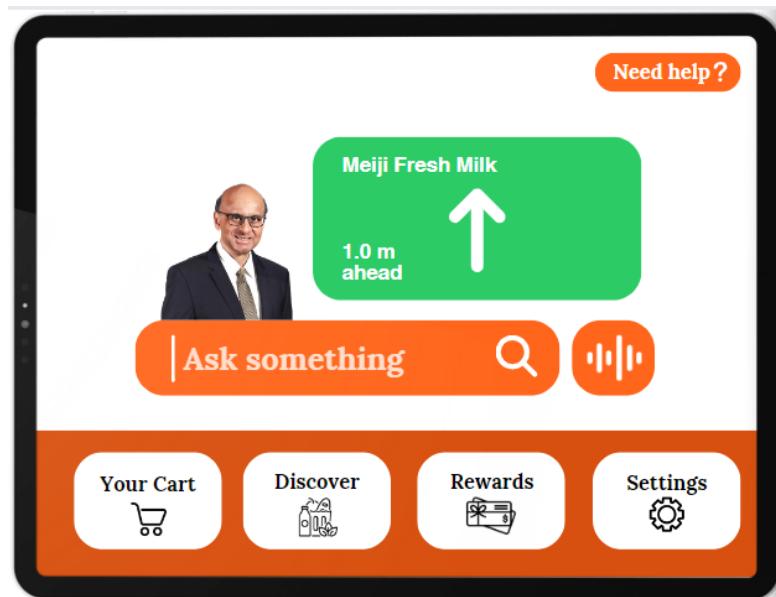


Figure 26. Product navigation: Arrows guide customer to product

When the product is near the customer, the customer is notified on the screen and through a vibration pulse that the product is in the vicinity.

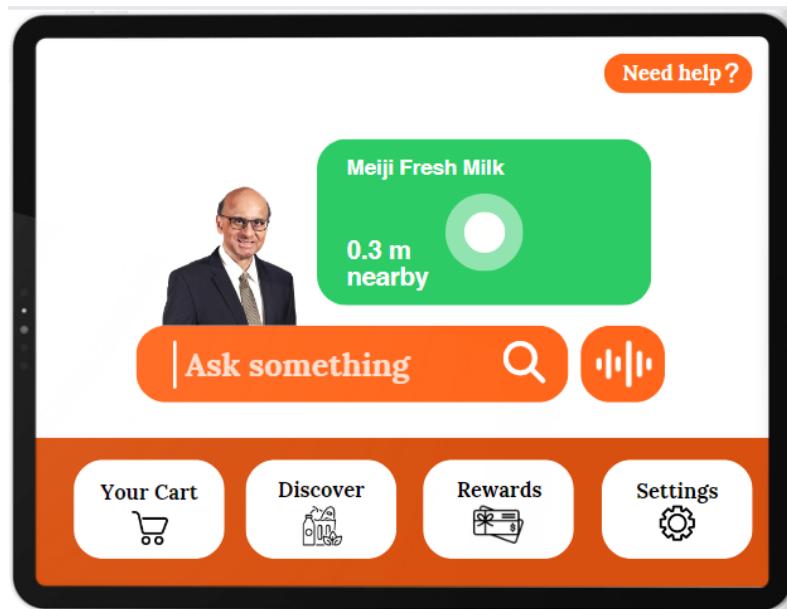


Figure 27. Product navigation: Customer is near product

A pop-up appears to confirm the location of the product.

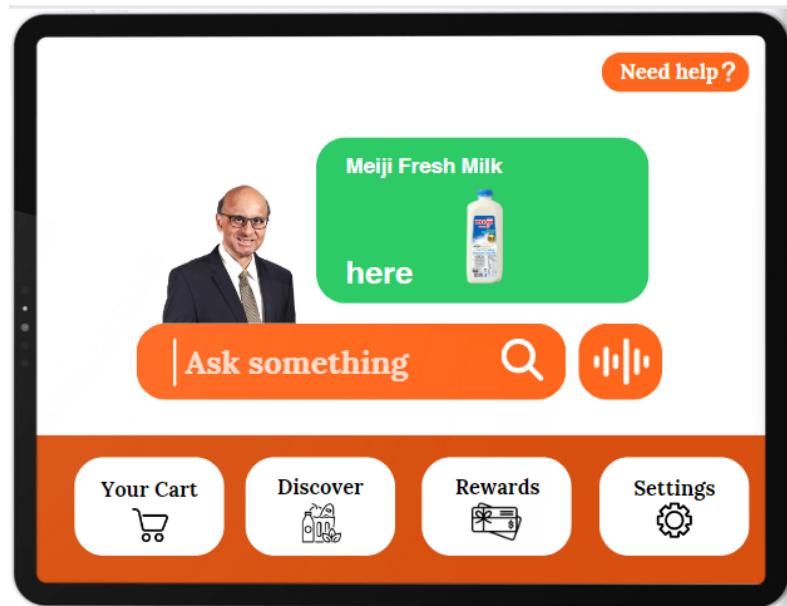


Figure 28. Product navigation: A pop-up confirms the location of the product

3.1.2.3 Feature 3: Your Cart

When products are placed in the trolley, a scanner lights up, emits a beep, and voice confirmation clearly states the name of the scanned product. This helps seniors keep track of their items, addressing potential issues related to forgetfulness, ensuring that seniors have an accurate record of the products they have selected.

ShopPal displays the current price of scanned items and calculates the running total, helping seniors keep track of their spending in real-time, thus empowering them to manage their budget more effectively when shopping.

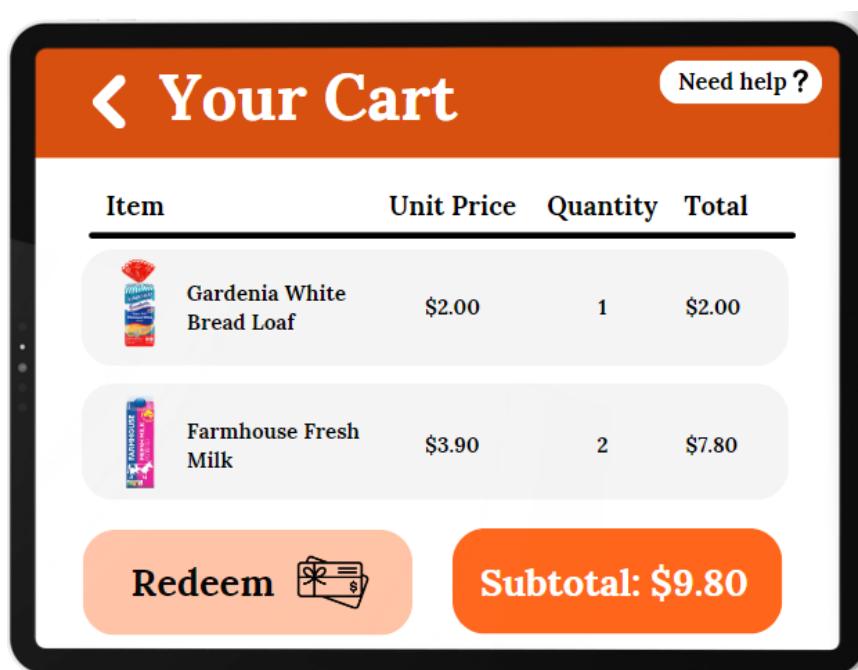


Figure 29. “Your Cart” functionality on ShopPal

3.1.2.4 Feature 4: Discover

Drawing insights from customers' shopping history, ShopPal's AI-powered system recommends products that align with their preferences and past purchases, promoting efficiency. Additionally, ongoing discounts are highlighted, ensuring customers, especially seniors, can make cost-effective choices. These features streamline the shopping process and enhance the quality of life for senior customers, making their shopping experiences more efficient, convenient, and budget-friendly.

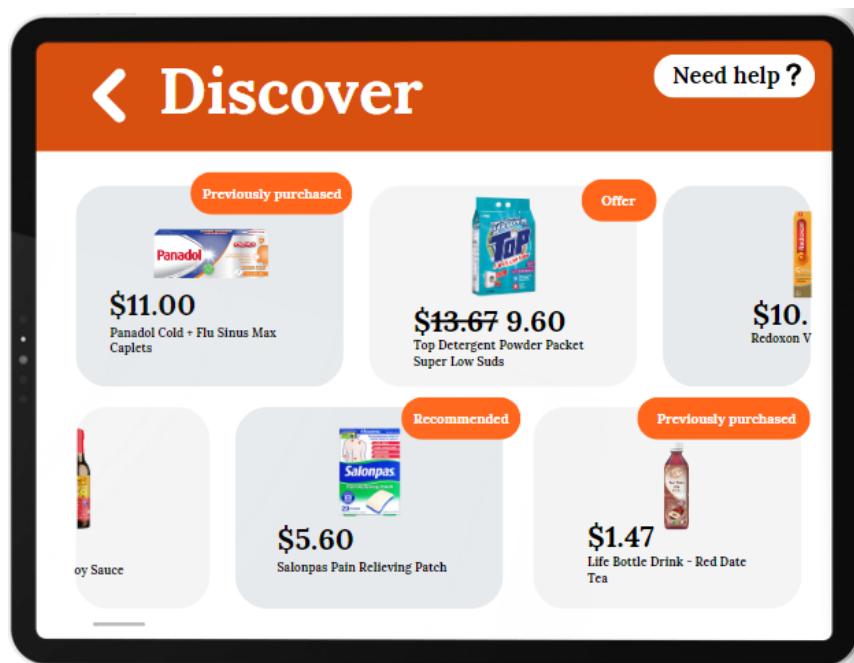


Figure 30. “Discover” functionality on ShopPal

3.2 Pick & GO Quest: Shopping Expedition

Pick & GO can introduce a simulation game known as “**Pick & GO Quest: Shopping Expedition**”, which can be downloaded and played on phone or laptop after signing in using the Pick & GO app account.



Figure 31. Icon of “Pick & GO Quest: Shopping Expedition” application

3.2.1 Design of Game

The simulation immerses seniors in a virtual shopping environment that mirrors real-life scenarios they might encounter in UCSSs. Through interactive gameplay, seniors can perform various tasks, providing them with the hands-on trial to familiarise themselves with the processes involved in shopping at Pick & GO, thus giving them the skills and confidence required to shop at UCSSs.

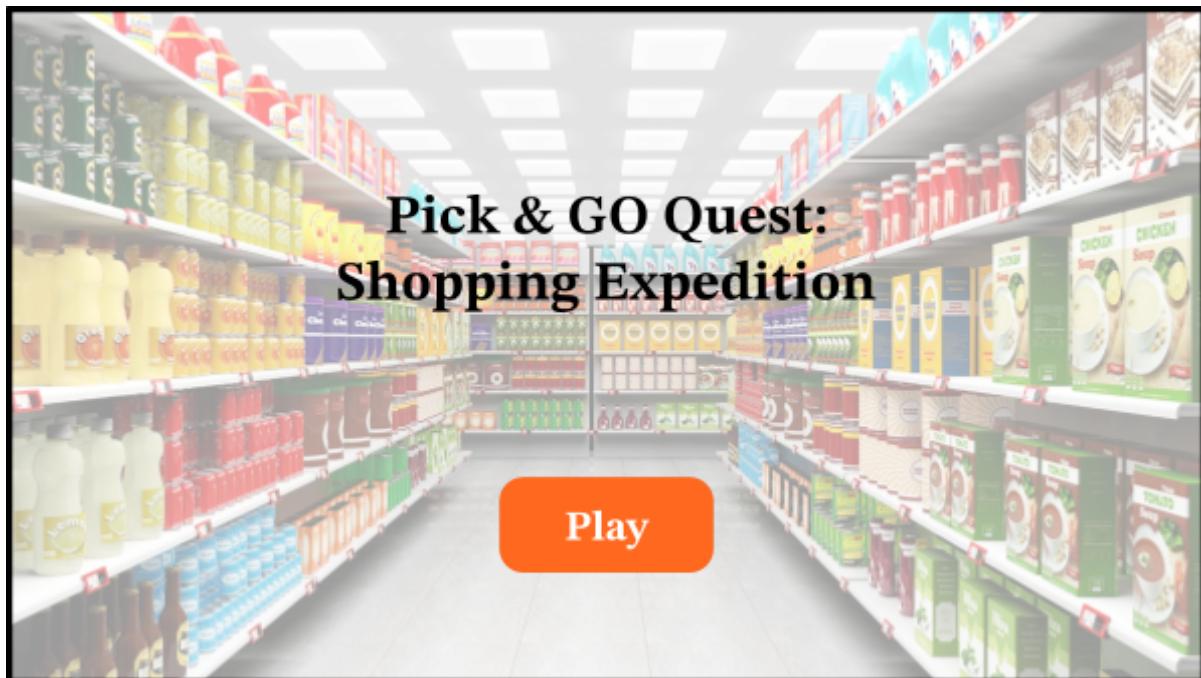


Figure 32. Home page of “Pick & GO Quest: Shopping Expedition”



Figure 33. A task on “Pick & GO Quest: Shopping Expedition”

A customisable avatar – the same one on ShopPal – guides seniors in the game.

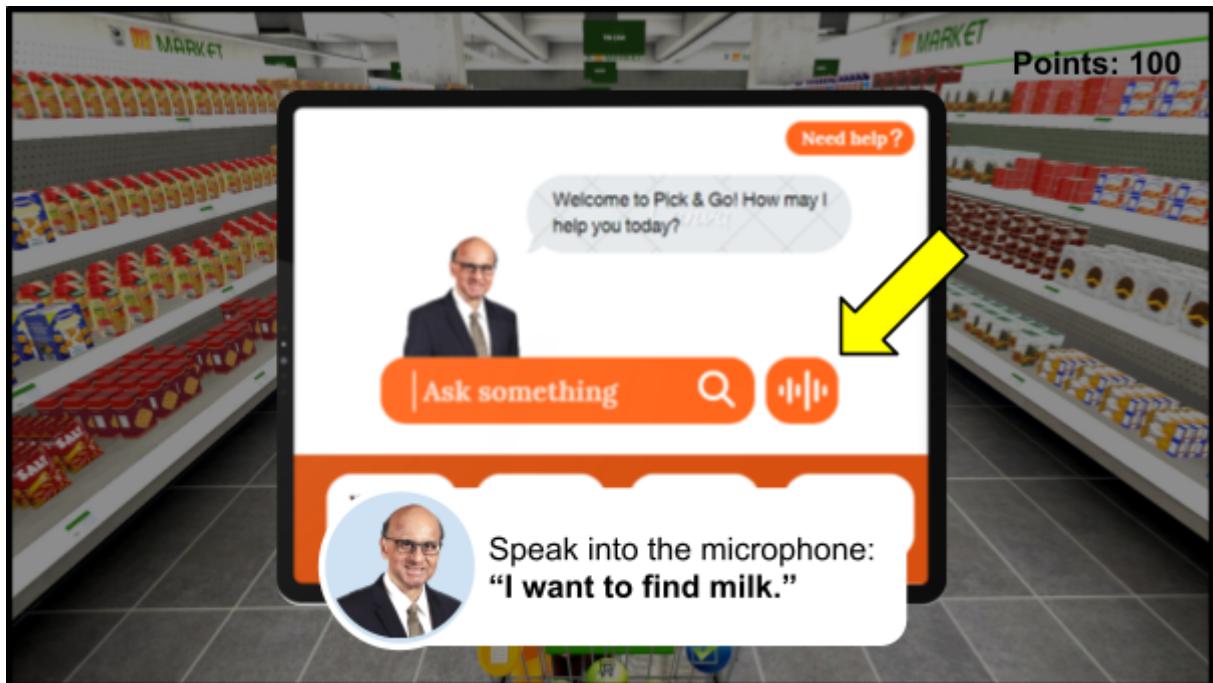


Figure 34. Avatar provides step-by-step guidance on “Pick & GO Quest: Shopping Expedition”

3.2.2 Points-based Rewards System

To incentivise participation and engagement, a point and reward system is implemented, where players earn points by completing in-game tasks and challenges. Points confirm the players' achievements and symbolise their merits (Anderson et al., 2013), an indication of their level of accomplishment in the game.

Accumulated points can be used to redeem various rewards, such as discounts and digital coupons when shopping at Pick & GO. This makes the shopping experience more enticing and enjoyable.



Figure 35. Players' accumulated points on “Pick & GO Quest: Shopping Expedition”

Customers' points are synced to their Pick & GO account. After clicking on the "Redeem" button on the home page, customers are redirected to the page where they can redeem the points for rewards when shopping at Pick & GO UCS.

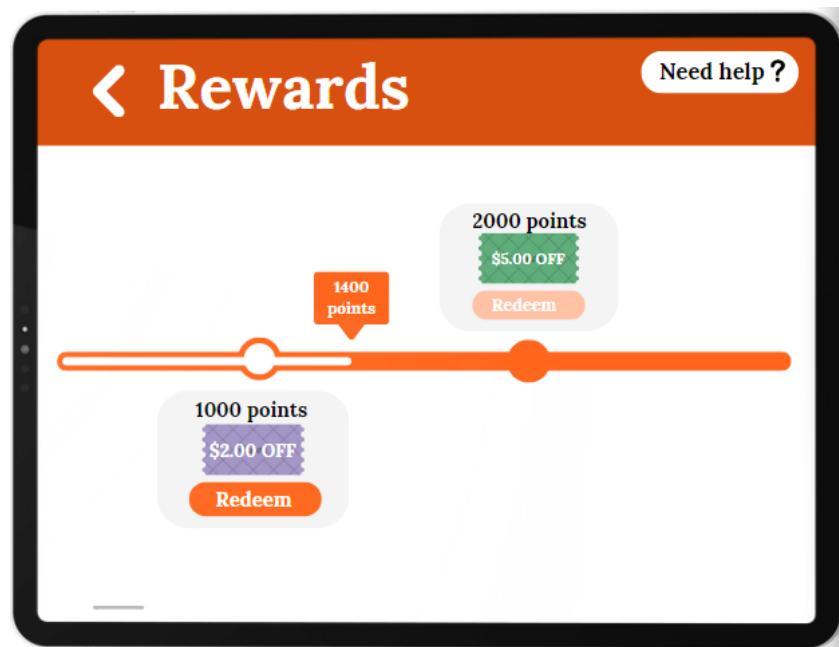


Figure 36. Reward redemption page on ShopPal

4 Evaluation of Suggested Interventions and Possible Solutions to Them

This section aims to maximise the positive impact and minimise the negative impact to create a positive and inclusive environment for seniors when shopping at UCSs.

Please refer to Annex 4 (page 59) for diagrammatic representation of evaluation of suggested interventions and possible solutions to them.

4.1 ShopPal

4.1.1 Discover

Product recommendations based on seniors' past purchases may inadvertently reinforce unhealthy eating habits, potentially promoting an imbalanced diet.

To address this problem, we can utilise both the general health profiles of Singaporean elderly individuals, considering prevalent health concerns among the elderly, such as hypertension, diabetes and high cholesterol level which are caused by high levels of intake of salt, sugar and fats respectively, as well as seniors' past purchases to recommend healthier products for seniors (AIC, 2023).

For example, ShopPal can recommend healthier alternatives with lower salt or sugar content to a senior who buys products with high salt or sugar content, thereby empowering them to make more informed and health-conscious decisions when shopping.

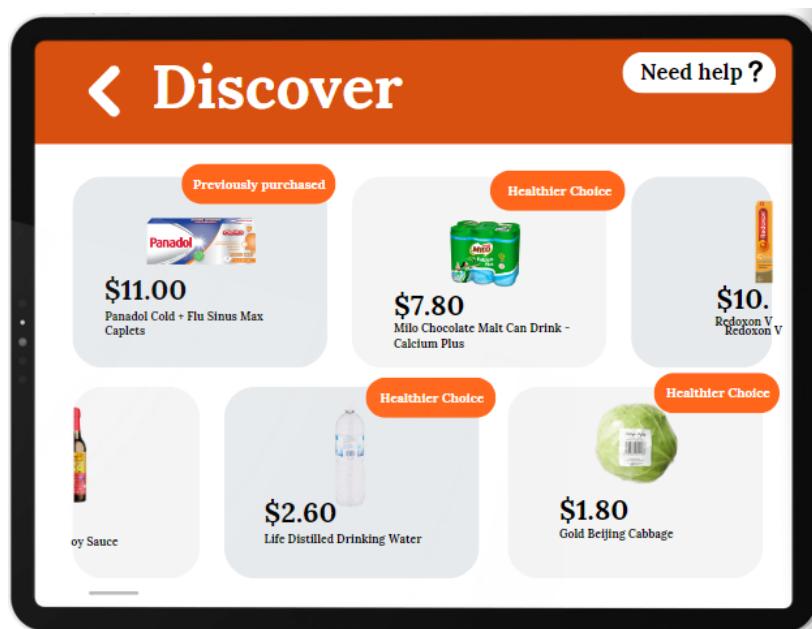


Figure 37. Healthier product recommendations on ShopPal

4.1.2 Publicity Campaign

One limitation of the Pick & GO Quest: Shopping Expedition game is its limited reach due to the lack of publicity efforts. Despite the potential of the game to educate seniors about ShopPal, seniors who are not well-informed about the game may miss out on its benefits, particularly those who have limited exposure to digital advertising or promotional channels. This limitation underscores the importance of an extensive publicity campaign to maximise the reach and impact of the game among seniors.

The publicity campaign would be centred on the acronym “EASE” which stands for efficient, accessible, safe, and easy. This helps alleviate the concerns of seniors regarding the safety and ease of access of Pick & GO and makes the adoption of ShopPal more appealing.

4.1.2.1 Physical Advertisements

Posters would feature seniors shopping in Pick & GO UCS and promoting the convenience of shopping at UCSs. The image of seniors using ShopPal shows that the technology is suitable and accessible for people in their age group, helping seniors relate to the product, seeing others like them benefit from it. These posters would be placed in locations frequently visited by seniors, such as community centres, senior activity centres, and hawker centres, allowing for repeated exposure to seniors.

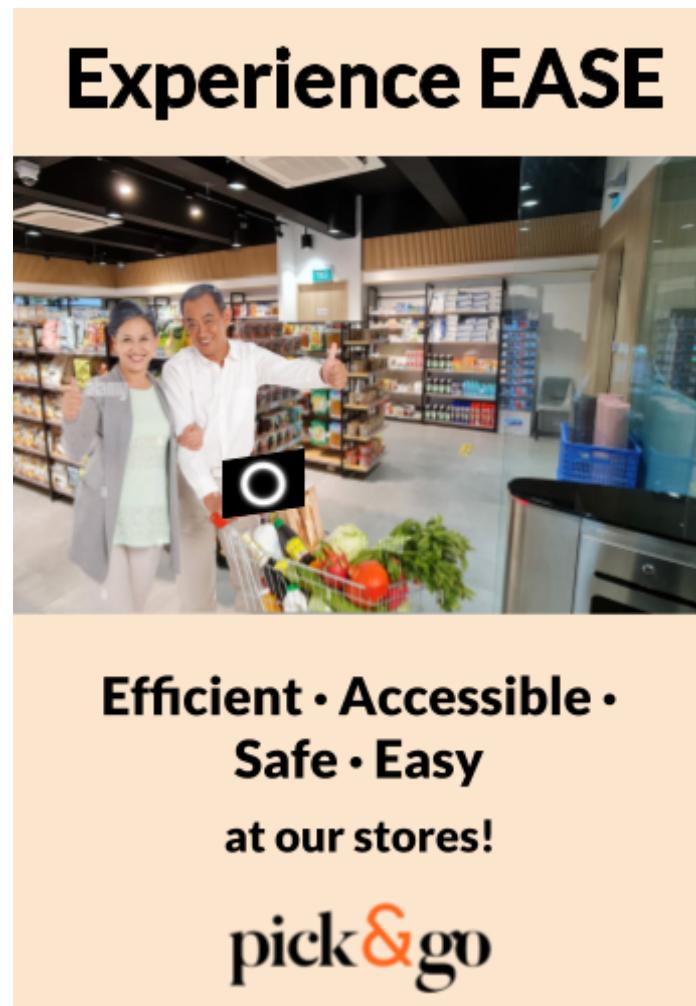


Figure 38. Design of publicity poster

4.1.2.2 Digital Advertisements

To effectively reach the senior citizen demographic in Singapore, capitalising on their high adoption of digital devices is essential (IMDA, 2023) (ROSA, 2023). Considering that Facebook is the most frequently used social media platform among seniors, leveraging this platform for advertising is a strategic approach (Rahim, 2016).

Digital advertising would involve the creation of short videos featuring seniors who have successfully adopted ShopPal. These videos will serve as powerful testimonials, showcasing how ShopPal helped seniors overcome their digital apprehensions and provided a seamless shopping experience.

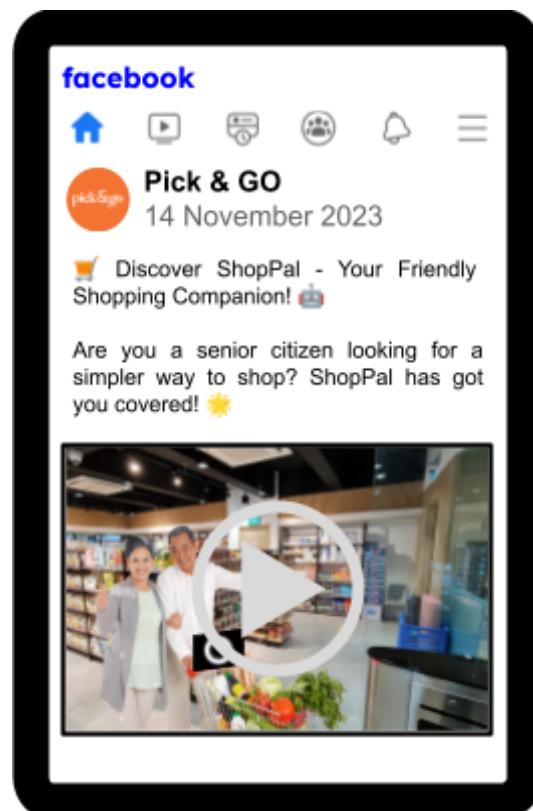


Figure 39. Design of video advertisements on Facebook

4.2 Pick & GO Quest: Shopping Expedition

4.2.1 Game Tutorial

Many seniors may possess limited experience with mobile apps and gaming, primarily due to a generational gap and a lack of exposure to digital technology. This lack of familiarity and experience can result in difficulties in navigating the game (Boot et al., 2020, p. 140).

To effectively address this challenge, Pick & GO can provide in-game tutorials aimed at assisting senior players in their initial engagement with the game. The tutorials would offer step-by-step guidance on fundamental navigation including basic gameplay mechanics, such as using the joystick to move, tapping to select items, swiping to browse, and pinching to zoom in. Additionally, voice narration would be incorporated into the tutorials, with instructions available in various languages to accommodate players with diverse language preferences.



Figure 40. Game tutorial of “Pick & GO Quest: Shopping Expedition”

5 Conclusion

In the pursuit of a forward-looking economy, businesses must eagerly embrace emerging technologies to enhance productivity while meeting the distinct needs of senior consumers. UCSs, through the seamless integration of cutting-edge retail technology into daily operations, offer a compelling glimpse into the future of the retail industry. This transformative shift underscores the paramount importance of catering to the evolving requirements of seniors within this unfolding narrative.

By actively encouraging more companies to engage in this transformative process, Singapore can ascend to a distinguished position as a global benchmark for inclusive and technologically advanced service provision. Such a dedicated commitment not only guards against the marginalisation of seniors but also firmly establishes our nation as a trailblazer in harnessing technology for the collective benefit of all stakeholders (Iswaran, 2017).

In conclusion, our project maintains an unwavering commitment to enhance the shopping experience for seniors in UCSs. It actively acknowledges and addresses their unique challenges while embracing change as the conduit to progress. With this steadfast mindset, we are optimistic that our project can usher in positive change, benefiting not only seniors but also the broader societal context.

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7 Annexes

7.1 Annex 1: Summary Diagram of Links between Actions and Impacts

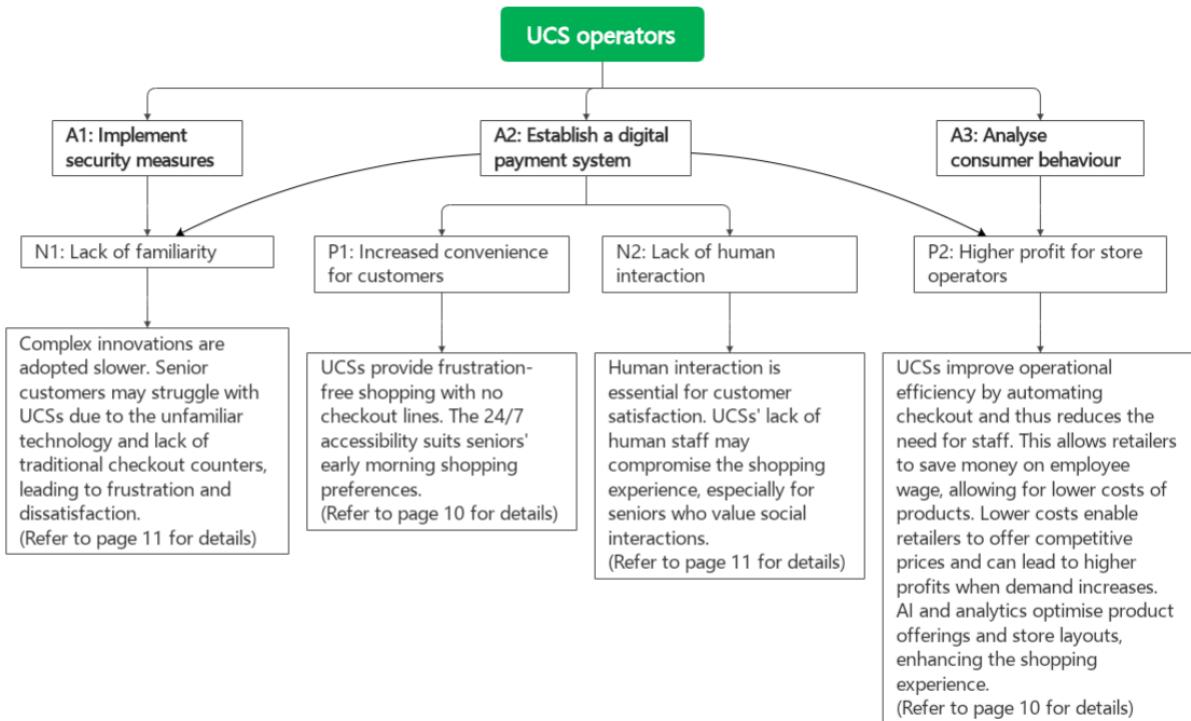


Figure 41. Summary Diagram of Links between Actions and Impacts

7.2 Annex 2: Summary Diagram of Links between Intervention ShopPal and Analysis of Target Situation

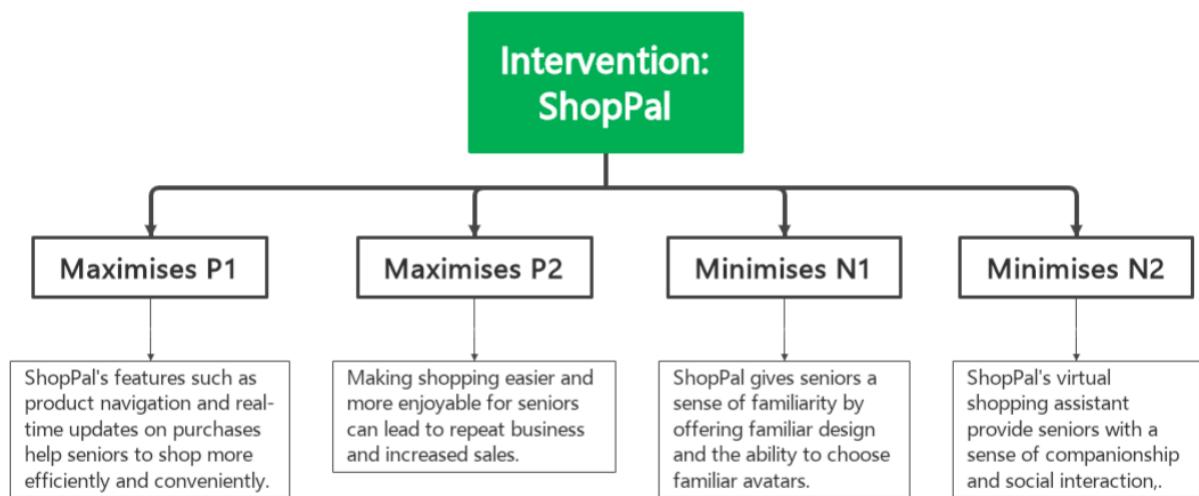


Figure 42. Summary Diagram of Links between Intervention ShopPal and Analysis of Target Situation

7.3 Annex 3: Summary Diagram of Links between Intervention Pick & GO Quest: Shopping Expedition and Analysis of Target Situation

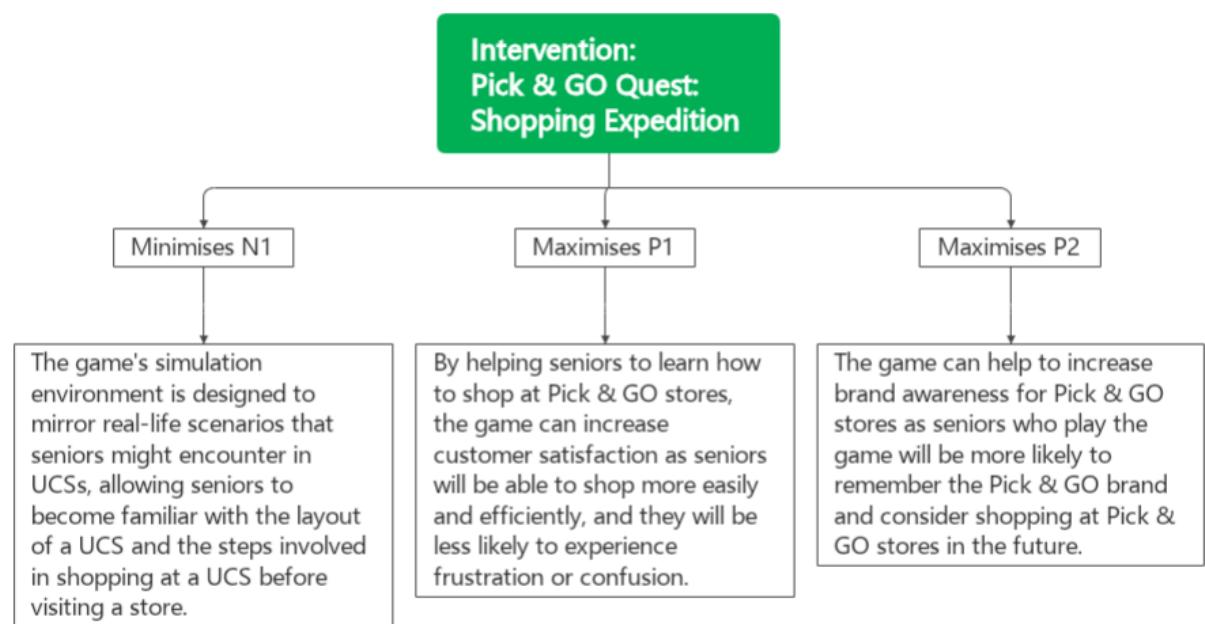


Figure 43. Summary Diagram of Links between Intervention Pick & GO Quest: Shopping Expedition and Analysis of Target Situation

7.4 Annex 4: Summary Diagram of Links between Evaluation and Interventions

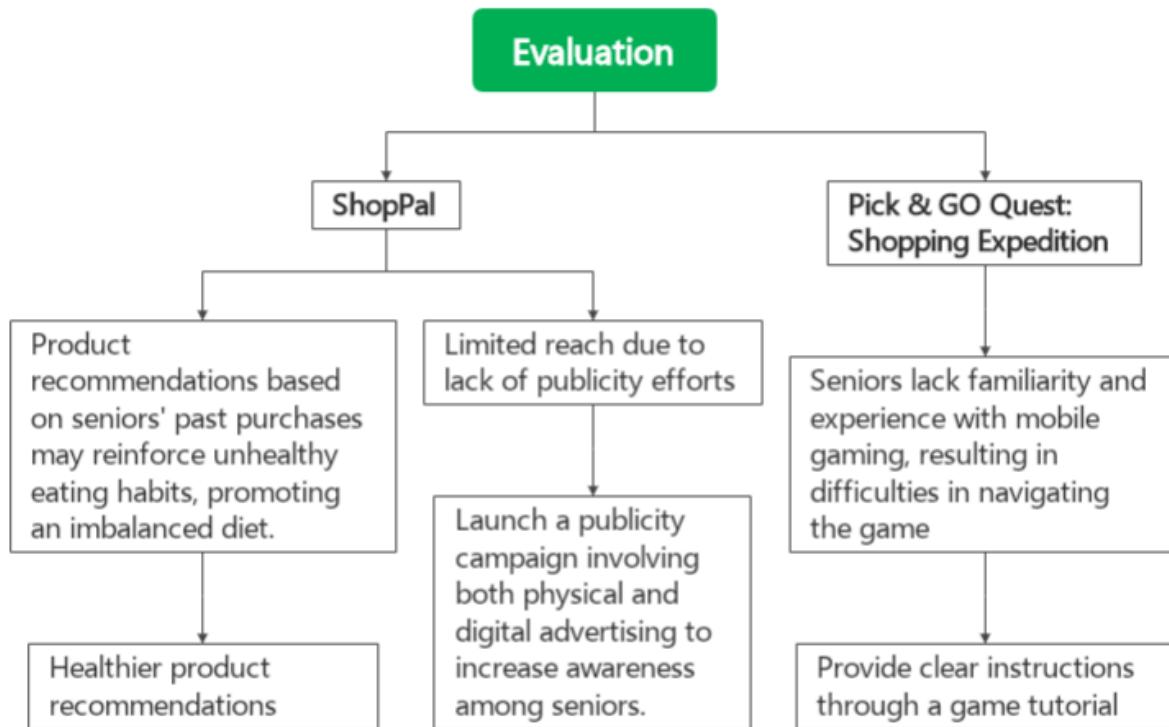


Figure 44. Summary Diagram of Links between Evaluation and Interventions

7.5 Annex 5: Steps to Navigate Pick & GO

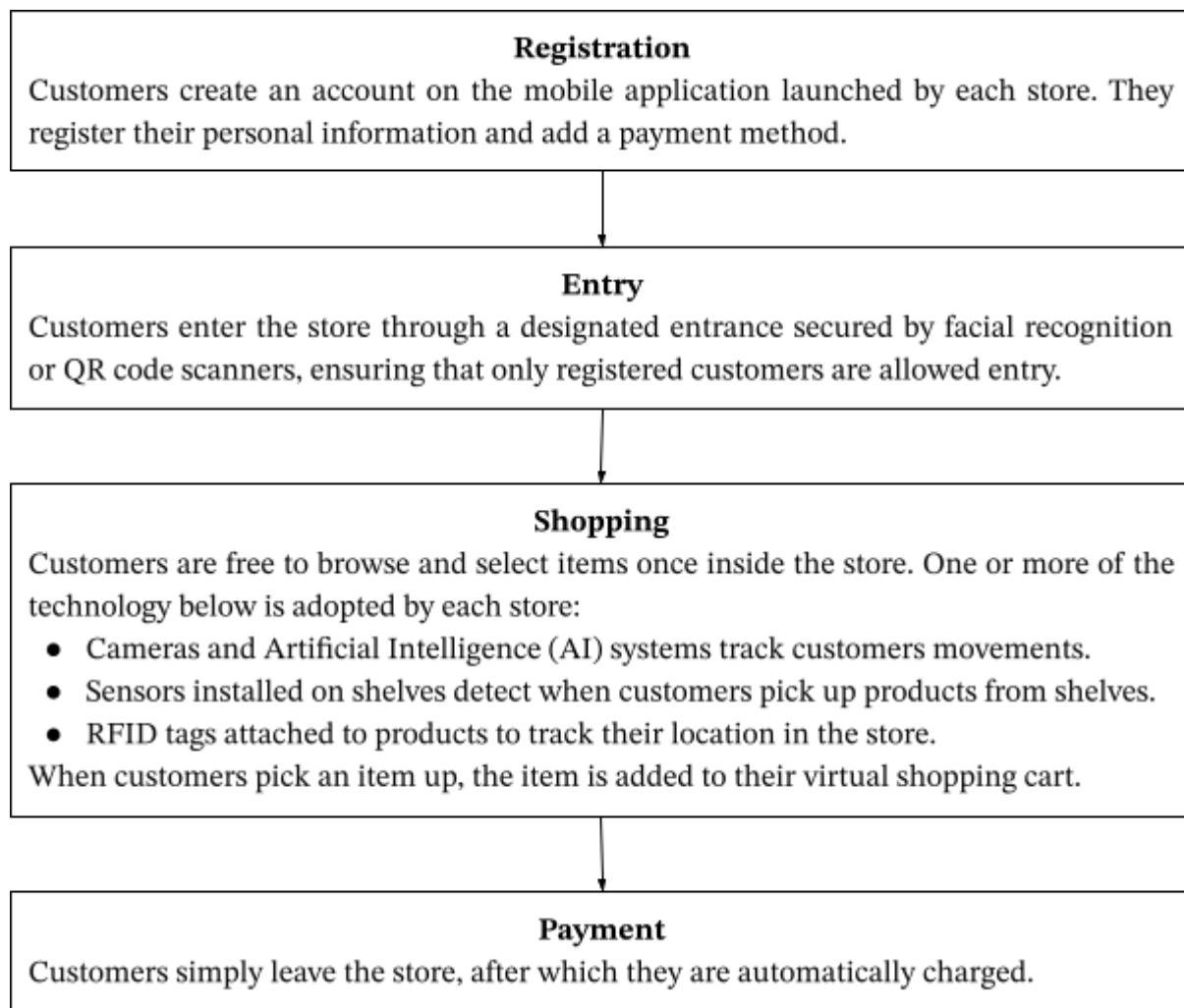


Figure 45. Steps to navigate Pick & GO