



SHOPPING ASSISTANT APP FOR PEOPLE WITH VISUAL IMPAIRMENT: AN ACCEPTANCE EVALUATION

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Abstract: Visual impairment refers to when someone lose part or all of the ability to see. People with visual impairment has many limitations including the freedom of doing grocery shopping independently. They will have difficulty to read ingredients or dietary information which usually returned in small font letters on the products. This information is deemed important to make informed decision in order to purchase products. Therefore, this research is conducted to investigate the need of grocery shopping assistant app for people with visual impairment and their acceptance level. An empirical investigation method is adapted and data was collected based on Technology Acceptance Model (TAM). The evaluation results indicate that the people with visual impairment positively inclined towards utilizing shopping assistant app caused by the technology is easy to use and therefore they can obtain benefit from the app, concluding that Perceived Ease of Use is a better indicator for the attitude towards using the shopping assistant app.

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1. INTRODUCTION

Visual impairment is vision loss or decreased ability to see to such a degree as to qualify as an additional support need through a significant limitation of visual capability. Referring to the formal definition [1], visual impairment could be totally blind or partially blind. In this paper, visual impairment is referring to people with limitation to see things clearly. They can be from old people or people who already suffered with decreased of vision [2]. Considering the visual impairment, this people has difficulty to obtained informed decision prior of purchasing goods [3,4]. The name, the type and the brand of a product are typical information people need to be aware of prior of buying any products [5]. Even worst, the ingredients and dietary information are written in a small font on the products and it is hard to read especially by people

with visual impairment. Therefore, it comes to a great assistance to have app to aid people with visual impairment to do grocery shopping on their own [6].

This paper presents an evaluation of shopping assistant app to provide assistance for people with partially visual impairment to shop independently. The methodology is described, the empirical investigation with Technology Acceptance Model (TAM) is elaborated and results and analysis is presented.

Following Introduction, Section 2 presents the study background. Subsequently, Section 3 elaborates on methodology and Section 4 explains on the Shopping Assistant App. This is then followed by Section 5 which discusses the empirical investigation elements. Next, Section 6 presents the results and analysis. Finally, Section 7 concludes the paper.

2. BACKGROUND

Partially visual impaired people are individuals who are incapable to read from a normal viewing distance even with the help of eyeglasses and contact lenses [7,8].

According to World Health Organization (WHO) [9], it is estimated that there are 253 million people who suffered with visual impairment where 36 million from them were blind and the others have moderate to severe vision impairment. Moreover, 81% of them are 50 years and above which can be considered as age people [10]. Globally, chronic eye diseases are the main cause of vision loss [11, 12].

Vision function can be described into 4 categories which are normal vision, moderate vision impairment, severe vision impairment and blindness. Moderate vision impairment combined with severe vision impairment are grouped under the term “low vision” [13]. Low vision can also be defined as people who suffered from short sighted and people who has limitation to read printed information clearly. Furthermore, visual impairment people with low vision has visual acuity of 3/60 to 6/60 with full field of vision. They also have visual acuity of up to 6/24 with moderate reduction of field of vision or with central part of vision that is cloudy and blurry [14]. They are mostly over 50 years old and they cannot see clearly especially small and tiny things or text information.

Therefore, this research is looking into providing a mobile application to assist people with special needs to shop independently. It is specially designed for people with low vision who has very limited ability to read clearly especially small fonts printed on the grocery products.

3. THE METHODOLOGY

Fig. 1 shows the operational research framework proposed for this study which is divided into two phases. In the first phase, the shopping assistant app was introduced to the people with visual impairment through briefing and app demonstration. Subsequently, the subjects are allowed to explore and use the app. After experiencing using the shopping assistant app, phase 2 commenced with subjects answering the questionnaire given.

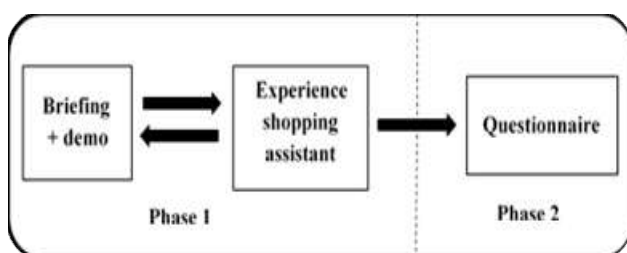


Figure 1 – Operational Framework

A model was developed in this study to investigate the people with visual impairment acceptance towards shopping assistant app. This model is designed based on the Technology Acceptance Model (TAM) [15] with the exclusion of Behavioural Intention (BI) and Actual System Usage (U) constructs. As the direction of the research is to evaluate the attitude towards acceptance of the shopping assistant app, U of the technology which is influenced by the BI is not relevant in this context. As such, these two constructs are excluded from the adapted Technology Acceptance Model (TAM) in this study as shown in Fig. 2.

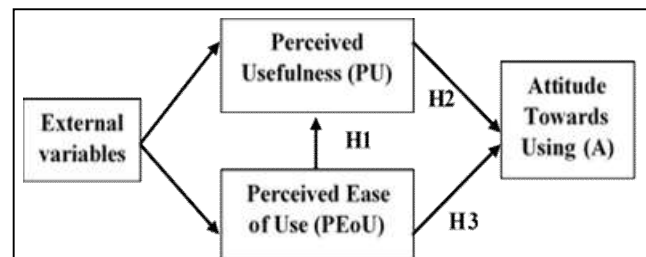


Figure 2 – Operational Framework

The model advocates that Perceived Usefulness (PU) which is also predisposed by Perceived Ease of Use (PEoU), are the two factors that are affecting the people with visual impairment towards the usage of app to assist them shopping [16,17]. PU can be defined as the degree to which the people believe in using the app will assist them shopping independently whereas PEoU is denoted as the degree to which the people with visual impairment expects the app to be free of effort [18]. As such, several hypotheses are proposed as depicted in Fig. 2.

- H1: Perceived ease of use has a positive influence on the people with visual impairment perceived usefulness for shopping assistant app.
- H2: Perceived ease of use has a positive influence on the people with visual impairment perceived usefulness for shopping assistant app.
- H3: Perceived ease of use has a positive influence on the people with visual impairment attitude towards using shopping assistant app.

4. SHOPPING ASSISTANT APP

Shopping assistant app is a mobile application developed to make life easier for people with visual impairment. This mobile application is designed to assist them to recognize grocery products without

having to read the printed text information on the packaging while shopping independently.

Fig. 3 depicts the structural overview of three-tier architecture of the shopping assistant app. The first tier is divided into two sections which are the mobile application for the client site and a web-based system for the administrator site. The business logic is in the second tier and the data is kept in the third tier.

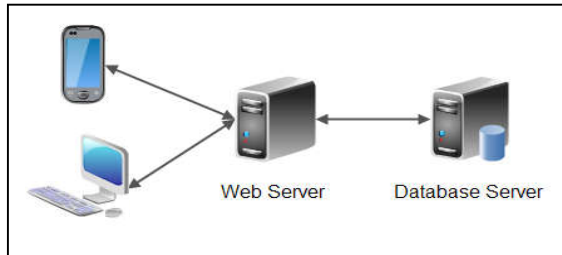


Figure 3 – System Architecture

This paper is focusing on the mobile apps for the client site as to provide assistance to the people with visual impairment to shopping independently. The main function is allowing people to scan the product and the app will be able to display the product's information on mobile screen with voice support.

4.1 THE FUNCTIONALITIES

This sub-section briefly describes the shopping assistant app functionalities based on the interfaces. Fig. 4 shows the shopping assistant app screen to scan the barcode on the product in order to get the information while Fig. 5 shows the camera side to scan a product. In order to accommodate the low vision people, the entire screen is the button to be pushed in order to scan the barcode.

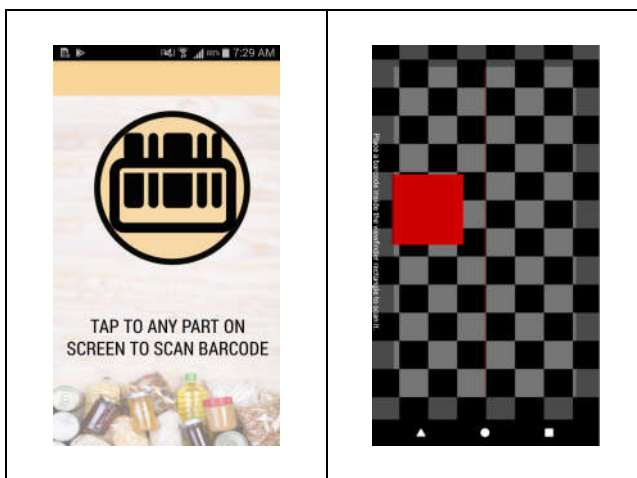


Figure 4 – Screen to Scan Barcode

Figure 5 – Camera side to Scan Product

Once the barcode is captured through the mobile camera, product information will be displayed as illustrated in Fig. 6. The description of the product is shown based on the barcode id retrieved from the database server. In addition, the app provides suggestion of similar products should option is needed. As an example, as illustrated in Fig. 7, other sardine products by different brands are listed.

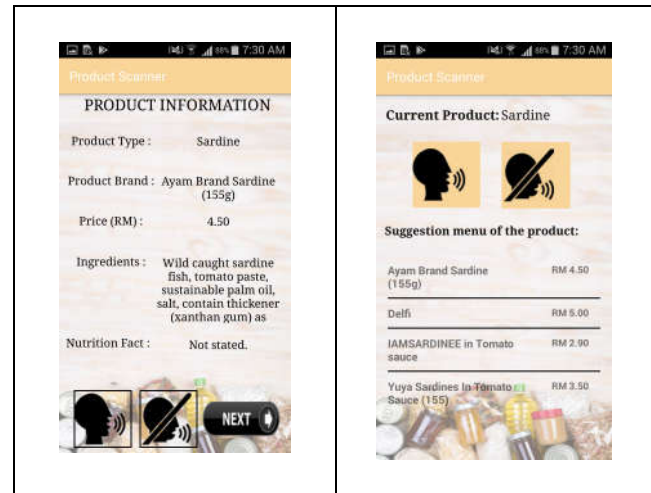


Figure 6 – Product Description View

Figure 7 – Product Suggestion View

Referring to the interfaces, the shopping assistant app is useful in many ways depending of the severity level of visual impairment. When the vision is low, the voice description is very useful for stating the product type, brand, price, ingredients and nutrition fact if applicable. The voice comes out automatically unless non-audio button is selected. In order to accommodate vision impairment, the buttons are huge too. However, if the vision is really low, they might have difficulty to locate the button.

5. EMPIRICAL INVESTIGATION

5.1 SUBJECTS

In this study, 30 people with visual impairment is approached to participate in the empirical investigation. Most of the subjects are elderly more than 65 years' old who have low vision [19]. Besides, there are also several known local people with visual impairment staying in the Taman Tasek Utama, Ayer Keroh, Melaka neighborhood. The subjects were individually approached and briefed regarding the empirical investigation. Then, they volunteer to experience the shopping assistant app and answer the questionnaires.

5.2 DATA COLLECTION AND PROCEDURE

Individual subjects were briefed regarding the purpose of the research project and the shopping assistant app. The functionalities of the app were explained and demonstration was conducted to show the usage. Then, ample time were given to the subjects to use the app. Following that, subjects were required to answer a simple questionnaire consisting elements of Technology Acceptance Model (TAM). The questionnaires were then collected and analysed.

5.3 SURVEY INSTRUMENT DESIGN

In order to measure the people with visual impairment acceptance on the shopping assistant app, a survey instrument was developed based on the adapted Technology Acceptance Model (TAM).

The acceptance was measured by two constructs which were perceived of usefulness (3 items), and perceived ease of use (3 items). The two constructs were the input which influence the attitude towards using the technology (1 items). All items used a 5-point Likert scale option ranged from 1 (Strongly disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), and 5 (Strongly Agree).

Stated in Table 1 are questions derived for Perceived Usefulness (PU), Perceived Ease of Use (PEoU) and Attitude (A) being used in the empirical investigation.

Table 1. TAM Questions

| | |
|--------|--------------------------------------------------------------------------------------------------------|
| PU 1 | This app has all the function to scan barcode and display product details and capabilities that I need |
| PU 2 | I felt very confident using this app to get details of some product before buying them |
| PU 3 | I can complete my task which is scan barcode and get the product details just by using this app |
| PEoU 1 | I am satisfied with how easy it is to use this app |
| PEoU 2 | The organization of information on the app screen is clear |
| PEoU 3 | The interface of the app is very simple and easy to handle |
| A | I think that using the shopping assistant app is a good idea |

In order to communicate the empirical investigation results, a descriptive statistic to

describe the means, correlations, standard deviations and alphas of the variables are used in the study.

6. RESULTS AND DISCUSSION

This section discusses results from the empirical investigation. It is divided into five sub-sections representing demographic analysis, analysis of reliability and validity, descriptive analysis, frequency analysis and correlation analysis.

6.1 DEMOGRAPHIC ANALYSIS

Prior to the empirical investigation, demographic information is collected through a simple questionnaire among the subjects. There are five simple questions to be answered as ‘yes’ or ‘no’. The questions are to inquire if the subjects are suitable for the empirical investigation as stated in Table 2. The suitability is important as to ensure the reliability of the empirical investigation results.

Table 2. Demographic Questions

| | |
|----|-------------------------------------------------------------------------------------|
| Q1 | Are you a smartphone user? |
| Q2 | Do you always buy items alone? |
| Q3 | Do you have any problem in reading product information on the packaging of product? |
| Q4 | Is the products’ information important to you prior to purchasing any products? |

Fig. 8 summarize the demographic and background information of the subjects for the empirical investigation. First and foremost, the subjects need to be a smartphone user. Besides, in order to get reliable responds from the subjects, it is important to know that the subject is among the people with low vision who need to do shopping alone.

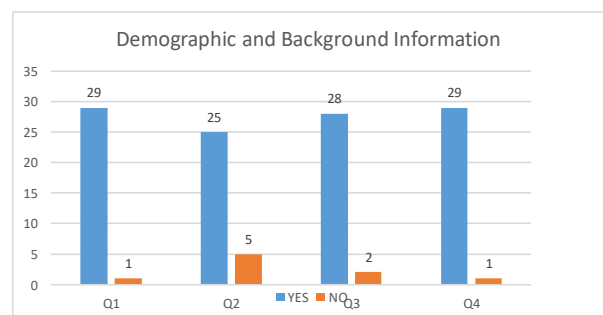


Figure 8 – Demographic and Background Information

Thirty people with low vision were approached to participate in the empirical investigation. The results showed that 29 out of 30 subjects are smartphone

users and therefore they are technology literate in order to utilize shopping assistant app. Answering question 2 and 3, 25 of them are doing shopping alone and 93% admitted that they have difficulties reading products' information on the packaging which may due to small font size. Besides, 97% of the subjects also admit that the products' information is important prior to purchasing any products.

6.2 ANALYSIS OF RELIABILITY AND VALIDITY

The reliability of the constructs used in the adapted Technology Acceptance Model was tested using SPSS 20.0.0 [20] based on 30 responses. Using Cronbach's alpha to measure the internal consistency of the instrument used in this study, the result showed an acceptable value above 0.7 thresholds for all construct as shown in Table 3. This threshold was recommended by [21]. Thus, the instruments used can be said to be reliable and acceptable.

Table 3. Cronbach Alpha Reliability Measurement Scales

| | Cronbach's Alpha | N of Items |
|------------------------------|------------------|------------|
| Perceived Usefulness(PU) | .752 | 3 |
| Perceived Ease of Use (PEoU) | .832 | 3 |

According to statistic experts, the size of at least 30 samples are sufficient enough to ensure the distribution of samples can be closely approximated by a normal distribution [22].

6.3 DESCRIPTIVE ANALYSIS

Analysis for perceived usefulness and perceived ease of use variable in Table 4 shows that the mean value for perceived usefulness was 4.32 and perceived ease of use was 4.4. The results showed that, as a whole, the respondents agree on the usefulness and ease of use of the shopping assistant app conducted in this study.

Table 4. Descriptive Analysis

| | N | Min | Max | Mean | Std. Deviation |
|--------------------|----|------|------|--------|----------------|
| PU | 30 | 3.00 | 5.00 | 4.3222 | .66369 |
| PEoU | 30 | 2.67 | 5.00 | 4.4222 | .76280 |
| Valid N (listwise) | 30 | | | | |

6.4 FREQUENCY ANALYSIS

6.4.1 PERCEIVED USEFULNESS

Table 5 showed the frequencies of the respondents. Referring to PU1, 6.7% of them were neutral on the usefulness of shopping assistant app, whereas 93.3% of the respondents agreed and strongly agreed that the shopping assistant app was useful. As for PU2, 10% of the respondents disagree on the usefulness, 13.3% felt neutral, whereas 76.6% agreed and strongly agreed that the app was useful. The outcome for PU2 is understandable as majority of the respondents are age people and lack of confidence to rely on the technology alone in order to provide information on the products they are buying. However, PU3 results showed that the respondents were confident to use the app without assistance in order to provide them information on the products they were buying as 83.4% respondents agreed and strongly agreed that the shopping assistant app was useful.

Table 5. Perceived Usefulness Frequency Analysis (PU1-PU3)

| | Freq | Percent | Valid Percent | Cumulative Percent |
|-------|-------|---------|---------------|--------------------|
| Valid | 3 | 2 | 4.8 | 6.7 |
| | 4 | 12 | 28.6 | 40.0 |
| | 5 | 16 | 38.1 | 53.3 |
| | Total | 30 | 71.4 | 100.0 |

| | Freq | Percent | Valid Percent | Cumulative Percent |
|-------|-------|---------|---------------|--------------------|
| Valid | 2 | 3 | 7.1 | 10.0 |
| | 3 | 4 | 9.5 | 13.3 |
| | 4 | 10 | 23.8 | 33.3 |
| | 5 | 13 | 31.0 | 43.3 |
| | Total | 30 | 71.4 | 100.0 |

| | Freq | Percent | Valid Percent | Cumulative Percent |
|-------|-------|---------|---------------|--------------------|
| Valid | 3 | 5 | 11.9 | 16.7 |
| | 4 | 8 | 19.0 | 26.7 |
| | 5 | 17 | 40.5 | 56.7 |
| | Total | 30 | 71.4 | 100.0 |

6.4.2 PERCEIVED EASE OF USE

Table 6 showed the frequencies of the respondents. Referring to PEoU1, 6.7% of them

disagree on the ease of use of the shopping assistant app, whereas 3.3% gave neutral feedback and 90% of the respondents agreed and strongly agreed that the shopping assistant app was easy to use. As for PEOU2, 3.3% of the respondents disagree on the usefulness, 20% felt neutral, whereas 76.7% agreed and strongly agreed that the app was easy to use based on the information organization. In addition, PEOU3 results showed that the respondents were 23.3% neutral and 76.7% agreed and strongly agreed that the interface of the app is simple and ease to handle.

Table 6. Perceived Ease of Use Frequency Analysis (PEoU1-PEoU3)

| | | Freq | Percent | Valid Percent | Cumulative Percent |
|-------|-------|------|---------|---------------|--------------------|
| Valid | 2 | 2 | 4.8 | 6.7 | 6.7 |
| | 3 | 1 | 2.4 | 3.3 | 10.0 |
| | 4 | 7 | 16.7 | 23.3 | 33.3 |
| | 5 | 20 | 47.6 | 66.7 | 100.0 |
| | Total | 30 | 71.4 | 100.0 | |

| | | Freq | Percent | Valid Percent | Cumulative Percent |
|-------|-------|------|---------|---------------|--------------------|
| Valid | 3 | 7 | 16.7 | 23.3 | 23.3 |
| | 4 | 5 | 11.9 | 16.7 | 40.0 |
| | 5 | 18 | 42.9 | 60.0 | 100.0 |
| | Total | 30 | 71.4 | 100.0 | |

| | | Freq | Percent | Valid Percent | Cumulative Percent |
|-------|-------|------|---------|---------------|--------------------|
| Valid | 2 | 1 | 2.4 | 3.3 | 3.3 |
| | 3 | 6 | 14.3 | 20.0 | 23.3 |
| | 4 | 3 | 7.1 | 10.0 | 33.3 |
| | 5 | 20 | 47.6 | 66.7 | 100.0 |
| | Total | 30 | 71.4 | 100.0 | |

6.4.2 ATTITUDE

Table 7 shows the frequencies of the respondents. Referring to A, 3.3% of them were neutral, whereas 96.7% of the respondents agreed and strongly agreed that the shopping assistant app was a good idea.

Table 7. Attitude Frequency Analysis (A)

| | | Freq | Percent | Valid Percent | Cumulative Percent |
|-------|-------|------|---------|---------------|--------------------|
| Valid | 3 | 1 | 2.4 | 3.3 | 3.3 |
| | 4 | 6 | 14.3 | 20.0 | 23.3 |
| | 5 | 23 | 54.8 | 76.7 | 100.0 |
| | Total | 30 | 71.4 | 100.0 | |

6.5 CORRELATION ANALYSIS

Further investigation has been conducted to analyse the correlation between Perceived Usefulness (PU), Perceived Ease of Use (PEoU) and Attitude.

Referring to Table 8, there is a statistically significant correlation between Perceived Ease of Use (PEoU) and Attitude (A) by a probability value of 0.025. In addition, there is also a statistically significant correlation between PEoU and PU by a probability value of 0.00.

Table 8. Correlations between PU, PEoU and A

| | | A | PU | PEoU |
|------|---------------------|---------|----------|-----------|
| A | Pearson Correlation | 1 | .224 | .409 (*) |
| | Sig. (2-tailed) | | .234 | .025 |
| | N | 30 | 30 | 30 |
| PU | Pearson Correlation | .224 | 1 | .630 (**) |
| | Sig. (2-tailed) | .234 | | .000 |
| | N | 30 | 30 | 30 |
| PEoU | Pearson Correlation | .409(*) | .630(**) | 1 |
| | Sig. (2-tailed) | .025 | .000 | |
| | N | 30 | 30 | 30 |

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 9 illustrates the results with respect to the three hypotheses constructed. The analysis indicates that Perceived Ease of Use has a significant relationship with Attitude ($\beta=0.279$; Sig = 0.025) and Perceived Usefulness ($\beta=0.548$; Sig = 0.003), thus H1 and H3 are accepted. However, Perceived Usefulness is not significantly related to Attitude ($\beta=0.176$; Sig =0.234) and therefore H2 is rejected.

Table 9. Hypothesis Results

| Hypothesis | Causal Relationship | β^a | Sig. ^b | Result |
|------------|----------------------------------------------|-----------|-------------------|-----------|
| H1 | Perceived Ease of Use-> Perceived Usefulness | .548 | .003 | Supported |
| H2 | Perceived Usefulness->Attitude | .176 | .234 | Rejected |
| H3 | Perceived Ease of Use -> Attitude | .279 | .025 | Supported |

Notes: ^aRegression coefficient; ^bstatistical significance of the test ($\alpha = 0.05$)

7. CONCLUSION

The study discovered that in using shopping assistance app, people with visual impairment were more inclined to use the app while shopping if the technology was easy to use and thus, taking less account of the usefulness of the app. Perceived ease of use was also found to be a better indicator of people with attitude towards using shopping assistant app as they did not have to concern themselves with the 'know how' of the technology.

In conclusion, the shopping assistant app must be easy to use and able to attract the people with visual impairment to utilize it for the benefit of doing shopping independently.

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