

# Integrated Study of Automated Checkout Shopping Trolley

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**Abstract**— Recently, Automated checkout shopping trolley technologies have taken an advance step than the previous introduced self-checkout system in terms of greater convenience, ease-of-use and greater efficiency. As this technology is considerable new in the market of developing countries, hence it is vital to explore the perception of consumers toward the use of automated checkout trolley. The purpose of this paper is to examine the perceptions and expectations of both enterprise users and end users toward the proposed checkout system for hypermarket in the context of Malaysia, as a typical paradigm of developing countries. Findings from this study indicate that both consumers and retailers possess positive attitude toward the automated checkout trolley system, and are enthusiastic to try this emerging technology. The main concerns of the users are the secureness of payment and the variability of payment methods, which forms their core criteria in determining whether to adopt the system. This study provides an understanding about the practicality and market condition of automated trolley system in the developing countries.

**Keywords**—Technology-based self-service (TBSS), Automated checkout, Market survey, Technology and innovation management

## I. INTRODUCTION

TECHNOLOGY-BASED self-services (TBSS) have gradually repositioning as one of the important mechanisms to deliver superior customer value, especially in retailing sector [1]. Mass retailers such as hypermarkets and department stores are the pioneers and main adopters of self-service technologies (SST). In this emerging trend of technologically-oriented service, customers utilize self-service technologies in order to provide service for themselves with or without help from a retail contact employee [2]. Studies postulate that self-service technologies create customer value by helping customer checkout more quickly, providing them a simple convenience and usually leading to higher perceived service quality [1, 3, 4].

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One of the most of common self-service technologies in retailing sector is the self-checkout system.

Provision of the technology-based self-service options such as self-checkout system entails advantages to both the enterprise users (retailers) and end users (shoppers). Benefits from the enterprise users mainly derive from cost efficiency resulted from reduced staff requirements, indirectly reduce personal training costs and other variable costs which proportionate to the number of staffs employed [5]. On the other hand, shoppers are benefited from the reduced checkout time, better service, perceived privacy and anonymity [4].

Despite the advantages offered, researches indicate that adoption of self-service technologies not necessary contribute to better customer value [6, 7]. Instead, customer dissatisfaction may occur due to frustration in using the SST. In fact, in order to reap the time efficiency benefit of using the self-service checkout system, shoppers required to able to use the system reasonably competent. An inexperienced customer can cause even more delays than an inexperienced cashier on a conventional register, and older customers may expect the attendant to assist them directly with scanning items, preventing the attendant from dealing with other customers who actually require intervention [7].

Recently, the introduction of automated checkout trolley indicates the potentiality to alleviate the shortfalls of existing self-checkout system. The differences between two, are the self-checkout system commonly exists as a stationary kiosk which located in close proximity to cashier-driven cash register in a retail setting, and there is often a head cashier nearby who oversees user interaction with the self-checkout system. Whereas the automated checkout trolley, by its name, it is a trolley features a built-in computer which allow users or shoppers to scan the items that being put into the trolley and to check out the trolley of items by simply passing through the sensor device.

As the automated checkout trolley is a variation of self-service technology, it may inherit the common problem of SST that the end user's adoption rate is lower than enterprise user's adoption rate [1]. In order words, enterprise users (retailers) is comparatively more aggressive in adopting the technology, but the end users (shoppers) is less willing to adopt the technology, which eventually lead to the failure of the self-service technology given the fact the successfulness of the technology will ultimately depend on the acceptance of end users. Hence, this implies that perceptions and expectations of both end user and enterprise user toward the automated

checkout trolley are vital inputs to the development and enhancement of the automated checkout trolley. In addition, the main streams of technology-based self-service researches have focused on the user behaviors and assessment of acceptance of the technology through service quality measurement. Scarce research has studied the system requirements from practical level which able to provide sufficient details of system requirements for the use of practitioners. Moreover, main stream of TBSS studies usually are done in Western context, application of TBSS in Asian context are less well understood. Their perceptions and expectation constitute the requirements of the technology to become success, especially in Asian contingent.

Therefore, the purpose of this paper is to assess the perceptions and expectation of both end users and enterprise users toward automated checkout trolley system. The understanding of the user requirements will able to provide better solution to the existing model and enhance the adoption rate by end users.

## II. AUTOMATED CHECKOUT SHOPPING TROLLEY

### A. System Overview

Automated checkout shopping trolley (ACT) system presented in this paper refers to the whole system working together to make the “trolley” or “cart” capable to conduct automatic checkout. In other words, the under discuss trolley system not only refers to the tangible “trolley”, but also the database system, networks, technologies used to identify sale items, sensors and the software as well.

In general, the most tangible module of automated checkout trolley system is trolley itself that attached with a built-in computer and sensor, which connected with the database system. In this environment, sale items are often tagged with automatic identifier such as Radio Frequency Identification (RFID) tag. The trolley automatically scans the items which the items are put into the trolley. The ultimate goal of the ACT system lies on its capability to check out the trolley of items at once, by pushing the trolley through the sensors. At the same time, the total amount of item purchased will be deducted from the user’s credit card or cash card.

The automated checkout trolley system puts service and checkout in the consumer’s hands, reducing reliance on the point-of-sale for customer service and freeing store personnel to provide customer service in the aisle.



Fig. 1 Mounted Computer and Sensor on S-Cart

### B. Developed Conceptual Prototype of ACT System

In order to enable evaluation by users, the research team has produced a conceptual prototype of the automated checkout trolley system, named as S-Cart with details of its feature and functionalities. The proposed S-Cart has a mounted computer and sensor device on near the end of trolley which facing the user. User can interact with the system through the touch-sensitive monitor or navigational buttons. Users can access to various information using the interactive display. The information can be displayed in English, Chinese, or Malay, based on the selection of the user. The following list shows the type of information provided by the S-Cart.

- a) Promotion and advertisement information
- b) Product details (e.g. contents, ingredients, tips)
- c) Check location of particular merchandise
- d) Check price of item
- e) Sum up prices of all items in the trolley
- f) Live chat function with supporting staffs

In order to use the S-Cart, users need to insert their credit card or cash card (a member card issued by the retailers, which users can reload the card with money at the customer service counter) into the card slot. The mounted computer on the trolley is connected to the retailer’s database system and credit card verification system through WiFi 802.11 network. Data of Credit card and cash card are sent over the network to be verified. Other information aforementioned is transmitted to the trolley using the WiFi network as well.

Fig. 2 illustrates the way S-Cart detect the added or removed item, subsequently updated the total prices of item in cart. When the sensor detects a flow from top to down, item is added into the list. In contrast, the item will be removed from the item list when the sensor detects a flow from down to top. The S-Cart adopts passive RFID tags as the automatic identification technique to identify merchandises in the trolley. The main reason of adopting passive RFID tag is the cost efficiency and energy efficiency provided by the method.

In order to checkout, the customers are required to push the cart pass through the exit gate. The detector embedded in the gate will automatically subtract the card value based on the total prices of item in the shopping cart, almost without waiting time.



Fig. 2 Flow Detection of S-Cart

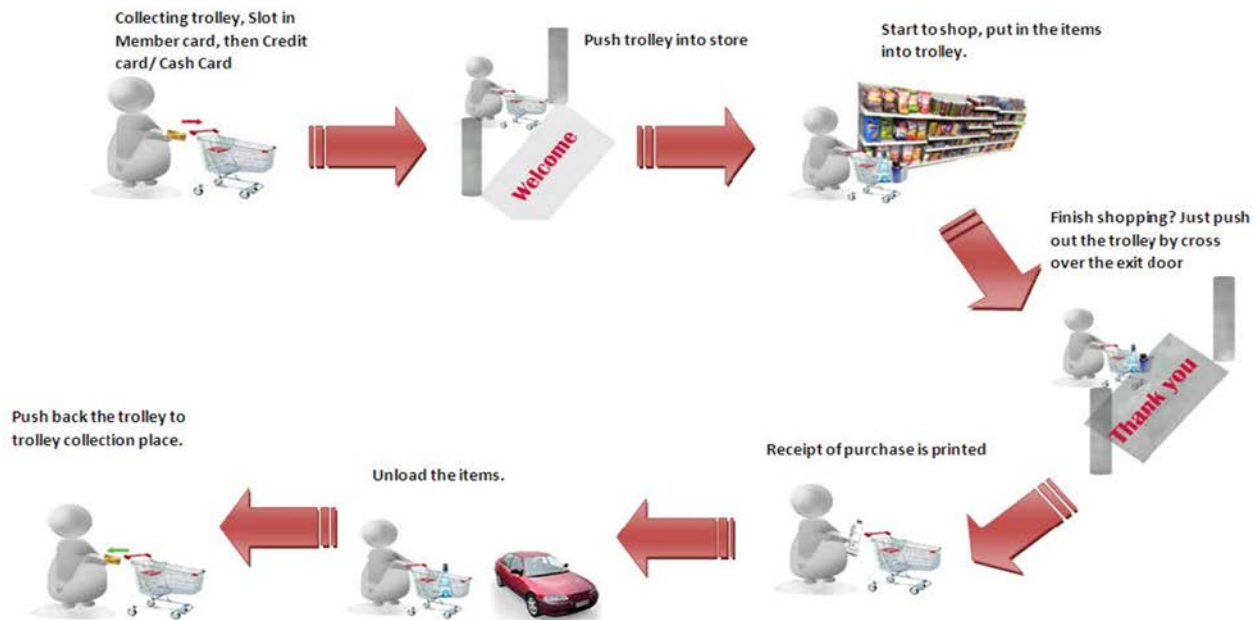


Fig. 3 Overall Process of using S-Cart

After the checkout process, customers are required to push the S-Cart back to the trolley collection area, in order to remove their credit card or cash card from the S-Cart. The S-Cart will produce alert message and sound to remind customer to retrieve their card from the S-Cart. Fig. 3 illustrates the overall process of using S-Cart which discussed so far.

### C. System Architecture

Referring to Figure 4.14, WiFi connection is required to transfer the data between data warehouse and S-Cart within the storehouse area. The S-Cart is designed with Auto Updater Program, which is used to automatically retrieve information from database without human involvement. The specific time for data update is free to be set by the management.

Each S-Cart is built with local data storage. Setting up local data storage helps reduce the burden of database server. It also does not require high performance server to support the operation.

For every item scanned, the system can immediately retrieve data from local data storage. If data is not available in local data storage, then it will retrieve data directly from data warehouse. For each item put in into cart, all details on cart is recorded into the local database.

For each transaction made, it will directly send data to the server computer which requires staff/management to manage and process it, and store it into data warehouse. Once the data are processed and stored, through the filter process, each department can easily obtain data from a particular data mart.

### D. System Modules

**The S-Cart Purchasing System:** This system manages the calculation, processes the data, and displays information via the monitor. Once the payment is made, the receipt of purchase is

automatically printed out for the shopper. The whole process is supported by the Wifi connection within the store, which is used to receive and send the signal to main server computer.

**Multiple-Languages Module:** The S-Cart provides three choices of language (English, Chinese, and Bahasa Malaysia) which will suite shoppers with different language need/support. Besides, it is also convenient for all visually challenged people as they can use the cart by listening to the voice from the system.

**Product Pricing Updater Module:** The S-Cart will automatically update the information (local data storage) in a certain period of time, set by the hypermarket. For example, the S-Cart will automatically update the local storage information for every week. The whole process is supported by the Wi-Fi connection within the store, used to receive and send the signal between server computer and the S-Cart system. The major purpose in installing the product pricing updater module is to reduce the human work, and also reduce the burden of server computer.

**Card Reader/Transaction Module:** The card reader allows two types of card to be slotted in, the Cash card and the Credit card. Before shoppers start their shopping, they need to slot in the cards (first slot in member card then followed by credit card or cash card). The system will check the value in the card. If the value of cash card is lower than certain amount, it will be rejected. To proceed, shoppers need to reload from the customer counter. If the credit card is invalid, the monitor screen will prompt a message to advice shopper to slot in other credit card or proceed to customer service counter to verify the problem. In case shoppers purchase more than the cash card value, S-Cart will alert shoppers immediately and advise them to remove some items from trolley. For shoppers; with the cash card, they do not need line up in a long queue. When they want

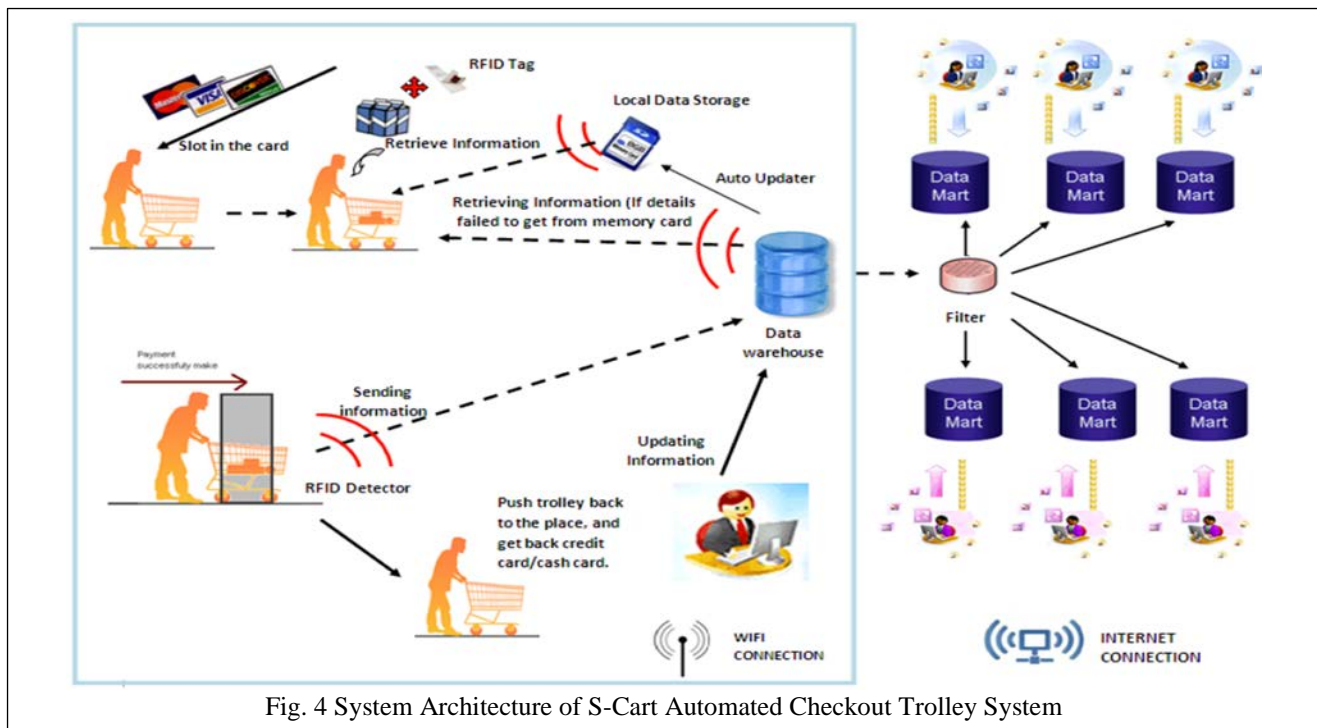


Fig. 4 System Architecture of S-Card Automated Checkout Trolley System

to make payment, they just need to go through checkout line (Infrared Gate/ exit door); the cash card value will automatically be deducted based on the total listing; however for the credit card user, all transactions will be recorded and will be saved into database for future use

**Monitor:** This is used to display the information of items scanned (once the item is dropped in into the cart), if the item is on sale and other relevant information. With this monitor, it can reduce the use of promotion catalog and also acts as a sales assistance by displaying the ingredients and details of the items scanned.

**Member card:** The member card is available to be slotted into S-Cart, to gather points of purchase, which then remains in the current consumer's loyalty card points.

**Customer service button:** If the consumer has a problem with S-Cart or needs to consult the staff, they can immediately press the button and have a live chat with the person in-charge

### III. METHODOLOGY

The purpose of this study is to explore the perceptions and expectation of Asian users toward the S-Cart system. Both enterprise users (retailers) and end users (consumers) are included in the study.

In the first part, this study adopts questionnaire survey to identify 1) the existing service problems faced by consumers prior to S-Cart adoption and 2) consumer's acceptances toward the S-Cart. Second part of the study involves in-depth interview with the enterprise users (employees of retailers), in order to understand their perceptions toward the idea of S-Cart.

#### A. Questionnaire Survey for End Users

In this part, the unit of analysis was the individual shoppers. Questionnaires are distributed to individual shopper in

hypermarkets. The research team collected back 86 sets usable questionnaires. The questionnaire can be divided into three session, which first session examine the perceived service quality of hypermarkets, the second session examine the acceptance of users toward the S-Cart and the payment method in S-Cart, whereas third session contained open-ended questions which attempt to solicit subjective perception of user toward to idea of S-Cart and the features they would like to S-Cart to have. Both sessions one and two are in the form of five point Likert Scales, which coded from strongly agree with value of 5 and strongly disagree with value of 1. The purpose of first session of the survey is to identify the service problems in the hypermarkets, thus new feature of S-Cart can be proposed to confront the problems. It attempts to examine the perceived service quality, by the factors from "The Service Quality Model" and "Evaluation of Customer Satisfaction". Table 1 show the factors and aspect which the factor attempt to measure.

Table 1. Constructs used to measure perceived service quality

Constructs	Aspects	Service Quality Model	Customer Satisfaction Model
Comfortable	Storehouse environment	Yes	Yes
Accuracy	Consistency of price tag	Yes	Yes
Service Quality	Service Quality	Yes	Yes
Ease of Access	Efficiency and Timeliness	Yes	Yes
Accountability	Service Quality	Yes	Yes

The details of items used to measure each aspect aforementioned are as shown in Table 2. It is an administrated survey so that researchers able to explain the idea of S-Cart to

respondents in better pictures, and to solicit further response whenever it is necessary. Full items of the questionnaire are available at the appendix of this paper.

Table 2 Items used in Questionnaire

Questions
<b>Storehouse Environment</b> <ul style="list-style-type: none"> <li>• Store atmosphere and décor are appealing.</li> <li>• A good selection of products was presents.</li> <li>• Merchandise displays are attractive.</li> <li>• Advertised merchandise was in stock.</li> <li>• The store layout makes it easy for customers to find what they need.</li> </ul>
<b>Consistency of Price Tag</b> <ul style="list-style-type: none"> <li>• Price tags are consistent with the cashier's scan.</li> <li>• Prices are known by cashier in order to avoid arguments.</li> </ul>
<b>Service Quality</b> <ul style="list-style-type: none"> <li>• Promoters are in full support and helpful.</li> <li>• Sincerity in solving customer's problem</li> <li>• Employees in this store are able to handle customer complaints directly and immediately.</li> </ul>
<b>Efficiency and Timeliness</b> <ul style="list-style-type: none"> <li>• Payment process is fast and efficient (&lt; 5 Minutes)</li> <li>• Sufficient counters are available</li> <li>• Staffs able to handle unexpected case effectively and avoid customer waiting</li> </ul>

*B. In-Depth Interview with Enterprise Users*

Three interviewees of a selected case company, who holding different positions (ranged from front end manager to customer service staff) are interviewed. The case company is a branch of a global grocery and general merchandise retailer headquartered in United Kingdom. It is the third-largest retailer in the world measured by revenues. The result of interview is recorded and transcribed. Research team first informs the interviewee regarding the result of survey – consumer's perception toward the S-Cart and the perceived problem with existing service. The purpose of the interviews is to understand the perceptions of enterprise users toward to idea of S-Cart, and their concerns or expectations on the S-Cart system. The general questions asked are:

- What is your comment on the S-Cart?
- What is your concerns regarding the S-Cart?
- What functionality or features which you would like to have on the S-Cart?
- Do you think the S-Cart system is applicable in the hypermarkets?

IV. RESULT

Customer satisfaction is the vital contributor to competitive advantage. Thus, a new creation or development of system to be used by customer must be able to meet their requirements and help them to solve existing problem. Otherwise the system is developed only for the sake of development. The results of this study are organized into two parts, which first part is the

result of questionnaire survey whereas the second part is the result of in-depth interviews with the representatives of the hypermarkets.

*A. Result of Questionnaire Survey by Shoppers*

The 86 samples constitute of 49 female shoppers and 37 male shoppers, which as illustrated in Fig. 5.

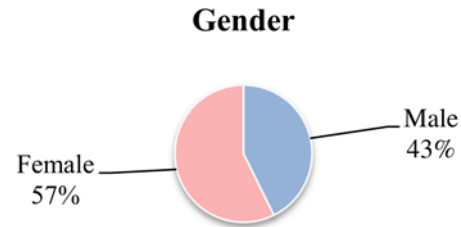


Fig. 5 Gender of Respondents

Table 3 indicates the result of session 1 which attempt to examine the customer satisfaction in existing shopping environment, in order to identify the service problems.

Table 3. Descriptive Statistics

Factors	Mean	Satisfaction
Storehouse environment	1.83	Satisfied
Price Tag Accuracy	2.70	Not Satisfied
Service Quality	2.81	Not Satisfied
Efficiency and Timeliness	3.10	Not Satisfied

The finding indicates that consumers or shoppers are satisfied with the storehouse environment of the hypermarkets, but dissatisfied with the other three aspects which are price tag accuracy, service quality, and efficiency and timeliness, with increasing dissatisfactory from tag accuracy to efficiency timeliness. These results indicate that the hypermarkets can improve customer satisfaction by solving the problems of efficiency and timeliness, service quality, and price tag accuracy. In which the S-Cart system is designed to address these problems.

In addition, the finding of survey indicates that approximately 70 percent of respondents agreed that they overspent when shopping in the hypermarkets, as shown in Fig. 6. This implies that behavior of overspending is prevalent. Hence a mechanism which is able to help shoppers to control their spending is much appreciated. In other words, the budget control and alert feature proposed in the S-Cart system is a practical and appropriate system requirement.

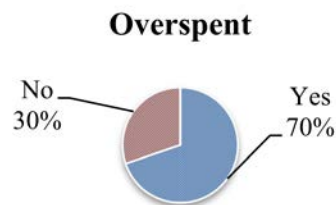


Fig. 6 Feedback of Respondents on Overspent

Session two of the survey examine the acceptance of shoppers toward the use of S-Cart and the payment methods used in the S-Cart, which the credit card and cash card methods. As illustrated in Fig. 7, about 88 percent of respondents are willing to use S-Cart or automated checkout trolley system when shopping in hypermarkets. This finding indicates that majority of the shoppers in hypermarkets are willing to embrace the S-Cart or Automated Checkout Trolley (ACT) system, which also implies of the practicality of implementing this system in the hypermarkets of developing countries.

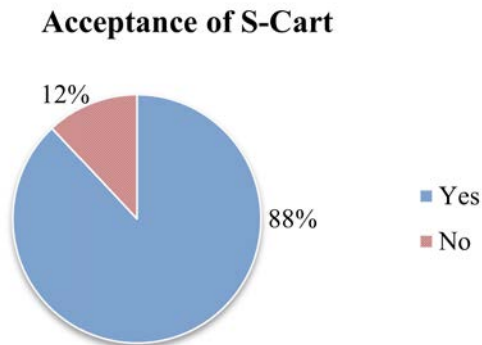


Fig. 7 Consumers' Acceptance toward S-Cart

On the other hands, 59 percent of the respondents not accept the credit card and cash card as payment methods used in the S-Cart, as shown in Fig. 8.

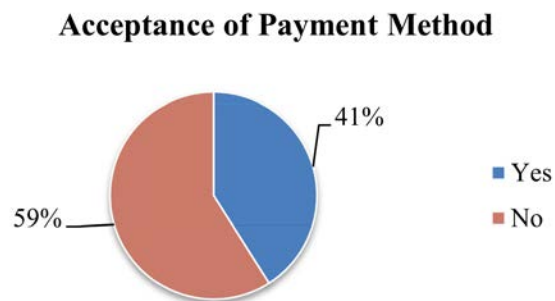


Fig. 8 Acceptance toward Credit Card and Cash Card as Payment Method

With the complementary qualitative response acquired, shoppers responded that they feel unsecure and worry to use credit card or cash card as the payment method used in S-Cart. The use of credit card as payment method is much concerned by respondents as the risks and amount of money involved are considerable high. This finding implies that security is single most important system requirement of S-Cart system. Mechanisms which allow to users to verify the transaction, password encryption of card information, and secured transmission of transaction information should be implemented in order to increase the acceptance level of the payment method. In addition, alternative payment methods must be

provided, which able to cater for the needs of customer who not own credit card and avoid customer frustration by forcing customer to use certain payment methods.

Session three of the survey consists of 2 open-ended questions to solicit subjective comments of respondents toward the S-Cart and the features that they would like to S-Cart to have. The advantages of open-ended question are that it allows respondents to provide creative, unconstrained feedbacks about the S-Cart. The following are the comments from respondents.

- Respondents are impressed with the convenience and efficiency which realizable by the S-Cart
- Multi language supports should be provided
- Respondents wish to have item-location associated floor directory function to help them navigate effectively
- Respondents are pleasant with the budget control and alert functions.
- Respondents suggest use cash as alternative payment method.
- Respondents concern about the security of the system since credit card or cash card is used, and amount is deducted automatically from the account. The risk of forgetting the card in S-Cart is perceived as high.
- Password verification should be used to initial the card access, and also to verify the transactions.
- The robustness of S-Cart is concerned as well as customers often put their child inside the cart during shopping.
- Respondents request for adding "Touch and Go" card as one the payment method. "Touch and Go" card is a multi-purpose cash card in Malaysia that can be used in public transportations and road tolls.

Based on the qualitative feedbacks from respondents, it indicates that most shoppers responded that they are excited about the idea and enthusiastic to try the S-Cart, provided if it is use-to-use, convenience, and secure. As reconfirmed by finding from session 2 of the survey, system security is the main concern of shoppers, which form the vital system requirements of the S-Cart system in order to be succeeded. The second most prevalent comments from the respondents are regarding the payment methods, they request that the various payment methods such as cash should be available to make the S-Cart usable by wider range of users.

#### B. Result of In-Depth Interviews with Enterprise Users

Enterprise users of the S-Cart system are referred to the staffs of the retailers or hypermarkets. Their perceptions and expectations toward the S-Cart system are paramount as they potentially influence the decision of whether adopting the automated checkout trolley system or not. As aforementioned, staffs ranged from frontline manager to customer service staffs are interviewed.

Overall, the interviewers possess of positive attitude toward the ideas of S-Cart. They believe the use of S-Cart will significantly improve the checkout process, reduce personnel-related expenditures, improve the customer service, and increase customer satisfaction. At the same time, they have valuable comments as well as concerns on the S-Cart system,

which are the main information that sought by this paper. The following are the comments or concerns of the interviewees.

- Cash payment must be available
- How the system handle those merchandises which cannot be scanned
- How can the system handle items (such as vegetables and grocery) that need to be weighted?
- How the system handles merchandises which must be paid in internal counter (such as medicines and cosmetics)?
- Is the system able to prevent fraud in transaction, especially for credit payment?
- Will the S-Cart system prevent shoplifting techniques
- We are concerning about the robustness of the trolley as vandalisms are quite pervasive.
- The cost of the trolley is high, and we cannot afford the trolley to be stolen.
- Since the S-Cart use RFID tags on the merchandise, it will increase our costs.

The feedbacks from the representatives of the hypermarkets help this study to derive at the system requirements of the S-Cart system from the perspective of enterprise users. Most of the concerns are related to the system security and operations. To the retailers, the security and integrity of the S-Cart to verify credit card or transaction are most important as the compromises of these features are disastrous to them.

Furthermore, the operability of the S-Cart in handling routine operations or practices of the hypermarkets is vital as well. For instance, the system must be capable to handle items that paid in internal counter, to avoid redundant checkout and to avoid vulnerable to shoplifting. Additionally, RFID tags may not appropriate for all the merchandises (e.g. when the RFID price tag is more expensive than the price of merchandise or merchandise that need to be weighted). Thus, the S-Cart must able to use other tagging method or identification techniques to scan the items. Interviewees suggested alternative payments methods, especially cash are, as similar to the comments by the shoppers.

#### V. HOW S-CART SOLVES RETAILERS' PROBLEM

Through the questionnaire and interviews, the following are the common problems identified in the hypermarkets which agreed by both customers and the retailers. This section presents how the adoption of S-Cart able to solve the various service-related problems. Solving these problems implies improved service quality, customer value, and eventually leads to customer satisfaction. Table 4 shows the solution provided by S-Cart to service-related problems.

Additionally, as the S-Cart utilizes RFID tag, it make possible for the hypermarkets to create a vast database of customer information [8]. Later the retailers can extract business intelligence from the knowledge base, which help the retailers delivery product and service based on customers' needs, preferences, or past transaction [9].

#### VI. DISCUSSION

The findings from this study indicate that respondents possess of positive attitude toward the S-Cart system and most

Table 4 Solutions provided by S-Cart System

Problems	Solution offered by S-Cart System
Inconsistency of price tags	All prices are directly retrieved from central database. No longer need to physically change the price tags, retailers can change the price and other information from the database system.
Limited price checker device	S-Cart itself has price checker function. Users just need to drop an item into trolley and it would display price, as well as other product information such as expire date, content, ingredients, and tips.
Trolley stolen	S-Cart as a solution to prevent shopping cart lost, as users need to push the cart back to its dedicated storage area in regain their credit card in the S-Cart.
Long Queuing Time	S-Cart is an automated checkout system that significantly fastens the checkout process. It helps to reduce the loads of cashier counters, while maintaining the service level.

of them are enthusiastic to try the automated checkout trolley system. On the retailers' side, they are willing to adopt this automated checkout system, given its advantage to reduce operational and personnel costs. These results suggest that the shoppers and hypermarkets in developing countries have considerable high level of acceptance toward this evolutionary way of shopping. In other words, the rate of adoption and successfulness of the automated checkout system are likely to be high in developing countries.

The most common concerns of the both enterprise and end users are the security of payments and the method of payments to be used for the automated checkout trolley system. The developers of such automated checkout system must ensure that the transaction made using the system is highly secured and users are allowed to verify the transaction. The transaction security forms the core functionality of the system which must be fulfilled in order for the users to accept the system.

Moreover, the findings indicate that the payment method used for the automated checkout trolley should convenience and allow cash as one of the payment method. This is important because the credit holders in developing countries are not prevalent as in developed countries, and cash payment may provide great convenience and the feeling of secured. Furthermore, forcing customers to use certain payment methods are tend to result in frustration [7].

Enterprise users (retailers or hypermarkets) perceived the compatibility of the automated checkout system with their existing operations or activities as important criteria in the evaluation of adopting such systems. In fact, hypermarkets tend to have their own unique business process. Hence, the automated checkout trolley system must flexible enough to enable the system to customized or tailored to existing business process or practices. For instance, the system must be able to handle items which must paid in internal counter, rather require the hypermarket to change their process. On the other hand, a standardized system is more likely to be perceived as disruptive and risky since the adopter need to change their existing structure or process in order to use the system, and thus the

likelihood of adoption would be lower.

It is important to note that the automated checkout trolley system is a complementary mechanism to the conventional checkout line, but not a total replacement of it. Consumers should be given the freedom to choose among the automated checkout trolley or conventional checkout line. Solely dependent on the automated checkout trolley system is not practical as well, given that certain customer would prefer to feel of customer service provided by real human [7, 10]. Additionally, social pressure might make it impractical; because of fully adoption of the automated system potentially impair the employment opportunities.

VII. CONCLUSION

The findings of this study provide information about the perceptions of population in developing countries toward the automated checkout trolley, which is useful for the providers and suppliers of automated checkout trolley. The findings provide insights for these practitioners in defining the system requirements, from the users' point of views. Additionally, this study forms the foundation for more sophisticated or specific research which wishes to investigate in the domain of automated checkout trolley system.

This study is subjected to certain limitation as well. Firstly, the sample used in the study is the consumers from Malaysia, which the results might not be able to fully generalize to represent all the developing countries. Secondly, the assessment of users in this study is based on the conceptual prototype of the system, which might be varied from the assessment using fully developed system.

Future works can assess the perceptions of users based on the fully developed system, in order to represent their real experiences and perceptions of actual use of the automated checkout trolley system. Furthermore, future works can apply theories or models to derive at fortified hypotheses and statistical testing on the hypotheses, in order to enhance the result of questionnaire survey.

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APPENDIX

A. Appendix A: Full Items in Questionnaires and Result

	Mean
<b>Service Quality</b>	
Promoters were explained clearly when promoting new product	2.67
The behaviors of employees in this store instill confidence in customer	2.77
Employee in this store have the knowledge to answer customers' questions	2.81
This store willingly handles returns and exchanges	2.78
When a customer has a problem, this store shows a sincere interest in solving it.	2.9
Employees of this store are able to handle customer complaints directly and immediately	2.95
<b>Total</b>	<b>16.88</b>
<b>Mean (= Total /6)</b>	<b>2.81</b>
<b>Indicates =</b>	<b>Dissatisfied the current service quality provided.</b>



Table A2. Agree on Consistency of Item Price Tagged

	Mean
<b>ItemPrice</b>	
Price tag on item was exactly consistent with cashier scanned	2.55
Price tagged on advertisement catalog was known by cashier.	2.86
<b>Total</b>	<b>5.41</b>
<b>Mean (=Total/2)</b>	<b>2.7</b>
<b>Indicates =</b>	<b>Disagree and dissatisfied with the statement.</b>

Table A3. Satisfaction on Efficiency and Timeliness

	Mean
<b>Efficiency and Timeliness</b>	
When a cashier has a problem, he/she in this store advice you to proceed to next counter.	2.93
Payment process is fast and efficient.	3.27
<b>Total</b>	<b>6.2</b>
<b>Mean (= Total /2)</b>	<b>3.1</b>
<b>Indicates =</b>	<b>Dissatisfied with the service in efficiency and timeliness.</b>

Table A4. Store House Evaluation Responses Analysis

	Mean
<b>Store house evaluation</b>	
store house are convenient for my shopping needs	2.01
store atmosphere and décor are appealing	2.31
a good selection of products was present	2.27
Products/Items was in stock	2.58
the store layout at this store makes it easy for customers to find what they need	2.27
<b>Total</b>	<b>9.17</b>
<b>Mean Total /5)</b>	<b>1.83</b>
<b>Indicates =</b>	<b>Agree and satisfied with the overall store house environment.</b>

### B. Appendix B: Operation and Implementation Costs

<b>Operation costs</b>	<b>Cost per Month</b>	<b>Total costs per year</b>
Cashier's wages	RM57,200 (55 cashiers)	
Promotion costs	RM18,000 (RM 1*30 boxes *4,500 copies of promotion catalogs)	= RM 902,400
<b>Cost to implement S-Cart</b>		
500 units of S-Cart @ RM2,608	RM1,304,000	
Infrastructure cost	RM11,368	
* Please refer to Appendix H		
RFID passive tags (Assumed all products is tagged with RFID in year 2011)	RM0	= RM1,315,368
<b>Breakeven point</b>		<b>= 1.5 years</b>

RM1 equivalent to \$0.3306 USD