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A SMART TROLLEY WITH RFID IMPLEMENTATION: A SURVEY AMONG CUSTOMERS

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ABSTRACT

Smart trolley with Innovative RFID is proposed to facilitate users while shopping. It provides several benefits such as to facilitate users to search for things quickly without looking for assistants from promoter for the location of the items, to inform customers the amount of goods purchased and to allow customers to control financial budget while shopping. The main objective of this research is to identify the results of a market survey on a smart trolley with innovative RFID implementation among the users. The scope of the research is conducted among staff, customers and suppliers in Giant Hypermarket, Bandar Seri Manjung, Perak. A total of 250 questionnaires has been distributed to customers, staffs and suppliers. 200 questionnaires were collected which consists copies from 140 customers, 50 Giant Hypermarket staff and 10 suppliers. Three elements tested in the research covers on spending time, budget control and product layout. These elements are selected as an indicator from customers to enhance the importance of smart trolley implementation. Based on the mean, it shows that the highest element feedback from customers is budget control, it is because this new smart trolley could assist customers in purchasing expenses while shopping, thus it will help their money flow.

Keywords: smart trolley, RFID, market survey, customers.

INTRODUCTION

A shopping cart is a cart supplied by a shop, especially supermarkets, for use by customers inside the shop for transport of goods to the checkout counter during the shopping. Customers can then also use the car to transport the goods they buy cars. The most places in Malaysia, the customer is allowed to exit the car in determining the area in the car park, and store personnel will deliver the car to a warehousing area. As mentioned in [1] Aboli. H and Poonam. T (2015), Radio-Frequency Identification (RFID) is a technology that uses radio waves to transfer data from an electronic tag, called RFID tag or label, attached to an object, through a reader for the purpose of identifying and tracking the object. When the RFID technology combined with the trolley, it can identify the position where the goods or products are to further facilitate customers to seek goods or merchandise. In addition, it can also facilitate the company or the supermarket to identify the goods or products in short supply. It will make it easier going for the company to order goods or the new product so that it remains constantly available. Therefore, it will facilitate dealings between the dealer and the supplier. This research is to report from the market survey on a smart trolley with RFID implementation among users in Giant Hypermarket, Seri Manjung, Perak, Malaysia. Smart trolley with RFID is innovative projects that have been practiced in developed nations like USA. This trolley is believed to facilitate customers to find goods or product faster, to know how much the price of goods or to control budget while shopping. If customer wants to buy something in a mall, customers should take certain items from display rack and line up for payment. Problems would arise when the size of the shopping center is relatively large and sometimes customers do not know where certain items are placed. In addition, customers also need to queue for a long time to wait in line at the cashier to pay. This will be the hardest hit during the season or if the sale of the shopping centers still use conventional methods to include the price of each item by hand to the cash register. On the other hand, customers often have to worry about a lot of things when go to the mall. For example, most customers would be worried that the carrying amount may not be enough to pay for purchasing items. Therefore, customers with RFID smart trolley will be able to overcome these difficulties experienced by customers in the hypermarkets. In addition, this technology is also beneficial to the companies and suppliers to check their stock management.

Figure-1. The current shopping trolley image.

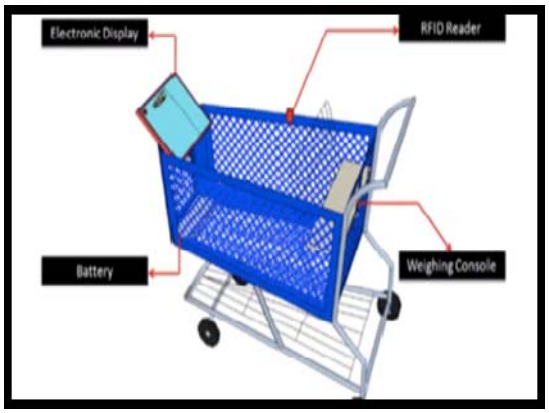

Figure-2. The proposed new trolley image.

Figure-3. Top view of the smart trolley.

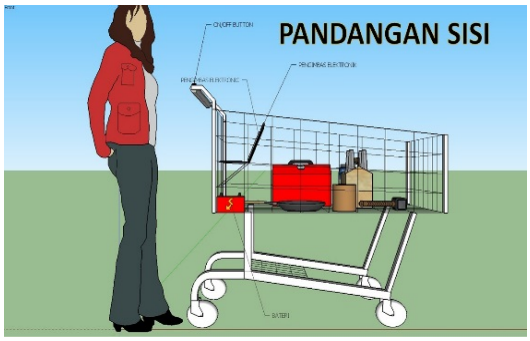

Figure-4. Side view of the smart trolley.

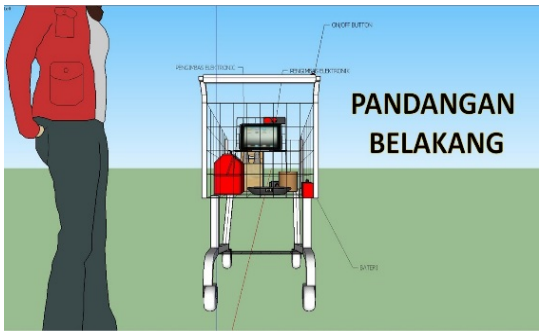

Figure-5. Backward view of the smart trolley.

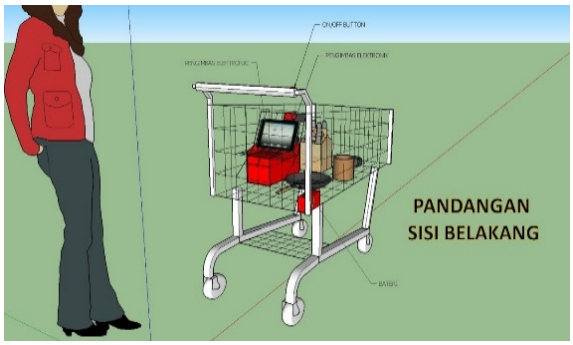

Figure-6. Backside view of the smart trolley.

Figure-7. Side forward view of the smart trolley.

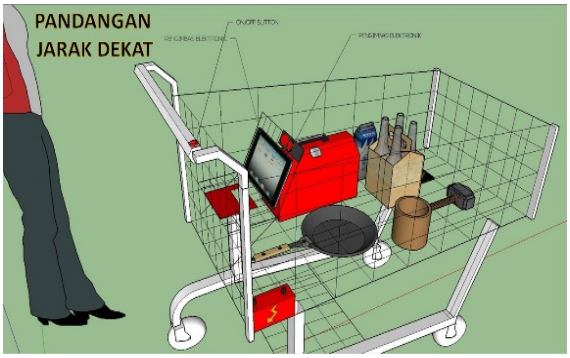

Figure-8. Closest view of the smart trolley.

The proposed image of the smart trolley is shown in figure two to eight from a different angle and view. The overall image of the proposed smart trolley consists of battery, electronic display, RFID reader and weighing console as shown in figure two.

LITERATURE REVIEW

Defined RFID technology

As mentioned in [1] Aboli Hanwate and Poonam Thakare (2015), Radio-Frequency Identification is a technology that uses radio waves to transfer data from an electronic tag, called RFID tag or label, attached to an object, through a reader for the purpose of identifying and tracking the object. RFID Tag is a special type wireless card which has inbuilt the embedded chip along with loop

antenna. The inbuilt embedded chip represents the 12 digit card number. The RFID reader is the circuit which generates 125KHZ magnetic signal. This magnetic signal is transmitted by the loop antenna connected along with this circuit which is used to read the RFID card number. In this project, RFID card is used as a security access card. So each product has the individual RFID card which represents the product name. The RFID reader is interfaced with microcontroller. Here the microcontroller is the flash type programmable microcontroller in which we already programmed with the card number. It is a small electronic device which reads the radio frequency and transfers the information to the device. The RFID device serves the same purpose as a bar code or a magnetic stick on the back of a credit card, ATM card etc. It provides a unique attribute for that object. And just as a bar code or magnetic stick must be scanned to get the information, the RFID device must be scanned to recover the identifying information. One of the main differences between RFID and barcode technology, is RFID rejects the need for line-of sight reading on which bar coding depends. There is a vast change in shopping methodology. From local markets people are moving to marts. The reason is simple; they get all their required things under one roof, from vegetables to cosmetics. But everyone will agree from one problem of standing in long queue for billing, even though people have electronic money now. Ultimately, people have to compromise with either their precious time or with the number of items purchased.

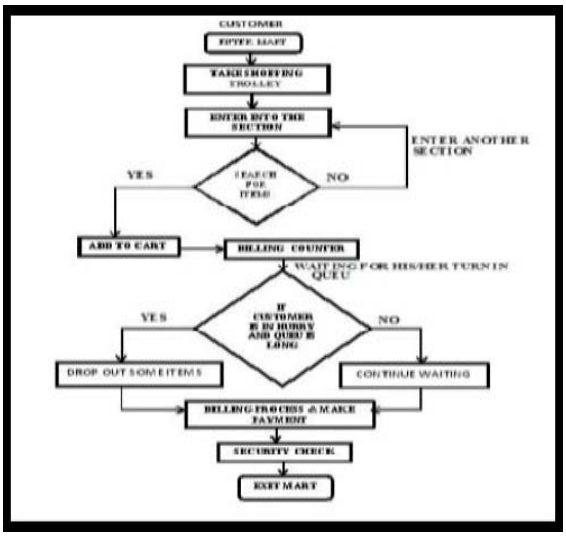

Figure-9. Flow chart showing current problem.

Normally, customers enter into the shopping complex, will take shopping trolley and go ahead for shopping and will put things of their choice in the shopping trolley. Then, will go to billing counter and stand in a queue and wait for a turn and when our turn comes, customers have to again wait for their bill because the barcode of each and every item is to be scanned in preparation of the bill. A lot of time customers spend on searching and selecting items, which is alright because customers want the best one, but waiting and spending our time for bill generation process, is obviously very tiring. Electronic cash has made the payment easy, but creation of the bill is still very time-consuming. A simple flowchart of above mentioned process is shown in Figure-9.

Advantage electronic shopping cart based on RFID

As mentioned in [3] Muthu Kannan and Anupriya Asthana (2013), shopping mall is a place where most people from all walks of life will get their daily necessities ranging from food production, apparels, toiletries; gardening tools electrical appliances, and others. The numbers of small and large shopping malls keep on increasing over the years throughout the globe due to the demand of the public. Thus, the level of advancement of the shopping mall system and infrastructure also varies. Compared to some foreign countries' shopping mall system, there are still plenty of spaces for improvement in terms of providing quality shopping experience to the consumers. Customers often face problems and inconvenience when shopping. These problems include worrying that the amount of money brought is not enough for paying all the items wanted, insufficient information about the items that are for sale and also wasting unnecessary time at the cashier. These are the problems that are currently faced by most consumers. There are some existing methods to solve the problems that are stated above, but the effectiveness still considers improvable. Examples of existing problem solving techniques are substituting the conventional way of keying item per item by hand to the cash register with the technology of barcode scanning where the price is stored in the barcode, and also set up a customer information counter to help the consumer if there are any inquiries about the items at the shopping mall. The problems stated above might eventually be solved or else improved by the implementation of RFID technology in a shopping mall. This can be done by simply attach an RFID tag to all the items in shopping malls and attach an RFID reader with an LCD display on the shopping trolley can solve all the problems above.

Application

The main application of this system is proposed to be used in shopping malls in order to reduce the billing time at the cashier counter especially during peak hours. In addition, it helps customers to ease customers while shopping with family members. It can be used anywhere like shopping markets where the barcodes are used to good solution which avoids barcode technology.

The operational of RFID in smart trolley

The current RFID technology is located at a certain static location at exit door. This system is widely used in almost all shopping complex in all places. Nevertheless, the proposed smart trolley with RFID is attached at the moving trolley, which is different from the current trolley. The proposed idea is when any selected

product is dropped in into the cart, RFID reader reads the tag inside the product and the information of the product is extracted and displayed on the LCD screen. At the same time, billing information is also updated. The working of the Intelligent Shopping Cart can be explained with the following steps: 1) When shoppers with the cart, press "start button" the system turns ON and then all the components such as RFID readers, microcontroller and physical media start working. 2) Every product has an RFID tag which contains unique id. These ID's are fed into the database assigned to the corresponding products. 3) When the shopper drops any product in the cart then the RFID reader reads the tag. The information of the product is extracted and displayed on the LCD screen. 4) These steps are repeated until the end of shopping button is pressed. Once the "End Shopping" button is pressed the total bill is send to master pc. 5) There is also an option provided to delete some of the products from the cart and the bill will be updated accordingly. This goes by the customer choice. 6) At the end of shopping, the customer can straight away pay the bill and leave and 7) Inventory status of the products is also updated at the end of shopping.

RESEARCH METHODOLOGY

Questionnaire distribution and unit of analysis

The questionnaires have been distributed to customers, suppliers and staff. The unit analysis covers individual from staff, customers and suppliers in Giant Hypermarket, Bandar Seri Manjung, Perak. At Bandar Seri Manjung, there are several established hypermarket, such as Tesco (M) Sdn Bhd, Aeon, Econ Save and Giant. Based from these four hypermarkets, by the interview from some customers, products by Giant is more reliable due to competitive price advantage and facilities such as free parking lots and also ATM services. On top of that, Giant Hypermarket is located strategically at the center of Bandar Seri Manjung, and it is also near to residential areas as compared to the other hypermarket. Based from the above criteria, thus the Giant Hypermarket is selected as a scope of the research. Moreover, Giant also provides more trolley located at parking space. The question survey has been distributed to individual at three categories of respondents. The questionnaire is designed to analyse two sections that consist of respondents' demography which covers customers, suppliers and Giant's staff, and the other section covers on respondents feedback on elements on speeding time, budget control and easy to find any product.

Population

The population for this research covers population at Bandar Seri Manjung, number of suppliers and staff working at Giant Hypermarkets. The listed population covers, among: customers of 500 people, suppliers which are approximately 200 and among staff of 70. The breakdown of 70 staff are as follows:

Table-1. Number of staff population (Internal staff).

Position	Number of population
Top Level Management	10
Middle Level Of Management	20
First Line Management	40
Total	70
Total	**70**

Sample

The research was conducted by purposive sampling techniques that allows more detailed information about a particular subject can be obtained. In order to maintain the quality and effectiveness of this research, this process involves participation (number) of respondents.

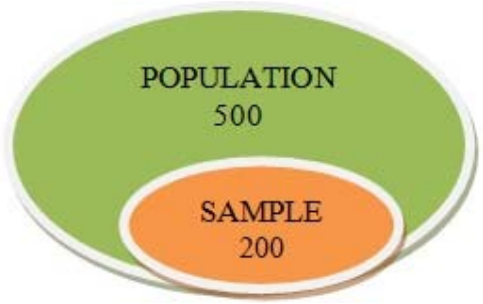

Figure-10. The list of samples.

Respondents

The breakdown total of 200 respondents who have participated in this research are as follows:

Table-2. Number of respondents.

Categories	Customers	Suppliers	Staff	Total
Total	140	10	50	**200**

The conceptual theoretical framework

The suggested conceptual theoretical framework of this research is as follows**:**

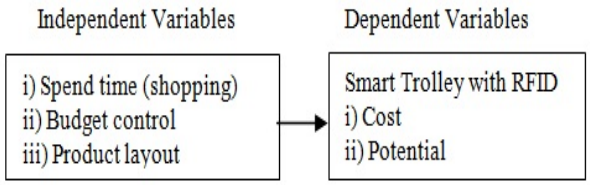

Figure-11. Conceptual theoretical framework.

Methods of conducting research

This research involves questionnaires distribution and interviews to increase the rate of reaction. Liker scale 1-5 is used to ascertain how strongly the respondents agree with the particular statement. It also helps to assess how

respondents feel towards a certain issue, product or service.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Figure-12. Liker scale.

Interview

Interviews were conducted between Giant Hypermarket Managers about some important things such as the number of staff working at the Giant Hypermarket and a total of supplier for Giant Hypermarket. Some questions answered developed and related to the topic of research. In interviews, all the data collected and allows the interviewer to explore deep feelings and perspectives of respondents on the subject.

RESULTS AND ANALYSIS

Based on the distributed questionnaires consists of six (6) independent variables that are more reliable with customer feedback on the implementation of a smart trolley. The six listed variables are as follows:

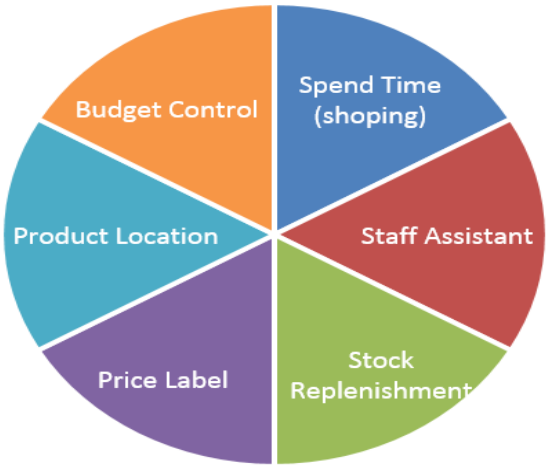

Figure-13. Independent variables elements.

These independent variables are valid based on previous scholar suggestion and also from customers' feedback. The importance of the independent elements through this research is to define which are the most significant and accepted elements as pre support to implement this new trolley. Based on the preliminary research, only three elements are stated as the most significant among the respondents which are spending time, budget control and product layout. This is because the remaining elements conflict with the other interest such as time constraints, location, etc. The theoretical framework involves three elements in the independent variables and two elements in dependent variables.This framework shows a structure that relates between independent variables and dependent variables used in this research.

Respondents' demography of staff, customers and suppliers

For demography study is divided to three different respondents who are among staff, customers and suppliers. Ideally, this analysis of demography study is developed to determine the significance and influence among respondents towards the implementation of the smart trolley. The elements in the demographic study cover on age, gender and monthly income. The age of the staff, customers and suppliers are reliable with the average of a group of people that consist from either still in education (primary, secondary, and higher learning institute), working and retired (civilian and army). From these groups of people, they needed a smart trolley is different based the elements. For example, a number of characteristic ageing are experienced by the majority people at different group. This element is important to determine the opinion of the most loyal customer or the familiar staff and suppliers and finally complied with this research. The second selected element are gender. Males are expected to be independent, assertive, and competitive; females are expected to be more passive, sensitive, and supportive. In this research, this element can give an impressive idea to understanding their role in the implementation of smart trolley, in order word the influence of gender behaviours of biological factors. The third factor or element are monthly income. Monthly income for a family is an instrumental in showing the frequency of shopping at the supermarket. It can be assessed as very important information in determining the capability in these groups shopping at Giants Supermarket and indirectly contribute to the implementation of smart trolley.

By Table -4, shows the summary result of staff, customers and supplier demographic. 200 questionnaires were collected which consists of 140 from customers, 50 from staff and 10 from suppliers. The male respondents are 51.5% and female staff is 48.5%. This group of male gender is the highest feedback compared to female. This is supported by most suppliers of Giant Hypermarket commonly are among male staff, as well as customers and staff. In terms of age distributions, 36.5% aged below 25 years, recorded the highest percentage. Mostly during the distribution of the questionnaires, the available group of staff, customers and suppliers are within this age. It can be seen that, those respondents under 25 years, easy to participate in the questionnaires distribution as compared to working adults who are busy and rushing while shopping. In addition, those who are aged below 25 prefers to hang out at hypermarkets. From the position of the company, the mostly feedback respondents are 43.5% of Non-Executive. This is because, by observation this research deliberately targeted at groups of workers at finishing area, especially in Giant Hypermarket such as cashier, logistic employees, butchers and general workers. Moreover, suppliers are mostly from logistics, drivers,

loader and lower executive.

Table-3. Staff, customers and suppliers demographic.

Label	Descriptions	Frequency	Percentage (%)
Age	Below 25 years	73	36.5
	26 – 35 years	63	31.5
	36 – 45 years	54	27.0
	51 – 55 years	5	2.5
	More than 55 years	5	2.5
Gender	Male	103	51.5
	Female	97	48.5
Position in company	Top Level Management	29	14.5
	Middle Level Management	30	15.0
	First Line Management	54	27.0
	Non-Executive	87	43.5
Monthly salary income in RM (Ringgit Malaysia)	400.00 – 799.99	66	33.0
	800.00 – 1,199.99	41	20.5
	1,200.00 –1,599.99	39	19.5
	1600.00–1,999.99	33	16.5
	More Than 20,000.00	21	10.5
Total		**200**	**100%**

The main goal in choosing this group is because respondents in this group are very close to the user (customers), and know what needs and facilities are necessary to facilitate the shopping process. Nevertheless, feedback from the suppliers and customers provide an important role in order to receive good opinion for the implementation of smart trolley. For monthly salary income, a group of staff with the range salary of RM400.00 – RM799.99 shows the highest percentage which is 33.0% compared to the other group. Users with low income monthly salary prefer to shop at Giant due to low price, high discount and products shall meet customers' requirement. At the same time, among staff also prefer to shop at Giant during their off duty to gain benefit from its low price since the price for staff is lower than normal customers.

Table-5 shows the specific data received from the supplier of Giant Hypermarket during the questionnaires distribution. The supplier is one of the important respondents, because it does influence the types of goods sell at shelves and also determine the feedback towards smart trolley implementation. During the distribution of questionnaires, 10 suppliers have participated that consist of different types of goods with various famous product brands such as Nestle, F&N, Maggi, Unilever, Procter & Gamber and others that related to beverage companies. From the observation, it is found out that Giant Hypermarket is one of the prefer shopping outlets for customers to find wet goods with different types of brands, Then, the needs of this smart trolley implementation easily can assist customers to search effectively and efficiently in terms of time consuming for various wet product brands at multiples shelves.

Table-4. Suppliers demographic.

Label	Description	Frequency	Percentage (%)
Name of company	Nestle	1	10.0
	F&N	1	10.0
	Maggi	1	10.0
	Unilever	1	10.0
	P&G	1	10.0
	Others	5	50.0
Types goods supply	Wet food	2	20.0
	Dry food	1	10.0
	Adult clothing	1	10.0
	Children's clothing	1	10.0
	Sports equipment	1	10.0
	Others	4	40.0
Total		10	100%

Cronbach's alpha is used in this research to measure of internal consistency (reliability) since this research involves multiple Likert questions in the questionnaire survey to determine if the scale is reliable. Besides that, this research also used Cronbach's Alpha to measure of internal consistency that is how closely related a set of items are as a group. It is considered to be a measure of scale reliability. A "High" value for alpha does not imply that the measure is unidimensional.

Table-5. Reliability.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No of Items
.737	.734	25

Table-6 shows the Cronbach's Alpha is 0.737. It means, the items in the questionnaire were suitable for the title research. N of items means refers to the 25 questions in the questionnaire. By referring to all 25 questions, the respondent received from respondents by answering the questions are valid and totally the value of Cronbach's Alpha for all questions are more than 0.7. It shows the average value given is 0.737. Thus, all the questions are accepted and valid. This is supported as mentioned in [2] Lance, Butts, and Michels (2006), state the urban legend that an alpha of 0.7 is acceptable for a measurement scale is just that: an urban legend. It is chronicled in a very amusing paper.

Means test

Statistical techniques used in illustrating important variations between groups of data. It is used to detect statistically significant differences. According to mean test results in Table-7, the average respondent has provided an opinion that the regulatory elements of the spend time (shopping) is the most widely accepted by respondents to rank the mean number of 4.19. Followed by elements budget control that have promoted mean 3.95 is the second largest by respondents. The rank means 3.86

is the third to be chosen respondents are product layout. From the analysis, the majority of the respondents have supported the suggestion of the smart trolley implementation that will reduce time spend to search various products. The suggested of a new technology is assisted customers in spending less time while shopping, since most of the customers are working group of customers and have limited time to shop only after office hour and to rush within the operation hours of Giant Hypermarket. Ideally, these three elements are suggested as the core elements in this research, due to the most significant in getting feedback towards its implementation.

Table-6. Means test.

Element	Mean Value
Spend time (shopping)	4.19
Budget control	3.95
Product layout	3.86

CONCLUSION AND RECOMMENDATION

Currently, the usual comment trolley at other related supermarkets/ hypermarkets is mainly used to store goods in the trolley after shopping. But, the real situation that is faced by the customers is hardly to estimate the correct total amount to pay at the cashier counter. By having this new smart trolley, it shows the actual amount to be paid by the customers after any price deduction (discounted price). Customers will know the exact amount to pay, before reach the cashier counter. Generally, customers may add the total amount of goods by scanning its price tag. The system is also provides information to customers on other important information such as expired date, Halal, ingredients, country of origin and the net price after discounted. Of the three elements which are spending time (shopping), budget control and product layout, are interrelated among the elements. These elements are used as a yardstick among inverters in the demand of the new systems in relative to the higher numbers of customers rises drastically from day to day. It is also to prevent any fraud from happening, especially the price shows are relatively not the same with the actual amount to be paid when it goes to the cashier counter. By introducing this new smart trolley, it is targeted to help related bodies in preventing criminal related to fraud. With the extra space from the Hypermarkets, of course it needs more time to walk in the hypermarket, thus this smart trolley will assists customers to find products easily available on shelves. As a conclusion, from the market survey conducted it shows the advantages of the smart trolley with suggested innovative RFID technology are covered on shorting the spend time to search for products or goods, can control the current budget shopping and also provides information on product details and easy to figure out where the items are located. Through feedback received from customers, staff and suppliers of Giant Hypermarket, thus the current trolley can be upgraded to the smart trolley with RFID. It is proposed that, a market survey for the smart trolley with innovative RFID technology is carried out more widely to other hypermarkets such as Tesco, AEON for their acceptance of the smart trolley. Based on market survey that have been conducted, this smart trolley must be adopted in hypermarkets as smart trolley makes it easy for customers to find items faster than using a regular trolley.

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