SMART TROLLEY FOR SUPERMARKET SYSTEM

S .Nilaxshan

(IT17037648)

B.Sc. (Hons) in Information Technology

Specializing in Information Technology

Department of Information Technology

Sri Lanka Institute of Information Technology

Sri Lanka

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S .Nilaxshan

(IT17037648)

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Department of Information Technology

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Abstract

In the modern era, the most common ways of buying products are at supermarkets. As Tradition people goes to shops surrounded by their houses and buys the necessary products. With the evolution in the business world, consumers mostly prefer supermarkets than retail shops due to several factors. It is more convenient for a customer to buy any good from a supermarket since a customer can buy any kind of products in different categories in one place and the prices are also displayed as well. Hence, a person can decide what to buy according to his budget and preferences. Customer do not like to wait the billing counter line to pay for their goods. This is happening in supermarkets where they may have a couple of items and they do not like to wait behind people who are buying grocery shopping. In Super Markets, Consumers must wait in the counters to bill the items taken from the shelves and to make the payment for the billed amount, which is a reduce the time consuming and may lead to customer dissatisfaction. Meanwhile, supermarkets also not able to increase the billing counter due to the additional cost and adequate spaces in the supermarkets. To stratify the consumers' needs without deploying more counters or utilizing additional spaces in supermarkets.

We have produced an idea of "Smart Trolley System". Smart Trolley System is a Super Market Trolley will detect the product and its price while a product is placed into it. The product is detected using image processing and weight sensor. The read price of the product will appear in the trolley display. There is also a facility of finding the needed products at supermarkets at specific location. The Location of every product will be already fed into the system and when the customer put the needed product in trolley. trolley display will show up its location. When we add on products to the trolley the prices of the products will be automatically added and billed. After billing, the respective payment can be made through mobile application. In the above system, each customer is uniquely named by a loyalty

card with **RFID Cards technology**, which is also used to access trollies at supermarkets.

Gaining customer loyalty card access is an important goal of marketing, and loyalty card program   intended is helping to reach to   the   customer.   Research Results show that loyalty card access is influences a customer's like to visit a particular supermarket and to prefer it over competitors. Loyalty program is more important for purchase behavior there is also a facility of finding the product Location. Location of every product will be already fed into the system and when the customer searches the needed product in the trolley display, it will show up its location. We alert Self-payment checkout alert also. In counter **if more than 5 people in the line system will alert do a self-checkout**. This is a time-consuming process and may lead to customer dissatisfaction. We wish to develop the   above   state   smart   trolley   and   implement   it,   which   will   support the supermarket to satisfy the consumers' needs as well as the revenue assurance process. For multi-object tracking, we use a separate tracker for each object.

Key Word: Smart trolley, RFID, Customer. Loyalty card

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I would like to express my deep sense of gratitude to my Research supervisor. Mr.Jesuthasan Alosius for his generous guidance, fullest support, encouragement during the period of whole thesis.

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1. Introduction

Our Research will focus in developing a smart trolley at supermarket in order to make the process of purchasing more effective. This is developed through an algorithm process to measure the advantage of business compared to disadvantages. To develop the research more efficiently. The project is divided into four different components assigned to each member of the group to develop using creative and innovative idea. Based on the previous ideas gathered on smart trolley system, the team has specified many more ideas to convert it as an interesting technology product. This product is more convenient, efficient and easy for usage.

1.1. Background Literature

1.1.1. Background

In today's modern era shopping is performed in various ways both manually and in online. We are usually used to manually shopping is the customer can choose any product according to their need. And they can also go with their preference and branding, comfort and many other factors. But here, the customers spend a lot of time at the billing counters. Our purpose in the project "SMART TROLLEY SYSTEM" will help a customer to save the time at billing counter. During this COVID 19 Pandemic situation, government has strictly imposed the rule of Social distance. They're for this system useful. Constant change in shopping is also required in developing customer satisfaction.

We are particularly interested in designing a system able to simultaneously detect multiple objects on a scene. This detection information will help surveillance cameras send real-time information about the detected objects to the back end central system. The information sent to the back-end system can be used to detect the presence of an object in the covered area or to recognize a specific 5 persons from the detected face in the area. It is proposing an OpenCV-based solution for multiple object detection, and finally, presents the results of the comparison of performances in a regular platform and an embedded device.

RFID card and RFID Reader

A Loyalty card is a RFID card in here. We fix the RFID reader on trolley. Customer can access the trolley if they have a loyalty card only. A Loyalty card is a cart issued by a super market stores to the customers to collects points while checkout in counters during the shopping time. However, here we will use the loyalty card for access the trolley and get the loyalty points and discounts.

Stage of RFID Loyalty card in supermarkets

Traditional features of loyalty programs include the following:

- Discounts at point of sale
- Special offers and rewards based on amount spent / points earned
- Time-based promotions
- Notifications: drops in prices, new arrivals, recall alerts
- Low-price guarantees

Additional, personalized capabilities provided by RFID include the following:

- Better service, with notification when a specific customer accesses the trolley.
- Real-time, personalized messages and offers at critical points of decision making (via digital signage, SMS to phone)
- Recommendation of product selections based on purchase history, product prices, Product discounts and more
- Access to shopping lists, or the ability to build wish lists
- Faster checkout

It is usual for a consumer to search a product on supermarket for long time. There is also a facility of finding the needed products at supermarkets at specific location. The Location of every product will be already fed into the system and when the customer input the needed product the trolley display will show up its location.
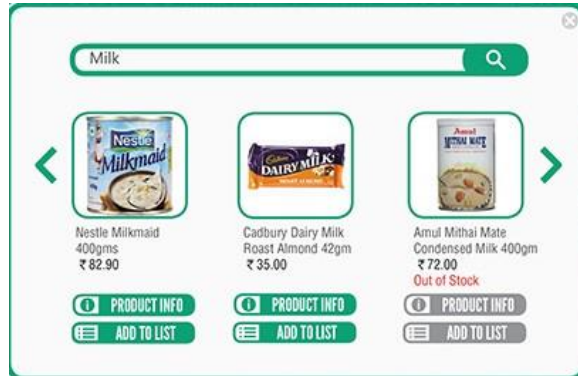

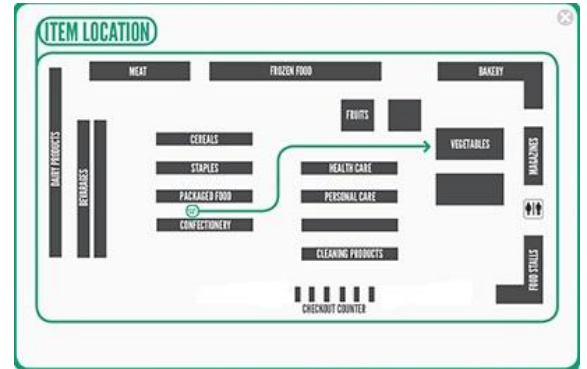*Figure 1:1: Searching of the product [1]*   *Figure 1:2: Location of product [2]*

When we add on product to the trolley the prices of the products will be automatically added and billed. According to the model of the customer loyalty factors forming customer loyalty such as understanding the customer's needs, wants. The company must pay attention to price, promotion, service and products in order to gain the customer loyalty. At the same time to create the comfort environment between the customer and the company is vital. Investment to loyal customers brings advantages to the business such as growing effectiveness and profit of the business.

Businesses that need to make efficient use of both time and space, such as supermarket is taking notice of this innovative Self-payment checkout alert solution. By letting the customer handle payment, which represents about 45% of the total checkout time, checkout can be up to 1.5 times faster compared to previous normal checkout. This is a time consuming process and may lead to customer dissatisfaction. Meanwhile, super markets also not able to increase the billing counter due to the additional cost and adequate spaces in the super markets. In order to stratify the consumers' needs without deploying additional counters or utilizing additional spaces in super markets

1.1.2. Literature Survey

I. RFID Based Smart Trolley for Supermarket Automation

This paper describes about the designing of a trolley based on RFID reader for supermarket automation. RFID reader with electronic hardware system is fitted with the trolley to make the purchase comfortable. Each and every product will contain the RFID tag, it has unique ID number so that it is used to identify the product. The RFID reader gets information about the product from RFID tag, and when the customer put the product in to the trolley, when item is shown in front of the reader, the amount of the item is added to the purchase bill, and is shown on the LCD display. The trolley is programmed in such a way that it will find the rack number displayed on the LCD. It also has the provision for removing the items from the trolley where the cost is removed from the total cost. Once the items are added, the cost is added up and when it crosses the certain limit, it gives an alarm signal to indicate that the customer budget has exceeded. Figure shows the block diagram RFID based Smart trolley for supermarket automation.
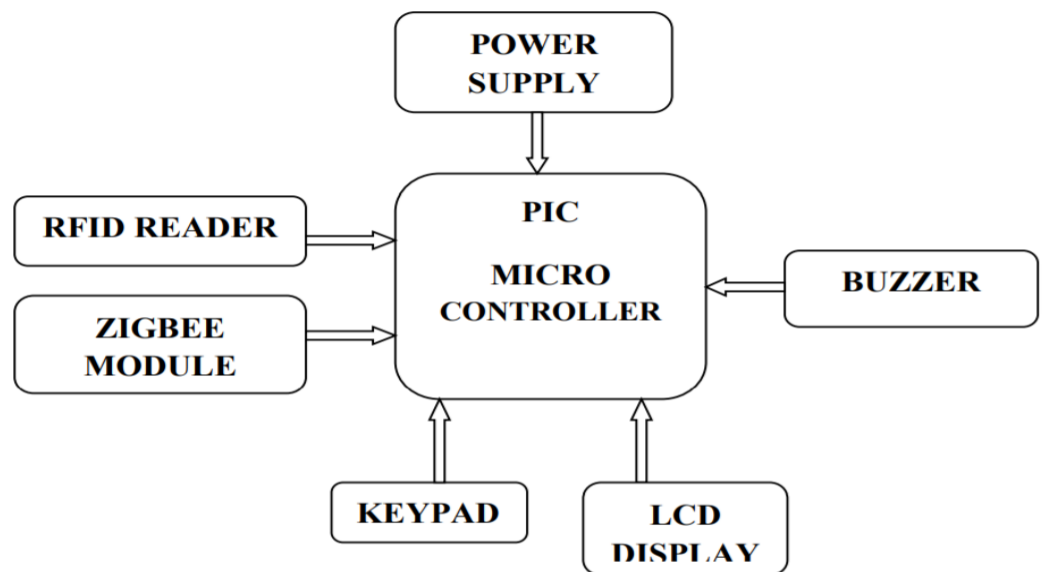

Figure 1:3: Block diagram RFID based Smart trolley [3]

II.   Automated smart trolley for Supermarkets

In this paper, trolley has done with a prebuilt RFID reader and display. These readers can read RFID tags in which details of the products are present. In the supermarkets each product will have RFID tag that holds whole information about that product. That is price, quantity, etc. Customer can scan the product tags to RFID reader and add the products to the cart by switch present in the trolley for adding and removing of products. They can edit the basket anytime during shopping. The total products in trolley amount is calculated automatically and displayed on display. There would be a system for billing where customer would scan their tag ID and transfer the product details for billing. When customer finishes up shopping, shopping end button is pressed. When it is pressed, through ZigBee details of the customer purchased is displayed. Payment is also made by paying total amount. Figure shows the block diagram of the smart trolley.
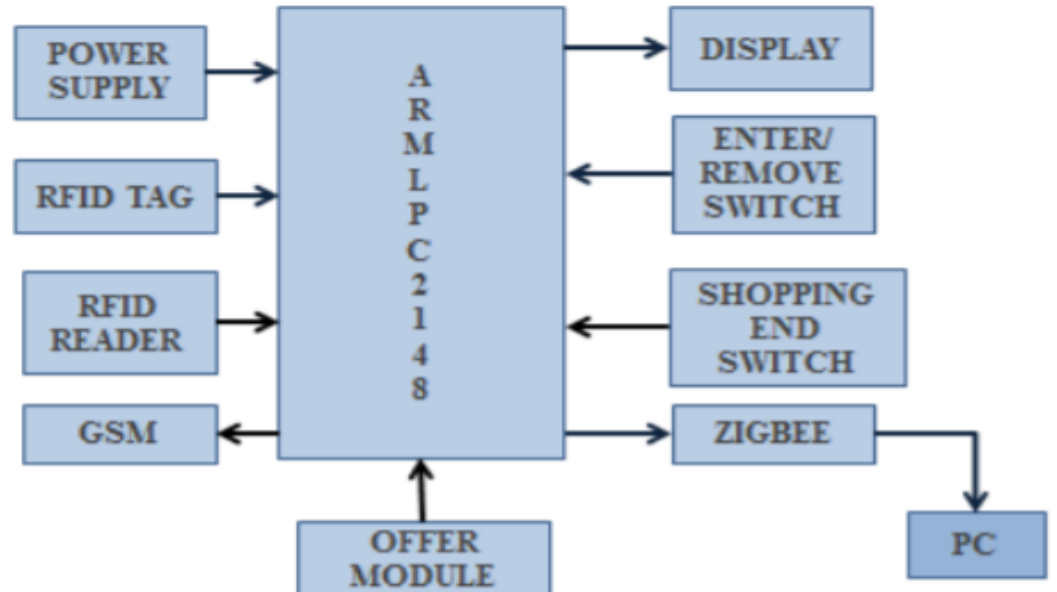
Figure 1:4: Block diagram of supermarket [4]

### III.   Developing Multitasking Shopping Trolley Based On RFID Technology

RFID reader is used to read the data's present in the RFID tag. RFID readers or receivers are composed of a radio frequency module, a control unit and an antenna to interrogate electronic tags via radio frequency (RF) communication. Many also include an interface that communicates with an application. Readers can be hand-held or mounted in strategic locations so as to ensure they are able to read the tags as the tags pass through an "interrogation zone."

RFID systems can be classified by the type of tag and reader. A Passive Reader Active Tag (PRAT) system has a passive reader which only receives radio signals from active tags (battery operated, transmit only).

The antenna emits radio signals to activate the tag and read and write data to it. Antennas are the conduits between the tag and the transceiver, which controls the system's data acquisition and communication. Antennas are available in a variety of shapes and sizes; they can be built into a door frame to receive tag data from persons or things passing through the door, or mounted on an interstate tollbooth to monitor traffic passing by on a freeway. The electromagnetic field produced by an antenna can be constantly present when multiple tags are expected continually. If constant interrogation is not required, a sensor device can activate the field.

Often the antenna is packaged with the transceiver and decoder.
The reader emits radio waves in ranges of anywhere from one inch to 100 feet or more, depending upon its power output and the radio frequency used. When an RFID tag Passes through the electromagnetic zone, it detects the reader's activation signal. The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer for processing.

RFID Tag   RF Antenna   Network   Workstation
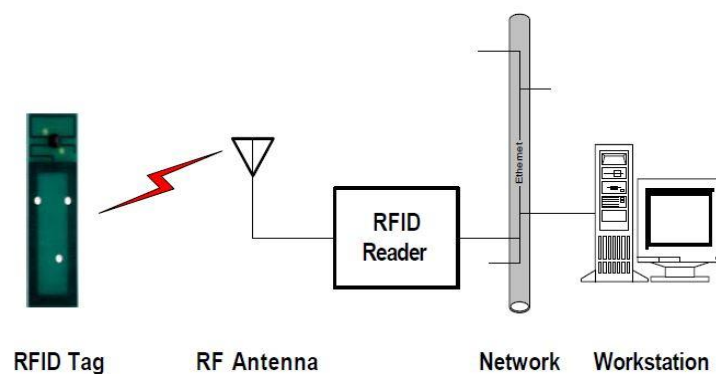
IV.   Smart shopping cart with automatic billing system through RFID and ZIGBEE [7]

A unified and optimized billing system utilizes the use of RFID and ZIGBEE interaction. With each product, an RFID tag is given. A Product Identification System (PID) that includes a microcontroller, LCD, RFID, and ZIGBEE module is used for each shopping cart. The product information purchased will be read by the RFID reader on the shopping cart and this information will be sent to the billing counter using the ZIGBEE module. The billing system collects the cart information and EEPROM data and then accesses the database of the commodity and calculates the total purchase amount for that specific cart. In smart shopping, an automatic main billing system for supermarkets and malls is created by the trolley application.

Customers won't have to wait for near-cash counters to pay their bills using PID. Since the inventory information purchased from them is passed to the central billing system. Customers may also pay their bills through credit / debit cards. The proposed system is highly accurate, genuine, dependable, and time-efficient. The wage sum given to workers will be reduced, fraud reduced. The scheme is also very time-efficient, too. They also developed a smart way of shopping in this paper.

In this case, instead of a bar code reader, each product has an RFID-tag. The smart trolley has an LCD monitor with an RFID [6] reader and a Zigbee transmitter. In this software, the product will be scanned when a person puts some product in a trolley and the cost and name of the product will be shown on the LCD. The cumulative cost of both goods is included in the final payment, which is stored in the memory of the microcontroller. Wireless product details will be exported to a computer system using a ZIGBEE transmitter. There is a distance issue with the malfunctioning of the device in Zigbee.

V.   Smart cart with automatic billing [8]

The supermarket is a place where most people get their everyday needs from food processing, clothes, toiletries, gardening equipment, electrical appliances, and others from all walks of life. Because of public demand, the number of small and large shopping malls continues to grow over the years across the globe. The extent of development of the shopping mall services and infrastructure varies therefore as well. Compared to the supermarket infrastructure of some international countries, there are still plenty of areas for development in terms of providing customers with a better shopping experience. When shopping, consumers frequently face challenges and inconveniences.

These issues include worrying that the amount of money taken is not adequate for all the items needed to be paid, inadequate knowledge about the items for sale, and spending excessive time at the cashier as well. These are the challenges that most customers face at present. There are a few current methods for solving the above-mentioned problems, but the efficacy still considers improvable. Examples of current problem-solving strategies are replacing the traditional method of keying goods per goods by hand to the checkout counter with bar - code scanning technology where the price is stored in the barcode, and even setting up a piece of customer data counter to aid the user if there is any query about the goods in the supermarket.

With the introduction of RFID system in a supermarket, the above-mentioned problems could probably be solved or otherwise improved. This can be managed simply by adding an RFID tag to all products in supermarket and adding an RFID reader with an LCD monitor on the shopping trolley can overcome all the above problems and in this paper the author invented such a device that contains of RFID, ARM7, Display, Power Supply, Switch, IR sensor pair, Visual Basics barcode reader. The system works when this inventor uses both the barcode reader and RFID. That if we put some product in the trolley then the product will have RFID and the RFID reader will read the price or if the product has a barcode sticker then the barcode reader will read the product price and the total bill will be shown on the show. There is a switch if we want to delete some product from the trolley, and if we push the switch, we delete the product from the trolley. And our shopping is done by means of the micro controller that we transferred the total bill to the bill counter to

print the print copy of the bill. A credit card or some other facility for payment is also available. The system's drawback is that both the RFID reader and the Barcode Reader are used as the system becomes more complicated.

VI.   Open CV

OpenCV is an open source computer vision library that is used in real time computer vision. OpenCV was developed by Intel and now supported by Willow Garage and Itseez. OpenCV is designed and optimized for real time applications, although it's developed in C and C++ languages, it's a cross platform library that runs on Linux, Windows and Mac OS .The OpenCV library contains hundreds functions that cover many areas in computer vision such as robotics, medical image processing, security [2]**.**

VII.   Object detection

The cascade classifier [1], adopted here for object detection is based on Haar-like feature and is consists of combining many complex classifiers in cascade structure, which increases the speed of object detection.

VIII.   Self-payment checkout alert

People counting by blob tracking are currently an option of systems which are mainly aimed to classify objects and their activities by analyzing their shapes and their trajectories. Those systems are based on the capability to separate an object from the background. In scenarios where people are crowded, those systems have a poor accuracy since precise object extraction is hardly possible [6].

1.2. Research Gap

	A smart trolley with RFID implementation a survey among customers	A New Technique foe smart shopping cart	Smart Shopping Cart for Automated Billing Purpose using Wireless Sensor Networks	Multitasking Shopping Trolley Based on RFID Technology	Using Open CV method to multi object tracking.
RFID	✓	X	X	✓	X
RFID card wise access the trolley	X	X	X	X	X
RFID card wise do the payment	X	✓	X	✓	X
RFID card wise Find the loyalty customers	✓	X	X	X	X
Bar code Scanner	X	✓	✓	X	X
LCD screen View the product details and bill	X	✓	✓	X	X
RFID sensor wise find the product location	✓	X	X	✓	X
Open cv	X	X	X	✓	✓

Table 1-1: Comparison with existing system

1.3.Research Problem

According to this research, the following have been identified as problems that customers face when purchasing the product in the supermarket. The purpose of this research is to find answers to these problems.

- The challenge will undoubtedly occur when a supermarket's size is almost enormous and sometimes customers don't even know where those products are having.

- Customers often need to wait at the counter for their payment for a long time. Since the cashier has to scan each item, and then make the payment would definitely take a lot of time.

- Only when the size of the supermarket is almost huge and often consumers do not even know where those goods are located would the issue occur.

- Since every single product needs to be checked by the cashier and then follow-up by making the payment would probably take a lot of time.

- In this COVID 19 situation customers need to maintain the distance .In here the que will take long place.

- Customer satisfaction is of first significance for any business. However, if billing takes time, if there's a problem with the delivery, etc., it turns out to be difficult for a business to hold the customers.

1.4. Research Questions

The main research questions that define this research are as follows. The questions below focus on solving the main research problems.

- How to access the trolley?
- How to reduce the customer line in counter?
- How to customers find the product location?

1.5.Research Objectives

- Key objective of the product loyalty card access and self-checkout alert is to reduce the time taken in the supermarket billing counter customer line and make customers feel more comfortable while purchasing.

- Using image scanners (camera) to allow customers to self-checkout and to reduce the number of human workers needed in the billing area.

- In here our total products have an issue, how to customer access the trolley in supermarket. So we find the solution. We provide the loyalty card to the customer. Customers can access the trolley by using loyalty card (RFID Card).

- The Location of every product will be already fed into the system and when the customer input the needed product the trolley display will show up its location.

2. Methodology

The proposed mechanism will be carried out by utilizing the following four components effectively This chapter explains about the methodology we intend to adopt to achieve the overall aim of proposing effective mechanism to develop a smart trolley for supermarket.
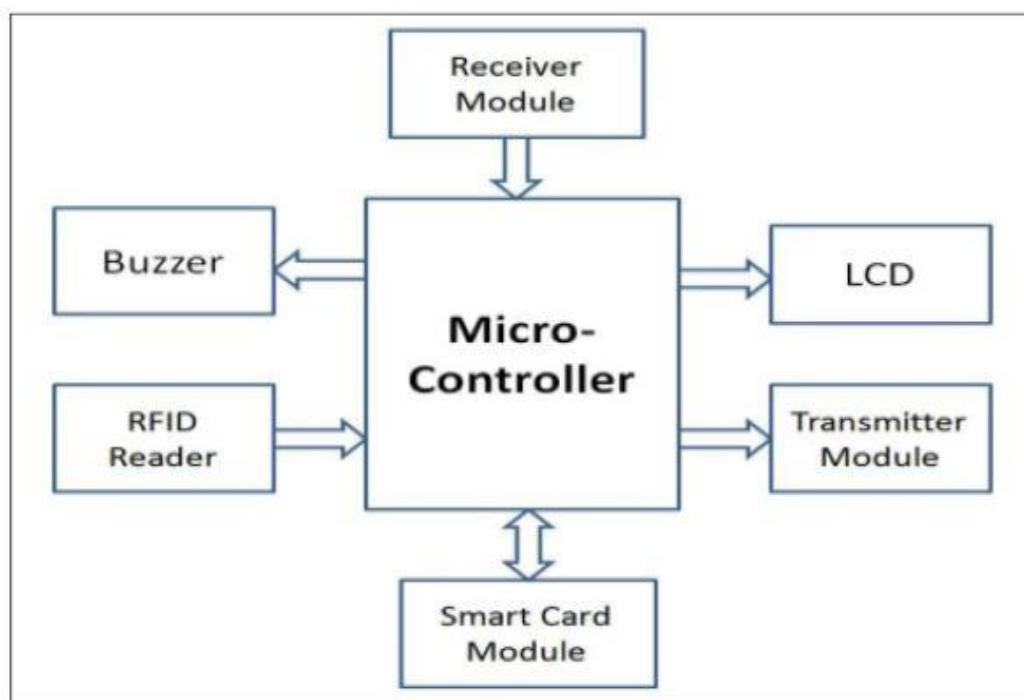
Figure 2:1 Block Diagram of RFID Access

Figure 2.1 shows the block diagram of smart trolley using RFID card reader along with smart card. The system is almost similar to the one using RFID card reader for the addition of a smart card to each trolley. The system provides the customer with two options of payment namely through cash and/or through the smart card. The smart card works like a prepaid card. When the customer chooses the trolley, respective smart card will be pre-recharged with a certain amount of money. At the end of shopping, the customer can easily make the payment through the smart card.

Collect the comprehensive multi objective database for different element of supermarket product on the selected supermarket and develop a GIS based interactive application (iFaME) to manage different Product at the supermarket.
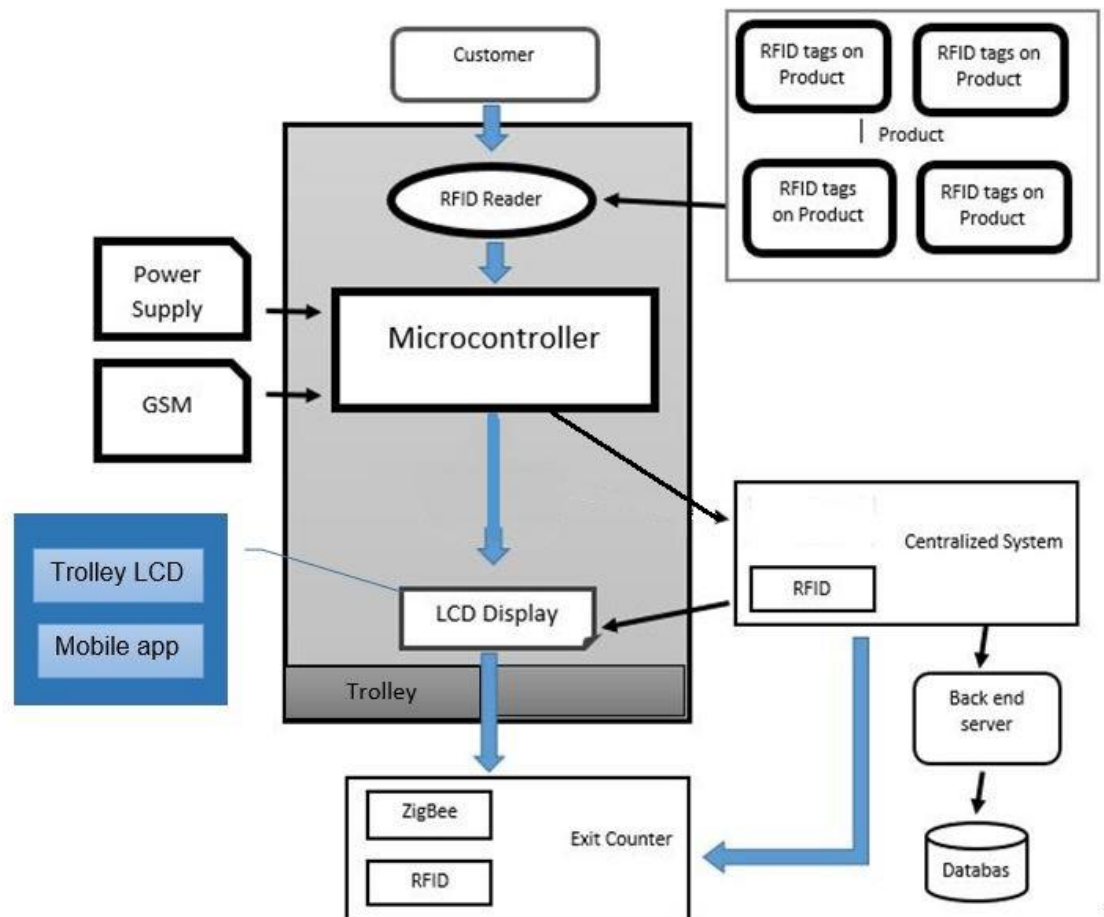

Figure 2:2: High level system architecture of RFID Access

I. Loyalty card access

When customer punch the Loyalty card (RFID card) near the trolley RFID reader, it will find the loyalty customer details and customer can access the trolley. Here, RFID reader will get the card access and send it to the micro-controller. The micro-controller then sends the card details to the transceiver, which sends it to the server. The server then receives the relevant information and sends it back to the micro-controller using the same transceiver

II. Product Location Finding

The Location of every product will be already fed into the system and when the customer input the needed product the trolley display will show up its location

III. **Self-Payment checkout alert**

In the billing counter, if more than 5 people are lined up, system will alert to do a self-checkout. The no of customers lined up in the bill counter is found by object tracking through camera. Vision-based real-time people counting comprise all techniques which are able to extract the number of people who are present in an observed area.
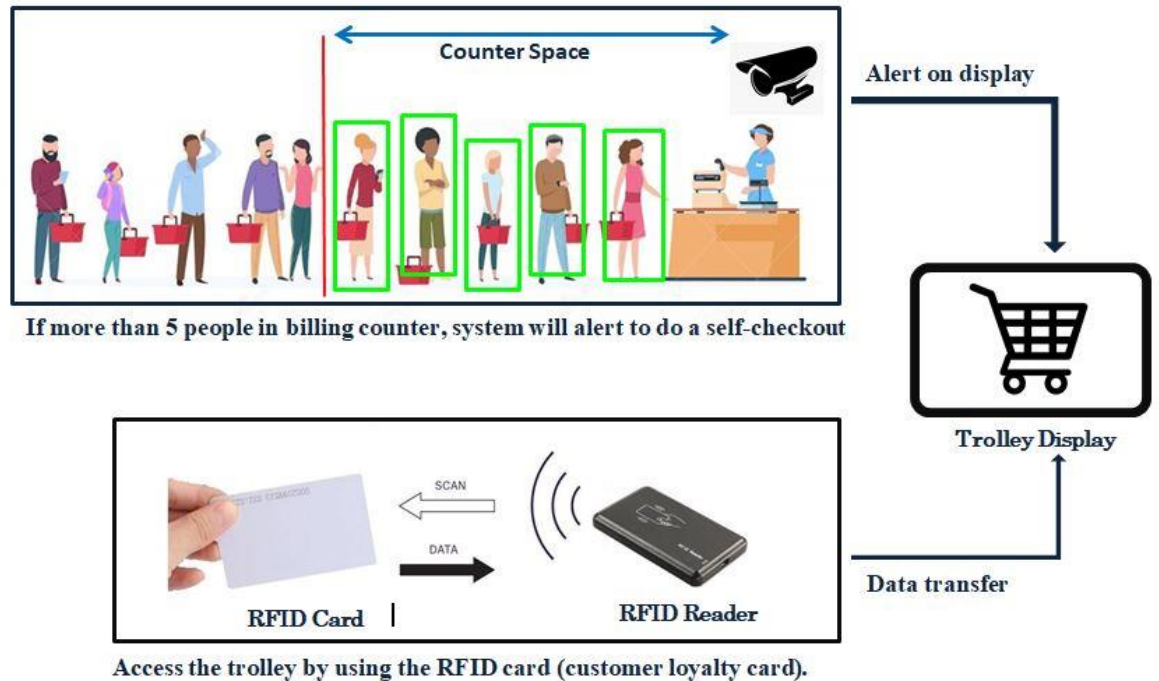
2.1. Methodology

Counter Space

Alert on display

If more than 5 people in billing counter, system will alert to do a self-checkout

SCAN

DATA

RFID Card | **RFID Reader**

Access the trolley by using the RFID card (customer loyalty card).

Trolley Display

Data transfer

Figure 2:3: Methodologie

3. Commercialization Aspect of the Product

Currently the number of consumers going to the supermarket is increasing. Customers often prefer to go to the supermarket rather than small shops. Shopping at the supermarket is easy for people and can save time. As a result, there is a need of the supermarket and its profitability will increase, making purchases through this system easier.

Many customers worry that they have enough money to pay for all the things they want to buy until they pay the bill. Many customers do not receive the full amount of the bill before payment. But with the help of this system customers can know total bill amount while making purchases. Supermarket

customers don't need to contact a shopkeeper to find out information or other aspects of their goods when making purchases. The customer can get the details with the help of the Voice Assistant. Product Recommendation system acts as a filtering system that finds the most relevant items that a particular user would like to purchase. Overall, the system can improve the customer satisfaction that leads to increase in sales.

4. PURPOSE OF THE PROJECT

Traditionally people goes to shops nearby and bought the necessary products. But, now a day's people do prefer supermarkets more than retail shops. It is more convenient for a customer to purchase any good from a supermarkets. It is because a customer can purchase any kind of products in different categories in one place and the prices are also displayed as well. So, a person can decide what to buy according to his budget. But at the Super Markets, after the purchasing we have to wait at the counters for billing of products. Sometimes, when there are more customers, huge amount of time is wasted during waiting for billing

5. RESEARCH GAP

Table 5-1: Research Gap of system

	A smart trolley with RFID implementation a survey among customers	A New Technique foe smart shopping cart	Smart Shopping Cart for Automated Billing Purpose using Wireless Sensor Networks	Multitasking Shopping Trolley Based on RFID Technology	Using Open CV method to multi object tracking.
RFID	✓	X	X	✓	X

RFID card wise access the trolley	X	X	X	X	X
RFID card wise do the payment	X	✓	X	✓	X
RFID card wise Find the loyalty customers	✓	X	X	X	X
Bar code Scanner	X	✓	✓	X	X
LCD screen View the product details and bill	X	✓	✓	X	X
RFID sensor wise find the product location	✓	X	X	✓	X
Open cv	X	X	X	✓	✓

5.1.1. Planning

A proper planning will always lead a project to success. Planning is a method of project development that estimates work using self-contained units of work called sprints. Agile planning described which items are carried out in each sprint and a repeatable method was developed. The project charter was created in order to officially authorize the project.

5.1.2. Design and Implementation

Trolley is designed with additional features compared with the usual trolley in all supermarkets. Here we include RFID reader in the trolley and have display. Here the customer come to the near the counter camera will find the customer count and give the alert to the customer in trolley display.

5.1.3. Smart Trolley and User Interface

Current period the number of consumers going to the supermarket is increasing. Customers are mostly like to go to the supermarket than small shops. Shopping at the supermarket is easy for people and to avoid time waste. As a result, the needs of the supermarket and its profits increase. Basically, the trolley is an integral part of the customer's shopping experience and the businesses that use them must ensure that its design meets the customer's need.

5.1.4. Connecting to the Store Database

The method by which customer software communicates with a database server is the database connection in this system. A database connection is used to send and receive requests [16] from the database. The database contains information which the customer software may query [5]. Main purpose of this application, the customer software is the application installed on the raspberry pi which is linked to the store database. In the database, all product details are stored.

6. RESULT & DISCUSSION

When customer punches the RFID Card (customer loyalty card) in RFID Reader, it viewed the customer access profile and customer can access the trolley. We maintain the RFID card for collecting new customer data and

collecting customers purchase history. Through this we can collect customer data.

Figure 6:1: loyalty card access

Location of each product is already fed into the database and when customer search for the product, product location will be display in message If customer searches the product, it will show the location in category base

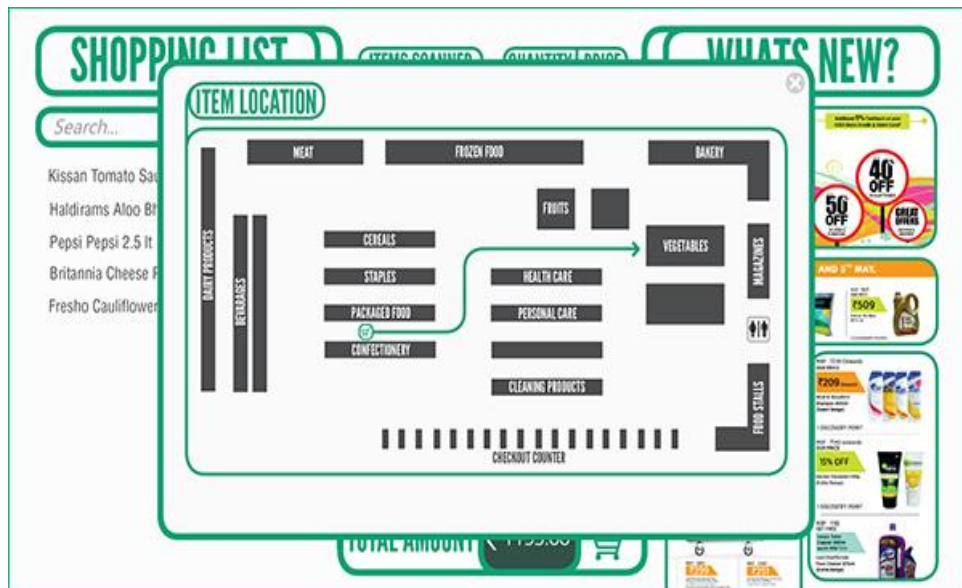*Figure 6:2: search the product :*

Figure 6:3:location finding:

In billing counters, if more than five people are lined up alert message will be displayed in the LCD display. Here we used object tracking method through camera. Techniques used here are Vision based real-time people counting comprise. Which are able to extract the number of people, who are present in an observe area.
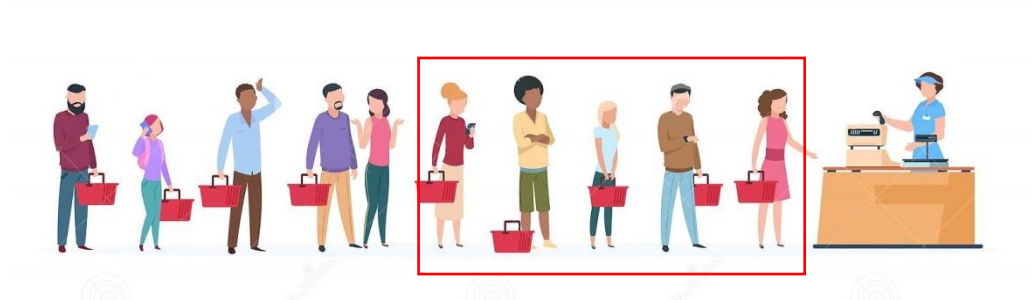

Figure 6.4: find the count :

The execution time of cascade classifier for single object detection in both platforms is shown in below:

Platform   **Time (ms)**

Windows based PC   : 31 ms

The performance on the regular platform is better than in the embedded platform. This is shown in the table above by the execution time in the windows platform, which is the smaller than the execution time in the card. Although these results were expected due to the difference in resources, the results in the embedded platform are encouraging. The profiling on the embedded platform allowed us to detect blocs that consume more the processor time. The result helps to understand the blocs in the chain on the card that need enhancements in order to achieve better results on the embedded platform. Especially, when adding more processors to the card to perform specific tasks in order to enhance the performance to achieve acceptable results for real-time application.
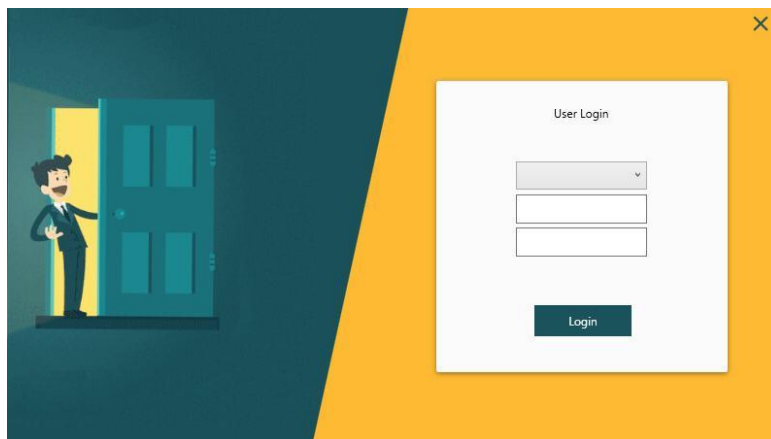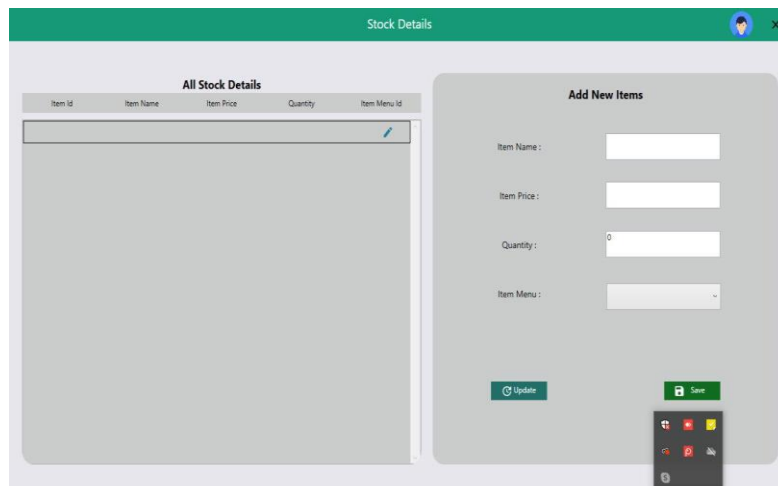

Figure 6:8:admin login:

Figure 6:9:new customers creation :

Figure 6:10: stock update :

Figure 6:11: stock view :

Figure 6:12: product entering :

1. **RESEARCH FINDINGS**

A survey is conducted to get feedback from random people about the smart trolley.
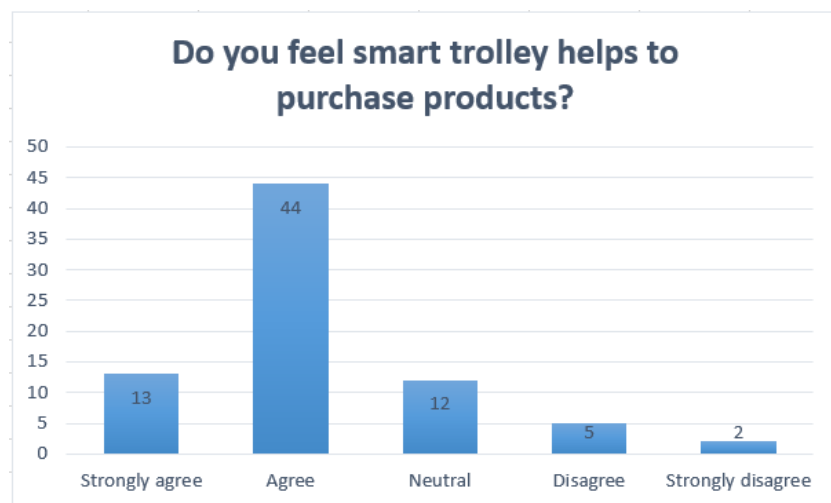

Figure: Bar chart of what people feel about smart trolley

Out of 76 people, 13 people agree that smart trolley helps to purchase products. 44 people strongly agree that smart trolley helps to purchase products. 12 people feel neutral that smart trolley helps to purchase products. 5 people disagree that smart trolley helps to purchase products. 2 people

strongly disagree that smart trolley helps to purchase products. As most of the people agree that smart trolley helps to purchase products, we can state that smart trolley helps to purchase products.
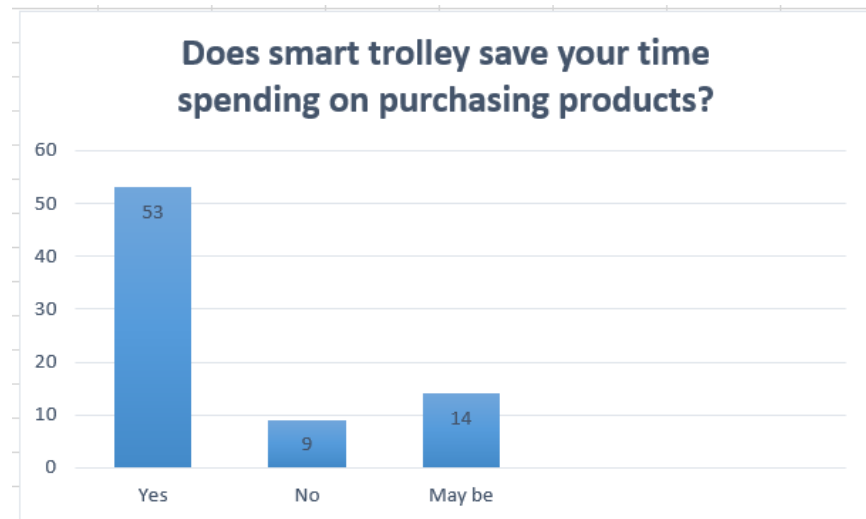

Figure: Bar chart of whether smart trolley saves time spending on purchasing products

Figure shows that out of 76 people, 53 people felt that smart trolley saves the time spending on purchasing products. 14 people felt that smart trolley might save the time spending on purchasing products. 9 people felt that smart trolley does not save the time spending on purchasing products. As most of the people felt that smart trolley saves time it clearly states that there is a need for smart trolley in supermarkets.
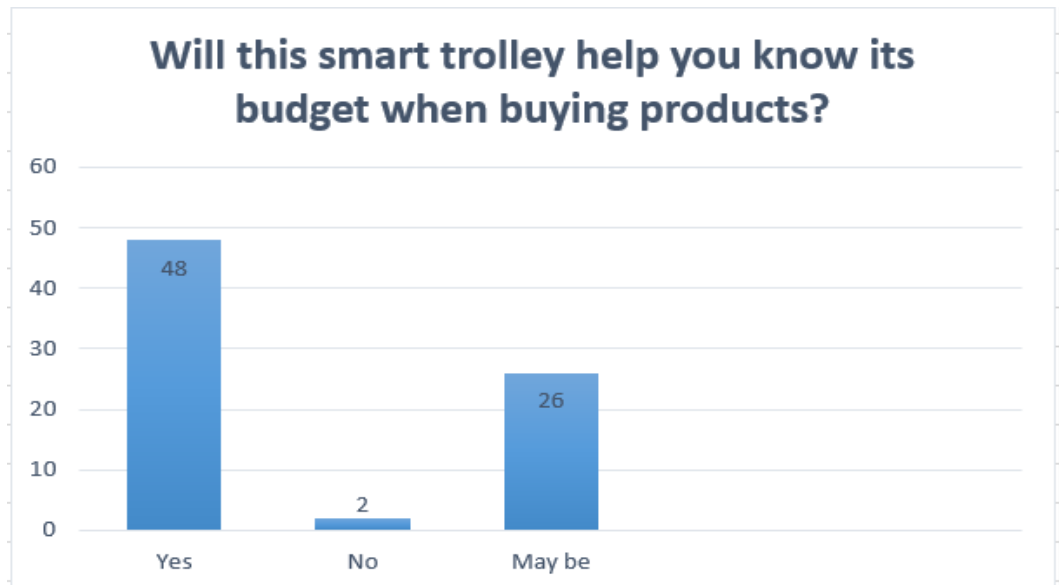
Figure: Bar chart of whether smart trolley helps to know budget before purchasing product

Figure shows that out of 76 people, 48 people felt that smart trolley helps to know budget before purchasing products. 26 people felt that smart trolley might help to know budget before purchasing products. 2 people felt that smart trolley does not helps to know budget before purchasing products. As most of the people felt that smart trolley helps to know budget before purchasing products it clearly states that there is a need for smart trolley in supermarkets.
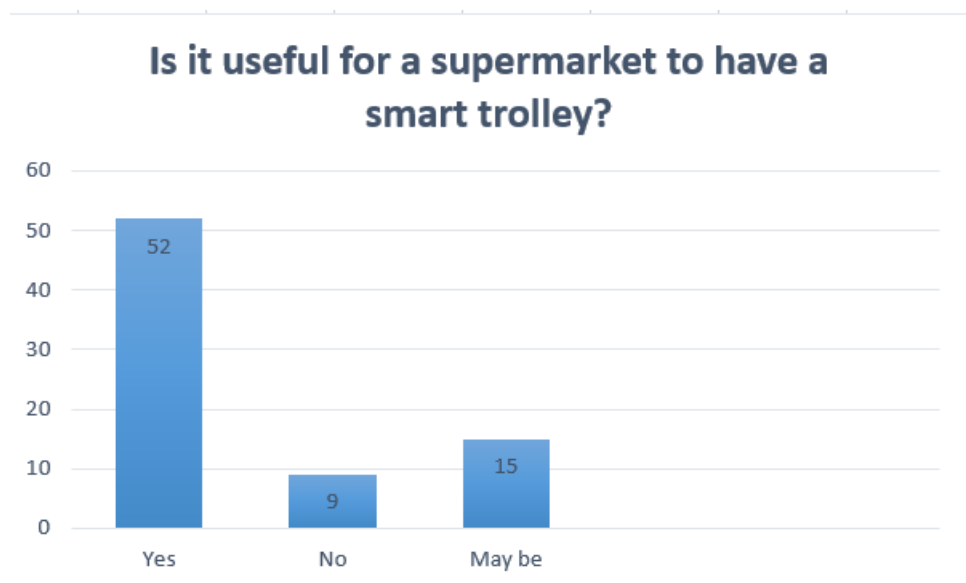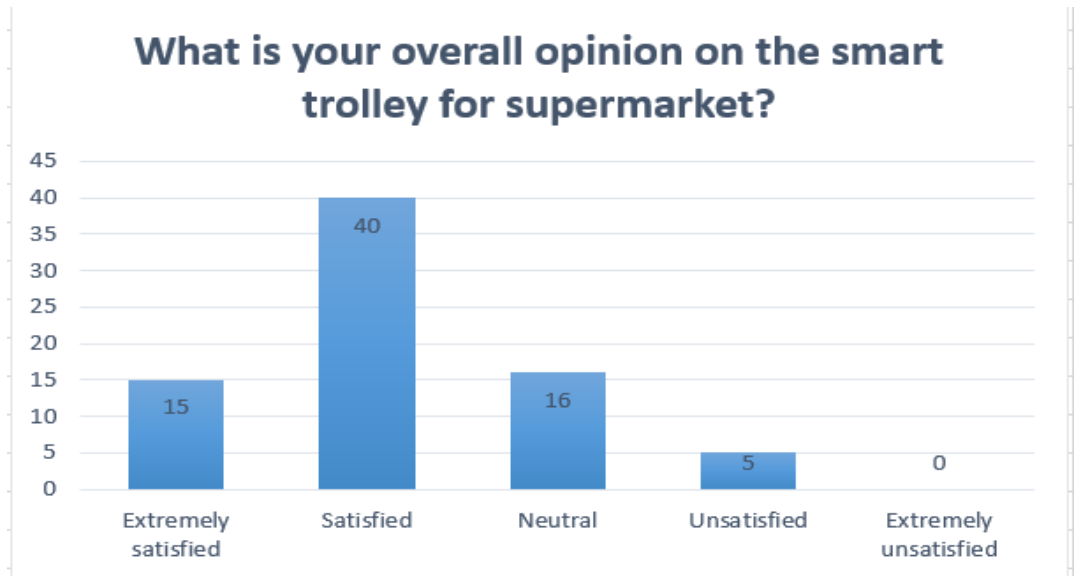
Figure: Bar chart of whether smart trolley is useful

Figure shows that out of 76 people, 52 people felt that it is useful for a supermarket to have a smart trolley. 15 people felt that smart trolley it is useful for a supermarket to have a smart trolley. 2 people felt that it is not useful for a supermarket to have a smart trolley. As most of the people felt that it is useful for a supermarket to have a smart trolley it clearly states that there is a need for smart trolley in supermarkets.

Figure: Bar chart of whether people believe smart trolley makes shopping easier

Figure shows that out of 76 people, 53 people believe that smart trolley will make the shopping easier. 18 people believe that smart trolley might make the shopping easier. 2 people will believe that smart trolley will not make the shopping easier. As most of the people believe that smart trolley will make the shopping easier it clearly states that there is a need for smart trolley in supermarkets.

What is your overall opinion on the smart trolley for supermarket?

Extremely satisfied	Satisfied	Neutral	Unsatisfied	Extremely unsatisfied
15	40	16	5	0

Out of 76 people, 15 people extremely satisfied on the smart trolley usage. 40 people satisfied on the smart trolley usage. 16 people feel neutral on the smart trolley usage. 5 people unsatisfied on the smart trolley usage. No one extremely unsatisfied on the smart trolley usage. As most of the people agree extremely satisfied on the smart trolley usage, we can state that smart trolley helps to purchase products.

Discussion

Based on the survey results it clearly shows that people are expecting to have a smart trolley in the supermarket as they feel that it helps to purchase products, save the time spending on purchasing products, makes the shopping easier, helps to know the budget before purchasing products. Therefore, it is necessary to have a smart trolley in supermarket.

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