SMART TROLLEY FOR SUPERMARKET SYSTEM
2020 – 078

Project Proposal Report

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B.Sc. (Hons) Degree in Information Technology

Department of Information Technology

Sri Lanka Institute of Information Technology

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September 2020

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DECLARATION OF THE CANDIDATE & SUPERVISOR

We declare that this is our own work and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The supervisor/s should certify the proposal report with the following declaration.

The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor: Date

Jesuthasan Alosius

ABSTRACT

As technology grows, advances are seen in various fields including machine learning, internet of things and so on, there is an increase in expectations from customer perspective. With the fast-moving life. Today a trolley is needed to buy a variety of items at supermarkets. Product purchases reflect a complex process. Many people spend a lot of time in the supermarket to purchase their goods. Because there is no proper way to pay the bills at the billing counter. The study aims to provide a smart trolley to a supermarket, which will enable customers to get the benefits through the system. In this research paper, we are introducing a smart trolley automated shopping system using Image processing, Weight load and Raspberry Pi controller can be very helpful for an automated billing system with the minimal human involvement. A real-time system for automated billing is developing in when a customer can bill their purchase using a Graphical User Interface on a LED screen linked to a camera, weight sensor and Raspberry Pi. The weight sensor is used to match the measured weight with the actual weight to avoid abnormal activities. Customers can easily scan the products (using image processing) in the trolley and put them on the price list while shopping. Each item can be scanned and placed in the trolley, giving the quantity of the products. Weight is measured by the Weight sensor when scanning the items to be purchased and placed inside the trolley. Each time the products are placed inside the trolley its weight is checked. If the customer does not want the product purchased, they can scan again and remove the product. Finally, checkout can be done easily. The system is also designed to simultaneously detect multiple items that offer multiple benefits over the barcode-based billing system. This new smart trolley can help customers find out the total invoice amount at the time of purchase, also avoid worrying about the budget and waiting in line for billing. The system also deals with anti-theft monitoring where the system does not allow customer to take unpaid products.

Keywords: Raspberry pi, Smart trolley, Weight sensor, Image Recognition

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBRIVIATIONS

3d	Three Dimensional
RFID	Radio Frequency Identification
PC	Personal Computer
PID	Product Identification Device
GSM	Global System for Mobile Communications
OTP	One Time Password
IUP	Image Understanding & Processing
RF	Radio Frequency
OpenCV	Open Source Computer Vision
DSI	Display Serial Interface
WLAN	Wireless Local Area Network
SIFT	Scale-Invariant Feature Transform
LCD	Liquid Crystal Display

1. INTRODUCTION

1.1 Background

Many supermarkets use bar-code scanners [8] at the check-out counter, but when the reader is used, the gap between the sensor and the goods should be near zero. Workers in charge of billing would need to handle this properly. This makes the work tedious for the human worker. Each item must be individually scanned, which is time-consuming and boring for billing employees, especially in supermarkets where hundreds of customers come in a day and have to scan thousands of items. People now have higher incomes that they can spend with less storage time, so they often choose supermarkets rather than nearby shops for grocery shopping.

In reality, the consumer is free to choose goods from huge varieties available that draw large consumers mainly in big cities as long as customer queues are seen in these stores. In certain cases, due to lighting effects, occlusion, poor resolution, etc., the barcode [17] is either damaged or there might be difficulties reading it. A bar code based billing system is also expensive because all products require a bar coding. It should be used in more intellectual works as the world moves towards the era of automation. Technology developments have led to high-speed computers [12] with excellent processors and storage capabilities. The concepts of Raspberry pi, Image processing, Weight load can be used to develop a real-time automated billing application to ease human work. The purpose of this system is to reduce the number of human workers and is to make purchases easier.

A real-time system for automated billing is developing in when a customer can bill their purchase using a Graphical User Interface on a LED screen [3] linked to a camera, weight sensor and Raspberry Pi. The weight sensor is used to match the measured weight with the actual weight to avoid abnormal activities. Customers can easily scan the products (using image processing) in the trolley and put them on the price list while shopping. Each item can be scanned and placed in the trolley, giving the quantity of the products. Weight is measured by the Weight sensor when scanning the items to be purchased and placed inside the trolley. Each time the products are placed inside the trolley its weight is checked. If the customer does not want the product purchased, they can scan again and remove the product. Finally, checkout can be done easily. The system is also designed to simultaneously detect multiple items that offer multiple benefits over the barcode-based billing system.

1.2 Literature Survey

- **RFID Based Automatic Billing Trolley [6]**

  Nowadays shopping malls and food cities are the best choices of the customers because of the smart systems. A lot of the malls are coming and already in action with different types of smart ideas. But most of them eating the time of customers while billing them. After the customers collected the items, they should have to line up for the bills. At the weekends they have to wait a lot of time for the bill because of a big crowd of customers. There are some of the labors, just 1 to 4 maybe something else that they assisted for the billing system. But they will have to bill for a lot of customers, mostly on weekdays each of the billing people have to bill more than 100 customers. When a customer consumes a large number of products, the next person on the line has to wait with his products for a long time, a better choice he can watch a full movie during that time. So, we need more smart ideas, what is that? It is RFID Based Automatic Billing Trolley. What is that?
  When a customer enters the mall there, he can pick up a trolley, he can go with that in the whole shopping areas. He can take the products how much he wants. Then he can pay the bill amount only to the labor at the end. It sounds good you see, yeah, he just needs to pay the bill only there, no need to wait at the billing counter or in a queue. That is RFID Based Automatic Billing Trolley. The new Idea for smart shopping.

  The author developed a system for supermarkets in this research. On the trolleys, the billing scheme is fixed. It includes an RFID reader and has an RFID tag for each product. When a person places some product in a trolley, their code is identified and the total bill is applied to the quantity of such items stored in the memory as we place the product costs. Billing is filled out on the trolley itself. The item name and its show of costs on the LCD screen. The total amount transferred by RF wireless module into the PC in the billing counter. The disadvantage of this project after the purchase is pressing the key indicating the final billing of the whole product. After pressing a key, we cannot add or remove products. It will be the biggest hit in the next generation of shopping.

- **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.

- **Smart Trolley using Smart Phone and Arduino [22]**

In this paper, RFID tag is attached to the membership card of the customer which is provided by the supermarket to their regular customers. RFID Reader is attached to shopping trolley or shopping basket which detects the presence of the regular customer and with this, shopping trolley will act as a Smart Trolley. The regular customer requires downloading a mobile application and then the smartphone act as a barcode scanner. With the help of barcode scanner, the barcode is generated which is send to Arduino through Bluetooth Module. Once the user is done with his/her shopping and near to billing counter, user press the button on the trolley and data which is displays on the LCD would transfer to the computer. This is

done by using NRF24L01 which is a serial peripheral interface and with this data will be transfer from the trolley to the computer at the billing counter. Figure shows the block diagram of smart trolley.

- **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

4

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.

- **Modelling of Future Automatic Trolley System based on Sensors and Image Processing Guidance for Supermarket [21]**

  This paper proposes a small trolley system which provide fast purchase and great convenience to customers. The main objectives of this proposed system are eliminating human labour to push trolley and reducing the time of the queue in supermarket. This automatic trolley system is an intelligent system which contributes as an efficient system in shopping mall to follow human and avoid the obstacles in the path. The proposed system starts to work when a customer gets into the mall and take the trolley. Each trolley has its own RFID reader. So, the trolley follows the customer who has the corresponding RFID card called as user card. The movement of the system is controlled by the ultrasonic sensor and RFID tag. The QR scanner working with the help of image processing used to read the QR code of the product which the customer is taking and it shows the price and other details of the product. Figure shows the block diagram of automatic trolley system.

- **Smart shopping cart with automatic billing system [10]**

  The research of demography is divided into three separate respondents who are among employees, customers and suppliers. Ideally, this demographic study research is established to assess the sense and effect of the respondents towards the smart trolley implementation. The elements of coverage, gender, and annual salary in the demographic data. The age of workers, customers, and vendors is accurate with the number of a group of people who are in education. They need a smart trolley from these groups of people which is different depending on the elements. For example, the majority of individuals in a distinct group undergo a number of characteristic aging. To determine the opinion of the most loyal customer or the familiar employees and suppliers, this aspect is necessary and finally complied with this report.

  This aspect can provide an amazing idea in this research to understand their part in the development of smart trolley, in order to convey the effect of biological

factors on gender behaviors. Monthly income is the third factor or part. Monthly earnings for a family are influential in demonstrating the level of grocery shopping. In evaluating the capabilities of these groups shopping at Empires Supermarket, it can be evaluated as very useful knowledge and indirectly lead to the development of the new smart trolley. Compared to working adults who are distracted and running while shopping, it can be seen that those respondents under 25 years of age easily participate in the distribution of the questionnaire.

The author considered such a device in this paper to consist of GSM, RFID, Automatic Billing, OTP, ZIGBEE, and PIC. In this system, the RFID reader will read the product and the price of products is shown on the LED display. And the existing mobile number in that scheme allows the GSM to produce the OTP for Net-banking to pay the online billing. We also add or delete the items in that framework and the overall bill also needs to be changed accordingly.

- **Smart shopping cart with automatic billing system [9]**

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 hard 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 their price tag. The system also provides information to customers on other important information such as expired date, Halal, ingredients, country of origin, and the net price after discount. 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 today. It is also to prevent any fraud from happening, especially the price shows are relatively not the same as 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 criminals 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 assist 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 surveys that have been conducted, this smart trolley must be adopted in hypermarkets as the smart trolley makes it easy for customers to find items faster than using a regular trolley. In this paper, the author invented such a system that presents the paper smart trolley with smart billing. In that they representing the system with additional functionality that functionality will calculate and update the customer bill when they stored the purchased product into the cart. Also, customers able to view the weight and name of their products on the display. They represented this paper because they added some additional features in the existing systems like in this system the product weight and name are shown on display; if the product weight is less than the stored weight then the buzzer will beep. Also, when shopping is done the customer has to press a button then the billing counter displays the number of a particular trolley on LCD and then the customer has to goes and take away the product after paying the bill. If the customer wants to remove some product then that cancellation is done at the billing counter. The new bill is generated only if the customer removed some products from their shopping.

1.3 Research Gap

Table 1.1: Comparison of related research

	Smart Trolley for Automatic Billing System	RFID Based Automatic Billing Trolley	Smart Shopping Cart for Automated Billing Purpose using Wireless Sensor Networks	A smart trolley with RFID implementation
Camera	✖	✖	✖	✖
Bar code Scanner	✖	✔	✔	✔
RFID	✔	✔	✔	✔
Arduino	✔	✔	✖	✔
Raspberry pi	✖	✖	✖	✖
LCD screen	✔	✔	✔	✖
Weight sensor	✖	✖	✔	✔

1.4 Research Problem

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

- 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.

- 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.

- If a customer wants to buy something in a supermarket, the customer wants to take some items from the shelf and stand in billing queue for their payment. And supermarket also need a large number of billing staff.

- The challenge will undoubtedly occur when a supermarket's size is almost enormous and sometimes customers don't even know where those products are put. In addition, clients 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. Additionally, customers often need to pay their bill by long queues at the counter. 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.

- When customers go to the supermarket they also have to think about several things. For example, many customers worry that they have enough money to pay for all the things they want to buy until they pay the debtor. Many customers do not receive the full amount of bill before payment.

- Recent research reported that trolley loss is significant with the cost incurred through reclaiming as substantial. Most trolleys end up in waterways, done so not by the customers but by local delinquents.

- Given the set of orders for different customers to be collected in the store, how can you reduce the travel distance required to select all items, satisfy the weight and power of the trolley volume, and set that in each box there are only one customer.

- When the trolley is full, the picker opens the new cart and continues to select items from this one, for the same customer. Sometimes it becomes a problem for the customer because the customer is only bought with limited products.

1.5 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 scan (purchase) the products?
- How to make purchases easier?
- How to identify the current weight of the product?
- How to validate the actual weight and estimated weight of the product?

1.6 Objectives

The main objective of this project is to reduce the time taken in the supermarket billing counter by developing a smart trolley that uses image scanners (camera) to allow customers to self-checkout and to reduce the number of human workers needed in the billing area. Customers can quickly scan the goods in the trolley (image processing) and place them on the price list while shopping. Each product can be scanned and put inside the trolley, giving the product quantity. To prevent irregular behaviors, the weight sensor is used to align the estimated weight with the actual weight.

The Image comparison algorithm that is chosen for the design is the SIFT (Scale-Invariant Feature Transform) algorithm. Using this algorithm, the image of the scanned objects will be generated by Image-processing and divided into segments. Then feature extraction is

performed and classification is produced. It is checked with the product image in the database.

An analog output voltage which is used to transform a force into an electrical signal. Each time you place items inside the trolley, the load-cell measures its weight. The measured weight is computed in the raspberry pi and then transmitted to the database, the weight in the database will be checked with the weight in the weight load.

2. METHODOLOGY

In this study we are using agile software development method. Agile software development refers to methodologies for software development based on the concept of agile process, where specifications and solutions grow through collaboration between cross-functional teams that are self-organized. Scrum is the most commonly used agile method. The purpose of Agile Development is to improve the quality of the system and increase the business value of the supermarket to increase customer satisfaction. Figure 2.1: shows the steps of Agile Development.
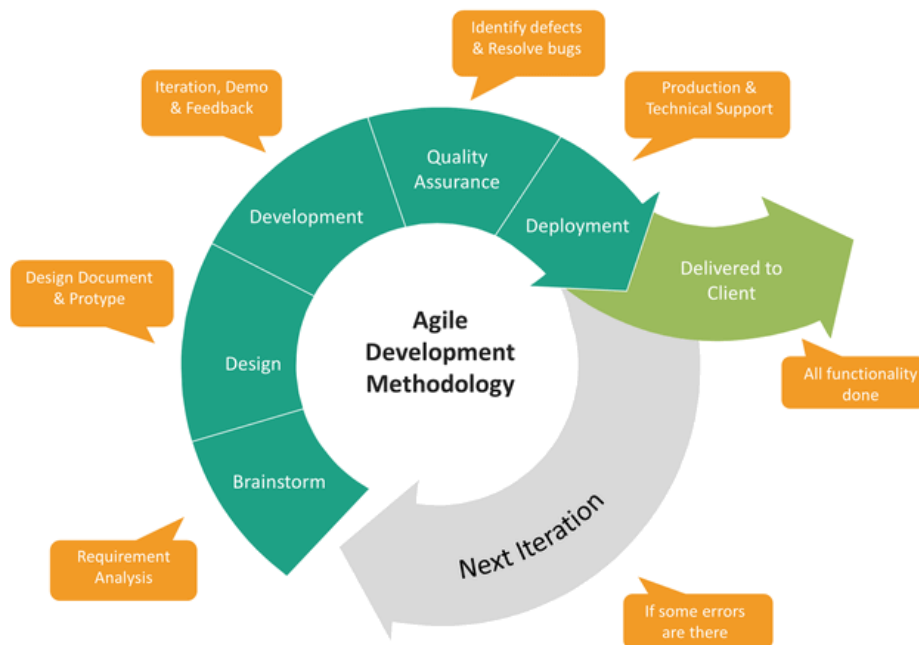
Figure 2.1: Agile Methodology

2.1. Planning

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.

2.2. Design and Implementation

Trolley is designed with additional features compared with the usual trolley in all supermarkets. Figure 2.2. Shows how our end product will look like that includes camera which have ultrasonic sensor and weight scanner. Here the customer has to place the product near camera which is located in the trolley to scan the product before placing inside the trolley. Camera will automatically take the image of the product. The image of the product will be checked with the image already stored in database using the Open CV BF Matcher method. The weight load will measure the weight of the product finally placed inside the trolley and it will calculate the total weight of the trolley.

The image scanned will be taken and according to the product ID, price and weight of the product details will be taken from the database and the weight will be check with the measured weight calculated by the weight scanner. After the verification, if both weights are same then the product ID, weight, price of the product will be shown in the screen. After scanning all items, it will show the list of items in the trolley with the above-mentioned details. Finally, it will calculate the total amount to be paid for the items in the trolley.
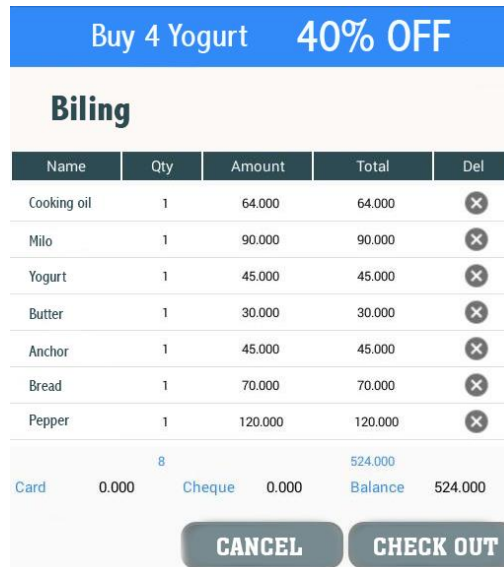

Figure 2.2: Smart trolley

2.2.1 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.

- The smart trolley should be easy to use.
- Camera and touch screen device must be fitted to display all product and prices scanned.
- The product search device can be linked to the store database.

Advantage of this product is that it makes shopping a lot easier, more flexible and saves time. The smart trolley will be designed with touch screen and application. Figure 2.2 shows the design of a user interface that should be used in the Smart Trolley.

Figure 2.3: User Interface Design

2.2.2 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.

It contains product Image, information, availability and pricing. Connection to the database is user friendly with a simple and interacting interface. The present design allows the tills and self-service checkout to have direct access to the store database because they are all directly connected to the network with the database server. The touch screen on the Smart Trolley will also operate in similar way through wireless access. All the Smart Trolleys will be directly and securely connected to the store Wireless Local Area Network (WLAN). It has access to the supermarket and online access to the company centralized database.

The design requirement includes:

- Designing and installing a modified till application on raspberry pi.
- Update the existing database.
- Connection to the database. This is a set of programing instructions that enables the application on the raspberry pi to access the database server.

2.2.3 Scanning Products

The Smart Trolley will have an image processing [19] technology. It is connected with raspberry pi. Products are scanned very quickly and efficiently through communication based on the IUP system.

The combination of camera and raspberry pie system allows you to scan the item and send it to the store database, and then register the detection between the system by sending the product details to the supermarket database, and it is automatically displayed on LED screen.

Product scanner helps customers to remove already scanned products without any problem. The customer can re-scan and delete the products that have already been scanned and put them on the shelf and continue shopping.

2.3 System Overview

The system developed is the automatic billing for a customer during shopping primarily focused on Image Processing assisted with other basic technologies. In shopping malls or supermarkets, Customer can easily scan the products to purchase. The shopping trolleys include the setup containing Camera, Weight load, power supply, raspberry pi, Touch screen. Figure 2.3 describe the system overview of the proposed system.
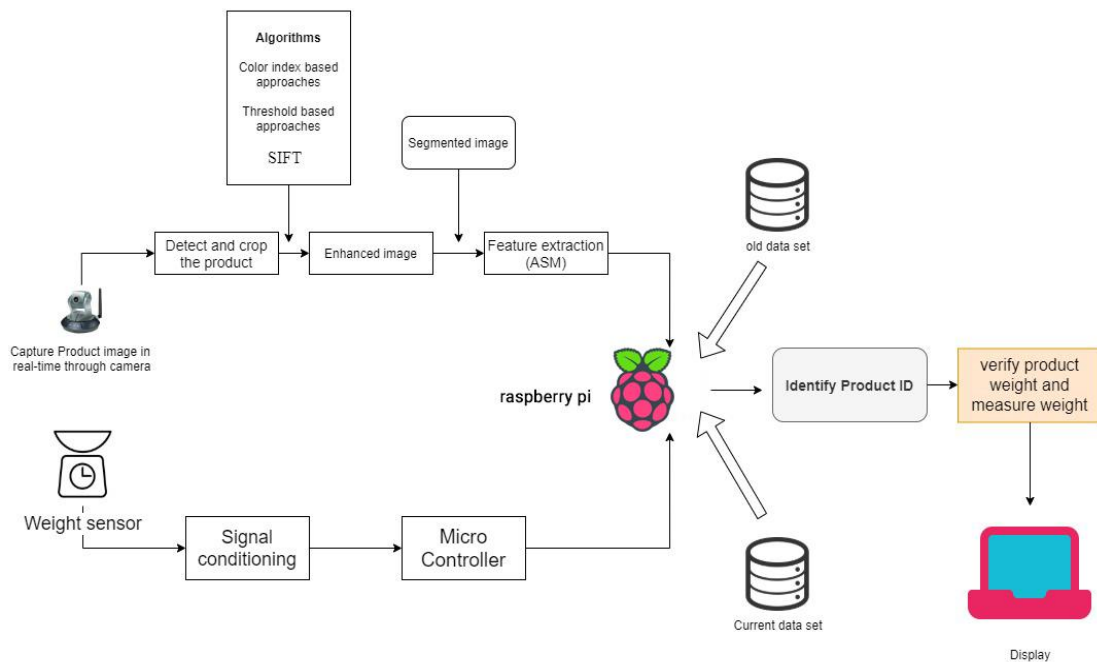

Figure 2.4: System overview diagram

2.4 Resources Needed

2.4.1 Software Boundaries

- **Pycharm**

  Pycharm is the fundamental tool used for developing the application. Pycharm is mainly used for python language to development of Image Processing part.

- **MY SQL**

- **OpenCV (Library)**

  In this project we are checking quality of object using Image Processing. Instead of Python we will use OpenCV Software. OpenCV (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. OpenCV also include statistical machine learning library.

- **Tensorflow**

2.4.2 Hardware Boundaries

Hardware Requirements the developed application should run without any problems. We have identified some hardware requirements for design, implementation and testing purposes. Such as,

- **Raspberry pi**

  The purpose of using the Raspberry pi 4 is to confirm the image taken by the camera and the measure product weight by weight load in the database with the help of python program.

Figure 2.5: Raspberry pi 4

- **Touch screen**
  The Raspberry Pi4 display is a flat touch display used to illustrate product and billing details. The name and price of the product details are displayed the LED display. The display screen is attached to the trolley and connected to the raspberry pi.

Figure 2.6: Raspberry pi touch screen

- **Camera**
  Camera is used to capture object images horizontally and vertically with accuracy. The camera is attached and placed on a trolley to the raspberry pi. We are using Raspberry pi camera module. This is a 2 MP camera. It has DSI port.

Figure 2.7: Raspberry pi camera module

- **Weight load**
  A weight load is used to transform an analog output voltage, a power, into an electrical signal. Weight load is used to measure the weight of the products. The weight load measure the product weight and transfer the measurements to the raspberry pi.

Figure 2.8: Weight load (20kg)

2.5 The Conceptual Theoretical Framework

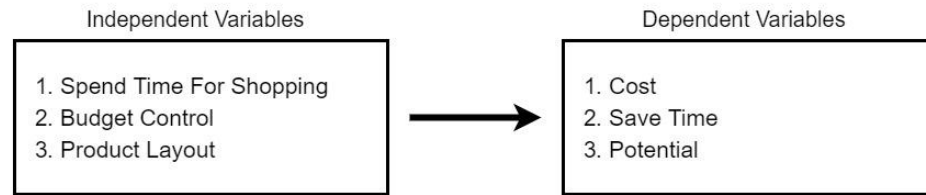This report's suggested conceptual theoretical framework is as follows

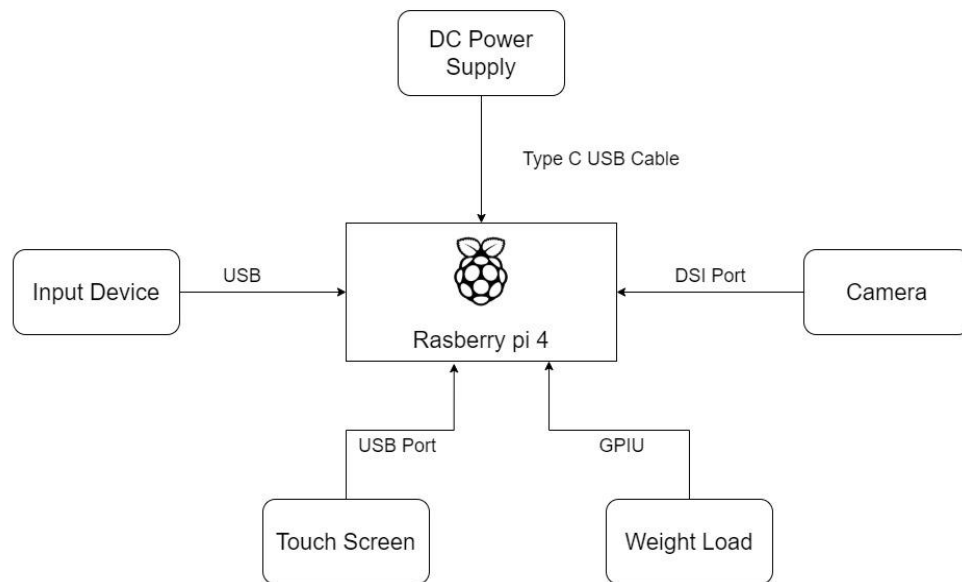Figure 2.9: Conceptual theoretical structure

2.5 Block Diagram

Figure 2.10: Block Diagram
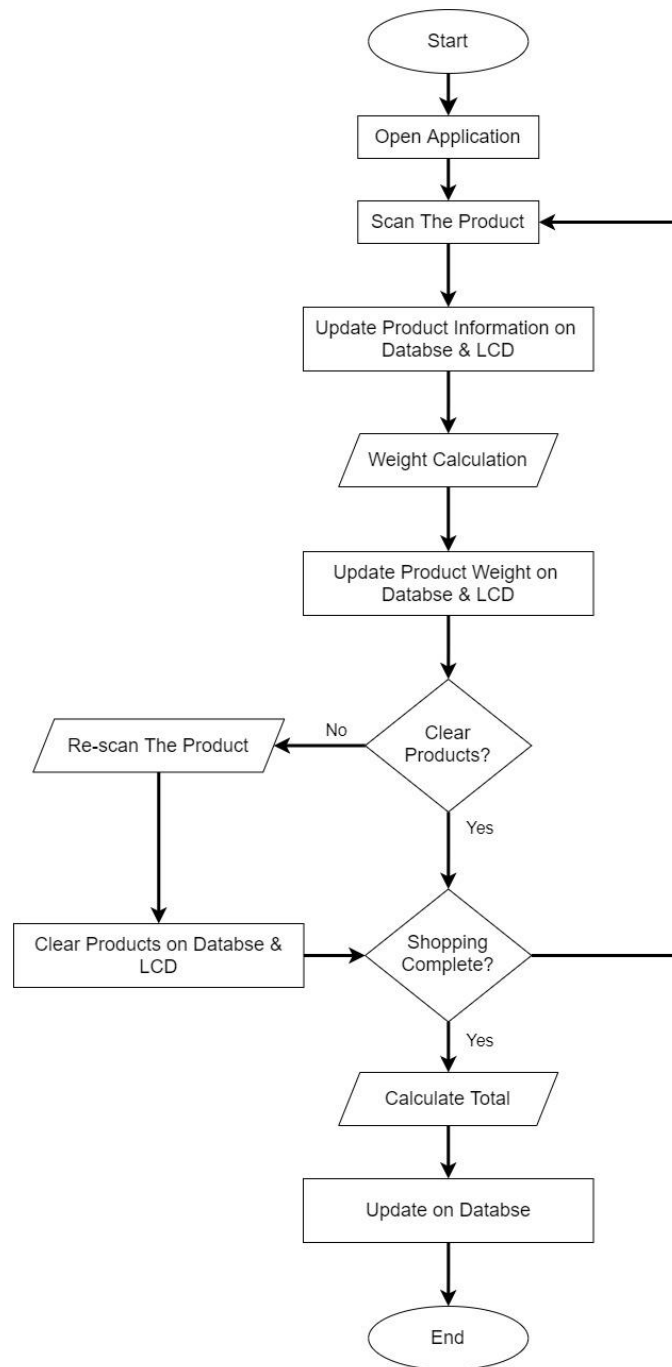
2.6 Control Flow Diagram

Figure 2.11: Control Flow Diagram

2.7 Commercialization aspects of the product

The proposed system would be useful for the two main groups. They are Supermarket, Who the customers are waiting in the queue to bill payment. Apart from that, the size of the supermarket is increasing. As well as the number of visiting customers is gradually increasing. This is because most people find it much easier to shop at the supermarket than at the grocery store. No need to wait in queue for billing after purchase. They can pay their bill themselves and leave the supermarket. Therefore, supermarkets or hypermarkets can use this system as their business strategy. It will also help increase customer satisfaction and increase the business value of the supermarket.

2.7.1 Business Pitch

As the number of customers in any supermarket increases so does the time it takes for the customer to pay the bill. This system can be used in all supermarkets in such cases.

What is the need to use this system in business arena?

- System will save the time of the customer.

- Faster shopping system for attracting customers.

- System will increase the business value of the supermarket.

3. TESTING & IMPLEMENTATION RESULTS & DISCUSSION

3.1 Training stage

In the training stage, training is provided for static images of the created database. In this case, each time the product is scanned, the photo taken at that angle will be uploaded to the CSV file in the database.

3.2 Testing stage

Each time the product is scanned, the product must be correctly identified. In this case matching code algorithms are used to test the product image in the database.

Table 3.1 : Test case

Test id	Test description	Expected result	Actual result	Test status
1	Results based on image processing	The system finds the shape of the product successfully	As expected	Pass
2	Results based on weight sensor	The system compares the actual weight of the product and the weight measured by the weight sensor successfully	As expected	Pass

3.3 Result

For real-time object recognition, the display, camera and weight load created are shown in the figure 3.1 below.

Figure 3.1: Real time system

4. CONCLUSION

This program creates an automated billing system for supermarkets using the Raspberry pi, camera and weight load. Customers can scan and bill the goods themselves on camera. Based on that we reduced the waiting time for billing. And we do not need to employ too many workers in the billing counter.

The automated shopping trolley for the supermarket billing system has moved fast in current year. Humans have designed and improved themselves through technological tools and artworks. Humans are always trying to develop technological tools that meet their basic needs easily and quickly. Time is frugal because people are not able to spend a lot of time shopping. People flock to the supermarket every day for this cause. Even though shopping at the supermarket saves time, people only get time on weekends to visit the supermarket. This is because the customers are waiting longer than the real shopping time in the billing queue. So, people face difficulties at the cash counter.

Smart Trolley aims to function as a small self- checkout system that provides users with adaptive capabilities to make easy transactions in the supermarket. This would be exceptionally effective and should be fully synchronized with the current structure of the supermarket.

In the smart trolley system, customers do not have to wait in queue for his/her turn to scan products. Especially on weekends or festivals, there is no need to waste time in queue and use no extra staff in the billing section. The customer can make the billing in the payment area and those customers can use the smart trolley. Therefore, supermarkets or shopping malls can use this concept as their business strategy.

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