SMART TROLLEY FOR SUPERMARKET SYSTEM

Using Machine Learning and image Processing

2020-78

IT17095136 | P.Satheesan
IT17037648 | S.Nilaxshan
IT17386296 | R.Thisanthan
IT17033374 | R.Priyanka

Introduction

- Electronic commerce has developed to such an extent to provide convenience, comfort, and efficiency in day-to-day life.
- Supermarket is a place where individuals get their everyday necessities[1].
- Lots of people spending too much of time in the supermarket to purchase their goods.
- The study aimed to provide a smart trolley for a supermarket which helps the customers to get benefit through the system.
- Techniques such as recommendations, voice assistant, Loyalty customer Program, image processing are used in order to enhance the performance of a smart trolley.

Research Questions

- How to achieve faster billing system?
- How to know about present day offers?
- How to recommend products to the customers?
- How to allow access to trolley?

Objectives

Main Objective

Developing a smart trolley for the enhancement of supermarket for the benefit of the customers.

Specific Objectives

- Achieving faster billing system
- Helps customer to know the bill details in advance.
- Providing details about present day offers
- Recommending personalized items to customers.
- Allow access to trolley using loyalty card.

Main Components

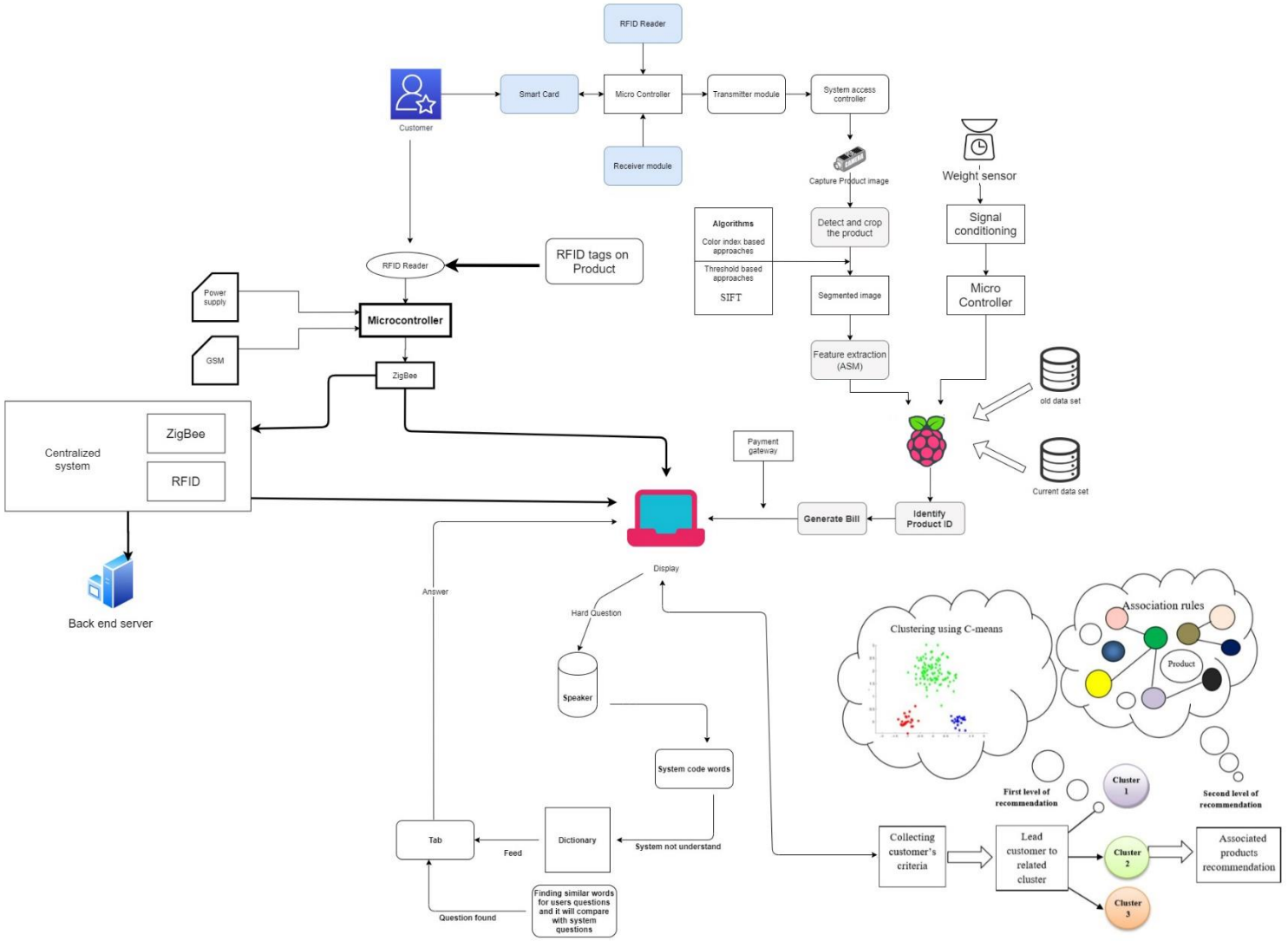
01 Loyalty Customer Program & Checkout Alert

02 Image Recognition & Weight Sensor

03 Product Recommendation

04 Voice Assistant

Overall System Diagram



Compare Existing Systems

	Online Payment	Loyalty Customer Program	Weight sensor	Detect Product Image	Recommendation	Voice Assistant	Location
Smart Cart with Automatic Billing, Product Information, Product Recommendation Using RFID & Zigbee with Anti-Theft[1]	✓	✓	✗	✓	✓	✗	✗
Modelling of Future Automatic Trolley System based on Sensors and Image Processing Guidance for Supermarket[2]	✓	✓	✗	✓	✗	✗	✗

Compare Existing Systems

	Online Payment	Loyalty Customer Program	Weight sensor	Detect Product Image	Recommendation	Voice Assistant	Location
RFID Based Smart Trolley for Supermarket Automation [3]	✓	✗	✗	✓	✗	✗	✗
Automated Smart Trolley for Supermarkets [4]	✓	✗	✗	✓	✗	✓	✗
Smart Trolley using Smart Phone and Arduino[5]	✓	✓	✗	✓	✗	✗	✗
The research	✓	✓	✓	✓	✓	✓	✓

Product Recommendation

IT17095136 | P.Satheesan

B.Sc. Special (Hons) in Information Technology

Research Problem

- Supermarket customers find difficulties to choose products from a large variety of products.
- Predict whether or not the customers purchase accessories are related to the products they tend to buy.

Background/Research Gap

	Recommendation for new customers	Collaborative filtering	Association Rule Mining
Basket-Sensitive Personalized Item Recommendation[6]	✗	✗	✓
A Product Recommendation system using vector space model and Association Rule[7]	✓	✗	✓
A real time targeted recommender system for supermarket[8]	✗	✓	✗
Development of a recommendation system based on navigational and behavioral patterns of customers in e-commerce-sites[9]	✗	✓	✗
Enhancing product recommender systems on sparse binary data[10]	✗	✓	✓

	Recommendation for new customers	Collaborative filtering	Association Rule Mining
Dihedral Product Recommendation System for Ecommerce Using Data Mining Applications[11]	✗	✗	✓
Large Scale Product Recommendation of Supermarket Ware Based on Customer Behavior Analysis[12]	✗	✗	✓
Market Basket Analysis for a Supermarket based on Frequent Item set Mining[13]	✗	✗	✓
Opinionated product recommendation[14]	✗	✗	✗
The Research	✓	✓	✓

Research Questions

- How to recommend products to new customers?
- How to find the relationship between users?
- How to find the relationship between products?

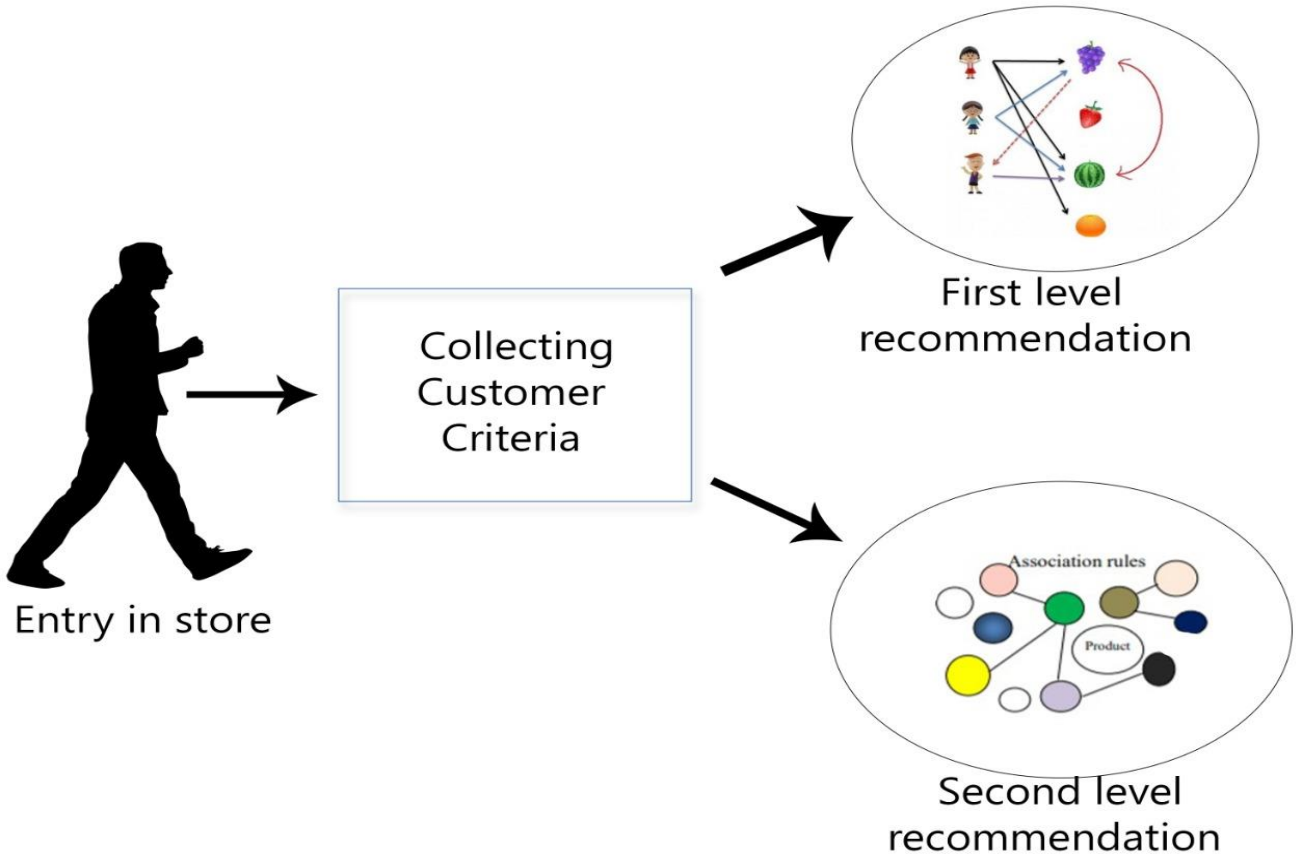
Main Objectives

Recommending personalized items to customers in-order to eliminate inconveniences arising from delay and confusion in searching.

Specific Objectives

- Implementing the first level of recommendation in prior to choose a product .
- Implementing the second level of recommendation in consequent with the choosing of product .
- Recommending the products to new customers.

Methodology



Two levels of Recommendation

- First level of product recommendation is prior to choose a product.
  - Item-Based Collaborative filtering
  - User-Based Collaborative filtering

- The second level of product recommendation in consequent with the choosing of product selection where potential relationships between products are discovered using association rules mining.

Recommendation for New customers

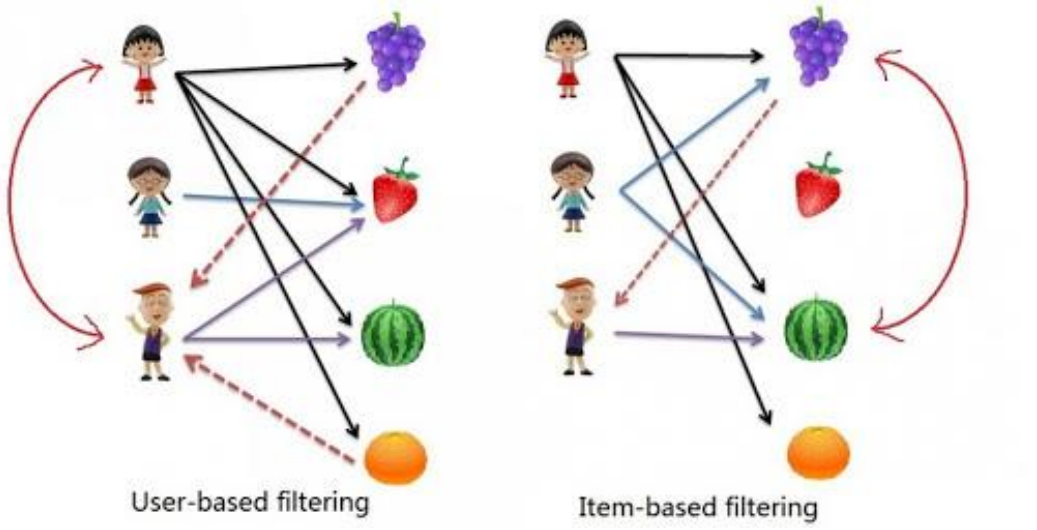
- New customers have no previous purchase history.
- Therefore, the system recommends the most popular products to them.
- Most popular products are identified by the ratings given by the existing customers of the supermarket.

Recommendation using Product Description

- This product recommendation is applicable when new supermarket or new customer which means it has no purchase history or product ratings.
- The product recommendation based on textual clustering analysis given in product description.

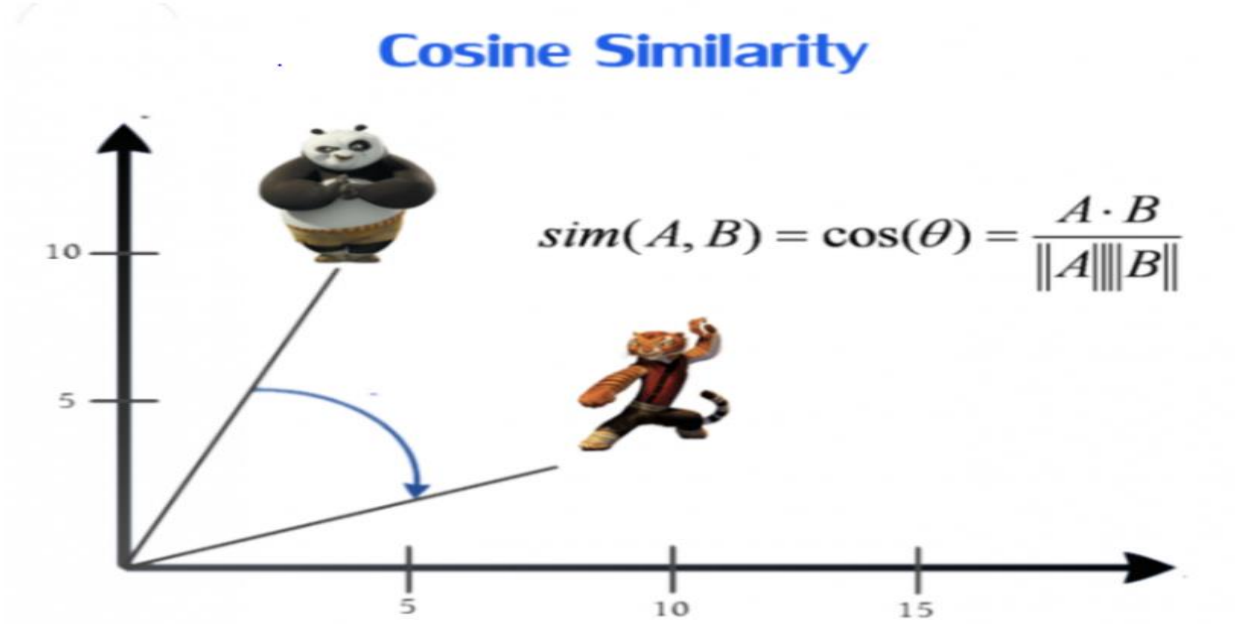
Recommendation using Collaborative filtering

Recommend products to customers based on purchase history and similarity of ratings provided by other users who bought items to that of a particular customer.



Cosine Similarity

Cosine similarity is a metric used to measure how similar the two items or two users are.



User-Based Product Recommendation

- Calculation of similarities between two users using cosine similarity.
- User-to-User similarity matrix is built by iterating through all user pairs and computing similarity metric for each pair.
- Recommendation to User B depends on User A buying pattern.
- Items recommend to B= Items bought by A- Items bought by B

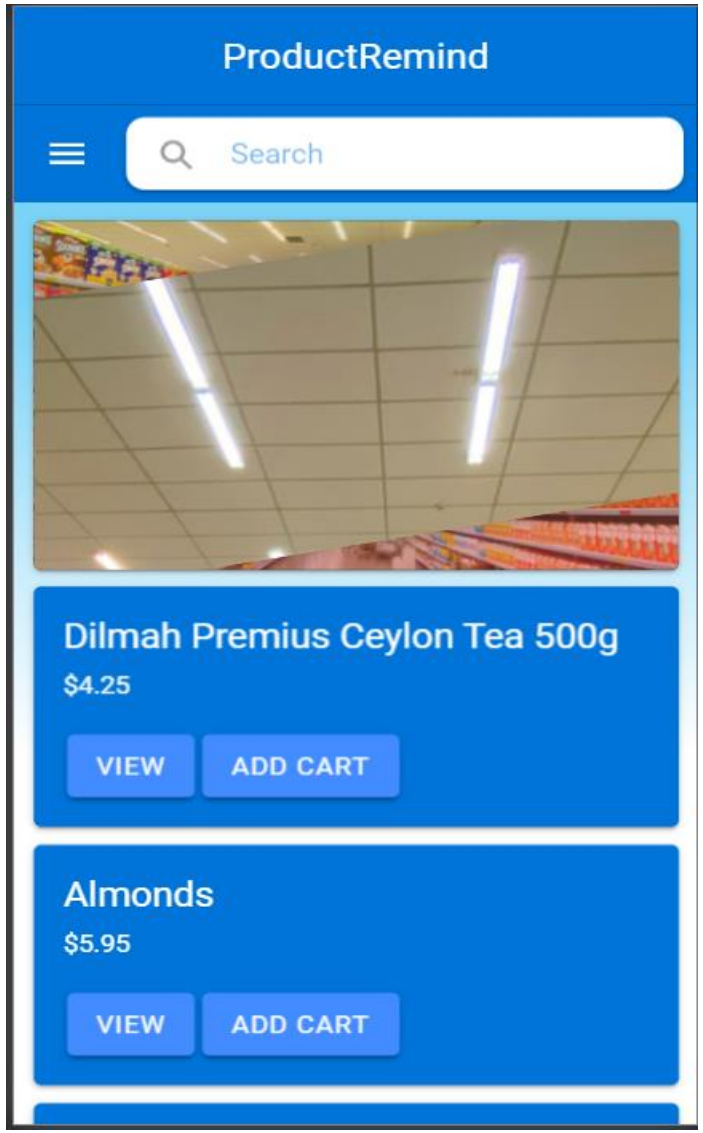
Item-Based Product Recommendation

- Calculation of similarities between two items using cosine similarity.
- Item-to-Item similarity matrix is built by iterating through all item pairs and computing similarity metric for each pair.

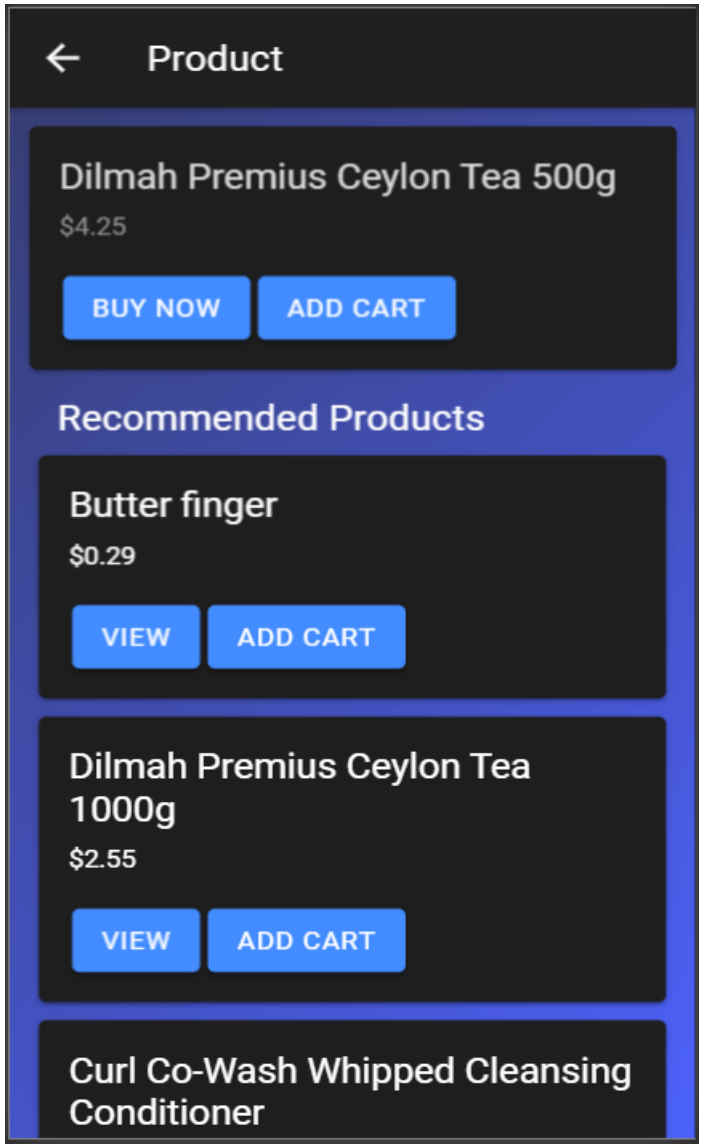
Association Rule Mining

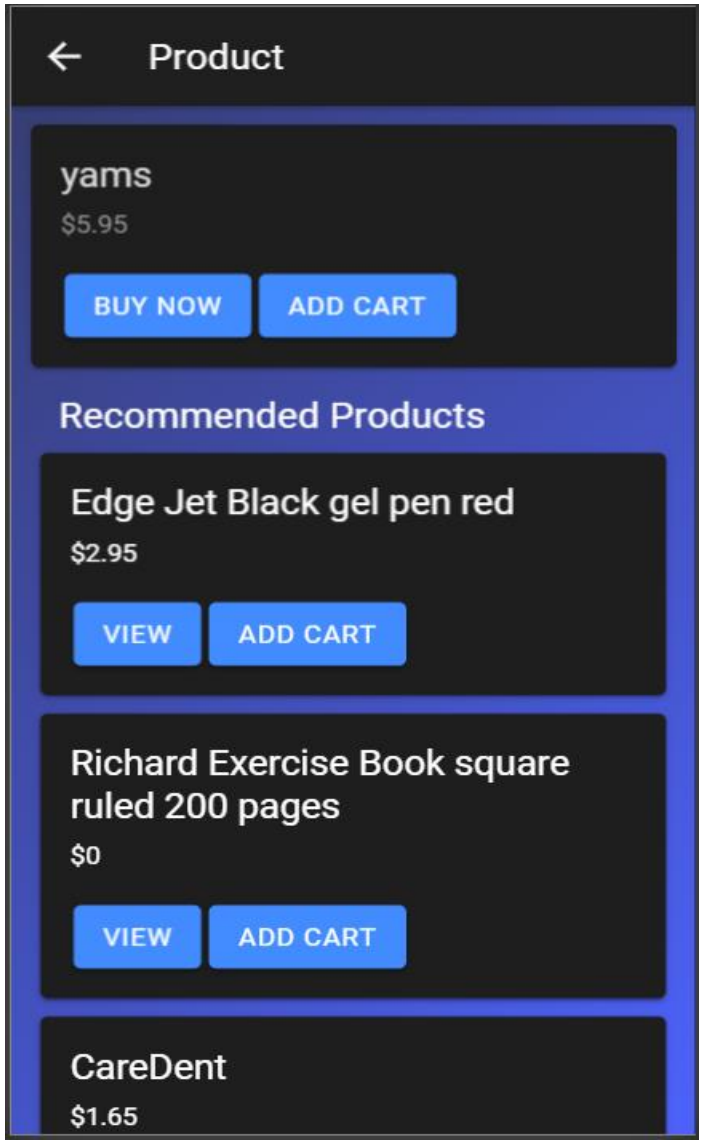
- Recommends the associated products with the desired product of customers to complete the buying process.
- K-Apriori Algorithm is used.

Results

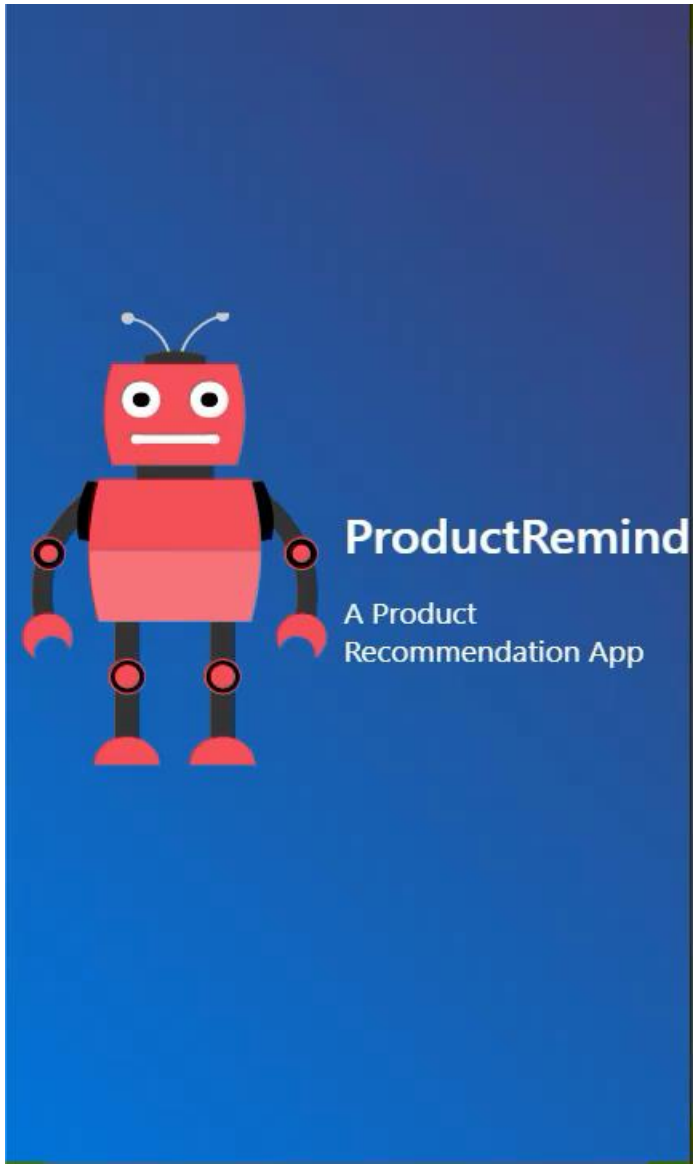

ProductRemind
Search
Dilmah Premius Ceylon Tea 500g
$4.25
VIEW
ADD CART
Almonds
$5.95
VIEW
ADD CART

Results


Product
Dilmah Premius Ceylon Tea 500g
$4.25
BUY NOW
ADD CART
Recommended Products
Butter finger
$0.29
VIEW
ADD CART
Dilmah Premius Ceylon Tea 1000g
$2.55
VIEW
ADD CART
Curl Co-Wash Whipped Cleansing Conditioner


Product
yams
$5.95
BUY NOW
ADD CART
Recommended Products
Edge Jet Black gel pen red
$2.95
VIEW
ADD CART
Richard Exercise Book square ruled 200 pages
$0
VIEW
ADD CART
CareDent
$1.65

Demo video



Achievement

Loyalty Customer & Check-out Alert

IT17037648 | S.Nilaxshan

B.Sc. Special (Hons) in Information Technology

Research Problem

- Usually customer search the product on supermarket for long time. Because they don't know the product location in supermarket
- In bill counter customers waiting for long time for billing
- How to access the trolley

Research Gap

	Loyalty card access	Self – payment checkout alert	Product location finding
Modelling of future trolley system	✗	✗	✗
RFID Based Smart Trolley for Automatic Billing System	✓	✗	✗
AUTOMATED SHOPPING TROLLEY FOR SUPER MARKET BILLING SYSTEM	✗	✓	✗
Multiple Object Detection using OpenCV on an Embedded Platform	✗	✓	✗
Deploying an Interactive GIS System for Facility	✗	✗	✓

Research Gap

	Loyalty card access	Self – payment checkout alert	Product location finding
SMART TROLLEY USING RFID	✓	✗	✗
RFID-SHOPPINGTROLLEY	✓	✗	✗
The Research	✓	✓	✓

Research Objective

- Loyalty card access
- Self – payment checkout alert
- Product location finding

Background

- Smart Trolley System is a Super Market Trolley will be 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.
- In the above system, each customer is uniquely identified by a loyalty card (RFID Cards)
- RFID Cards used to access trollies at supermarkets.
- If more than 5 people in the line system will alert do a self-checkout.

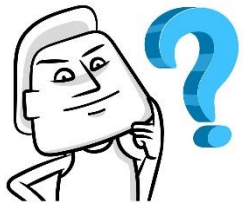
Knowledge Gap

Research Question

1. How to access the trolley ?

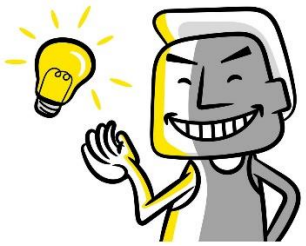
2. What is benefit of using the Loyalty card?

3. How to customer maintain their profile and earn point?



Creative Solution

- Using the Loyalty card (Have RFID).
- Customer can access the trolley. can get points for every shopping. Loyalty customer can easy to know about the discounts and can buy the product in low price.
- Using the Loyalty card system.



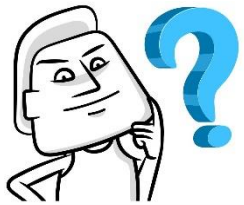
Knowledge Gap

Research Question

4. usually customer search the product on supermarket for long time. What's the reason?

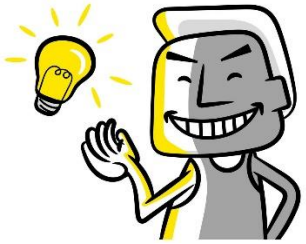
5. What is the solution for find the product easily ?

6. In bill counter customers waiting for long time for billing. What is the solution for this?

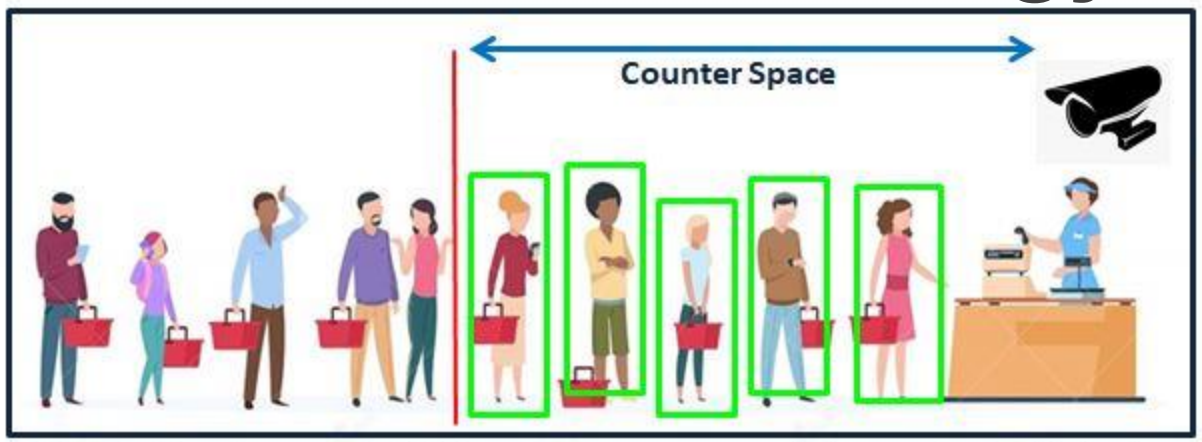


Creative Solution

- Usual customers mostly know the location, but new customers don't know about the product location. That's why they take a long time.
- We create a product location finding in here. If customer search the product ,product location displayed in trolley LCD.
- In counter if more than 5 people in the line system will alert do a self-checkout.



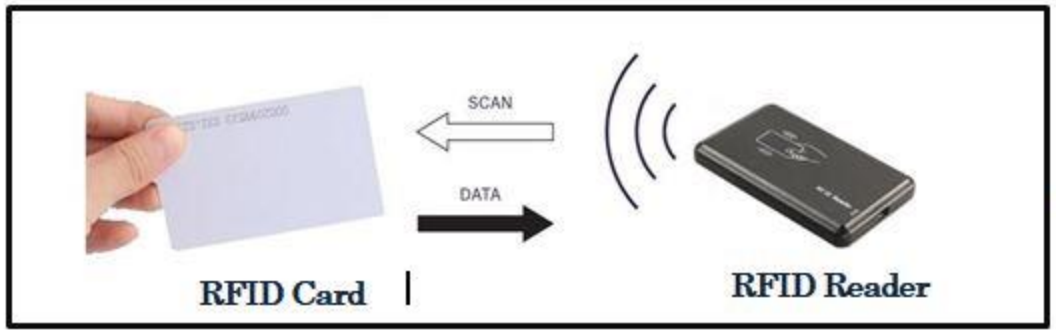
Methodology



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

Alert on display

Trolley Display



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

Data transfer

Loyalty card access

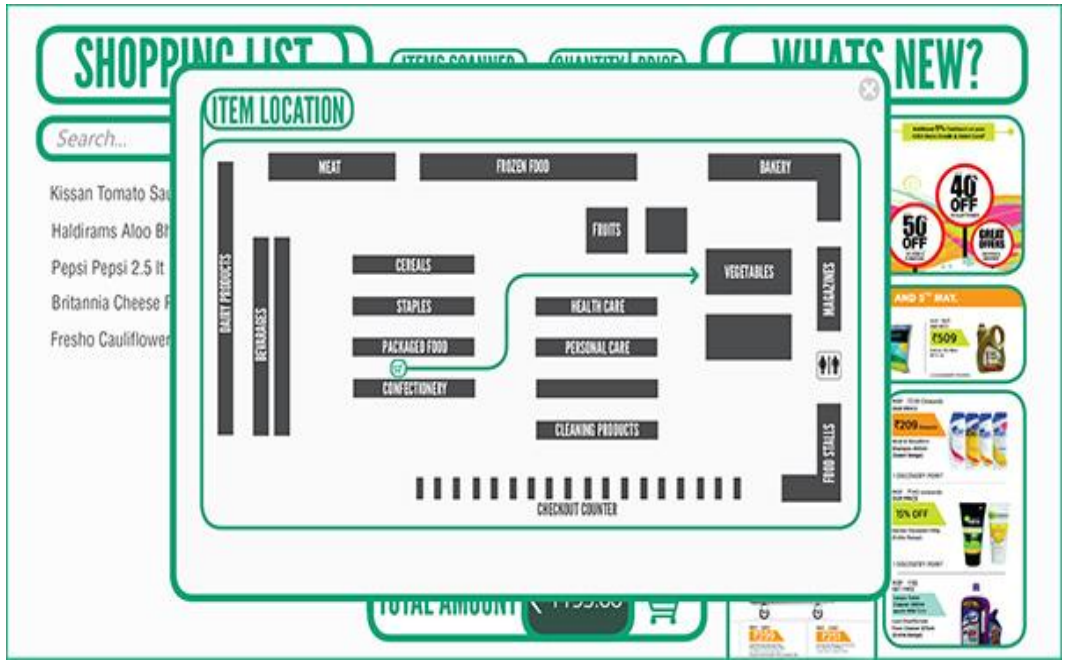
- When customer punch the Loyalty card (RFID card) near the trolley RFID reader, it will find the loyalty customer details and customer can access the trolley.
- RFID reader will get the card access and send it to the micro-controller.
- The micro-controller then sends the card details to the transceiver, 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

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 can extract the number of people who are

Product location finding

- Location of each product is already fed into the database
- when customer search for the product, product location will be display in category base.



Achievement

Image Processing And Weigh Load

IT17386296 | R.Thisanthan

B.Sc. Special (Hons) in Information Technology

Background

- 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.

- Customer can bill their purchase using a Graphical User Interface on a LED screen linked to a camera, weight sensor and Raspberry Pi.

- 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.

Research Gap

	Smart Trolley for Automatic Billing System	RFID Based Automatic Billing Trolley	Smart Shopping Using Wireless Sensor Networks	A smart trolley with RFID implementation
Camera	✗	✗	✗	✗
Raspberry pi	✗	✗	✗	✗
LCD screen	✓	✗	✗	✗
Weight sensor	✗	✗	✓	✓
Arduino	✓	✓	✗	✓
Bar code Scanner	✗	✓	✓	✓
RFID	✓	✓	✓	✓

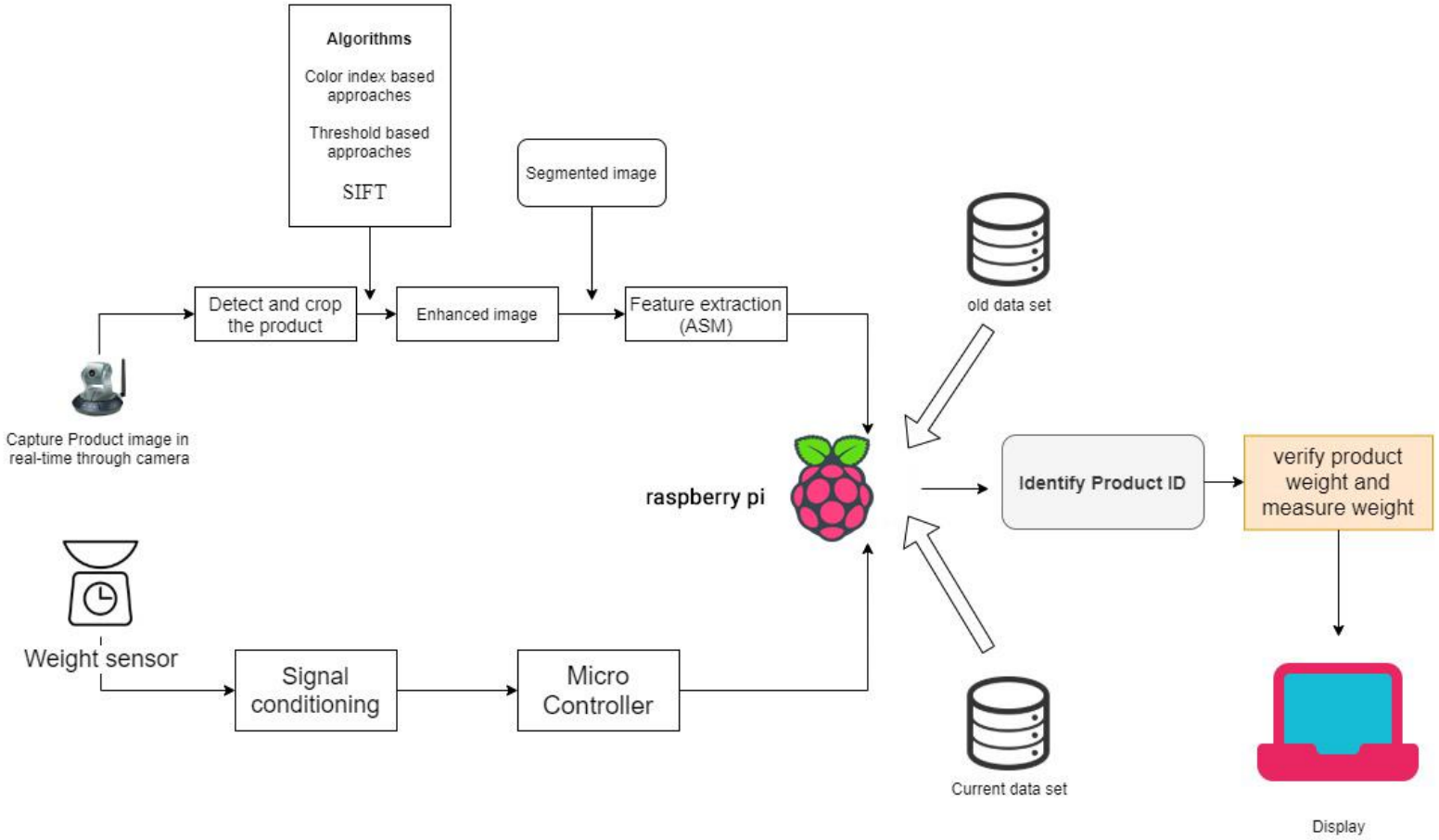
Research Question

1. How to make purchases easier?
2. How to reduce the time customers spend at the billing counter?
3. How to reduce the human workers at the billing counter?
4. How to scan (purchase) the products easier?
5. How to validate the actual weight and estimated weight of the product?

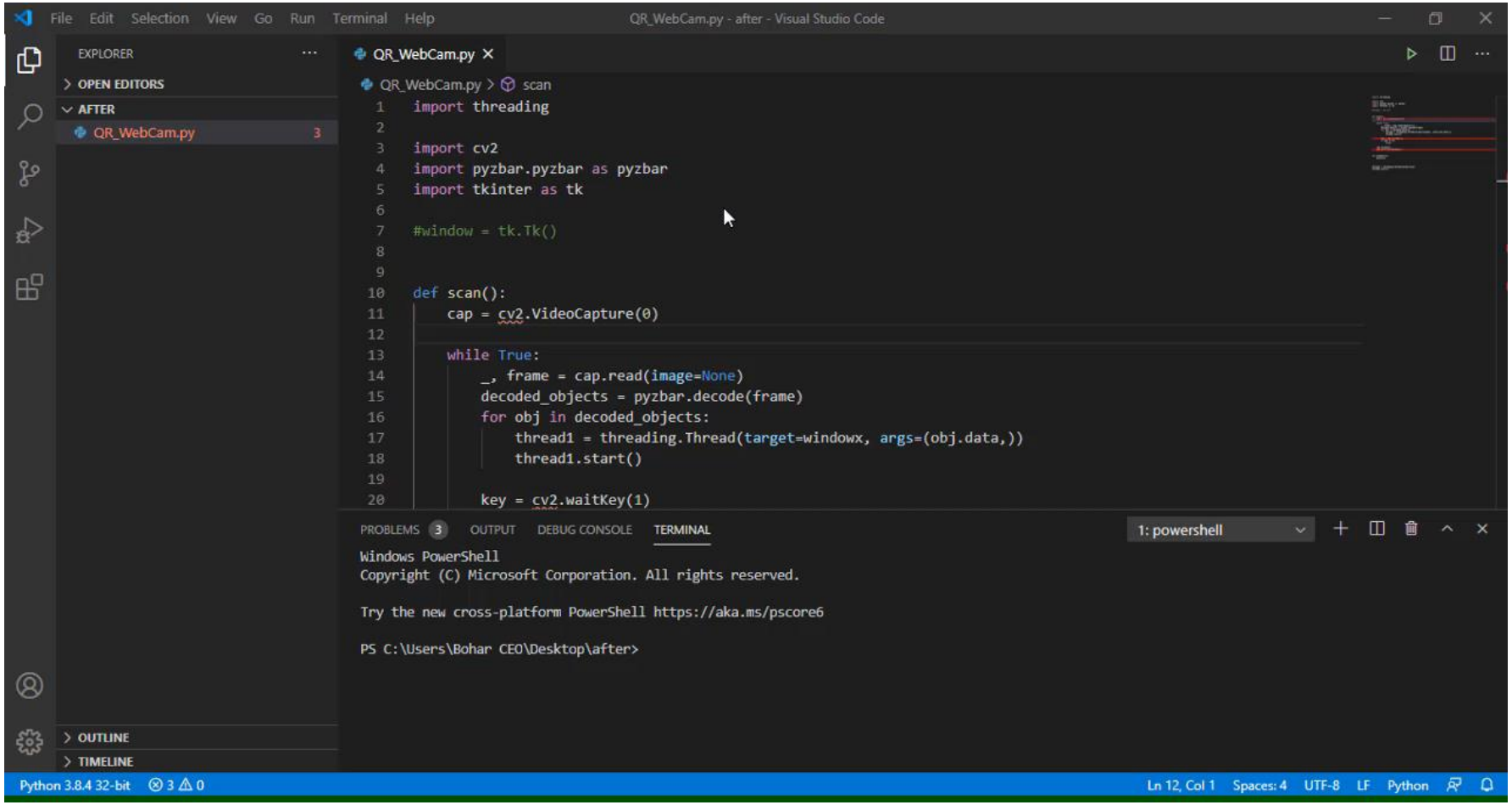
Specific and Sub Objectives

- The main objective of this project is to reduce the time taken in the supermarket billing counter.
- Customers can make self-checkout and to reduce the number of human workers needed in the billing area.
- The image comparison algorithm helps customers can quickly scan items in the trolley.

Methodology



Demo


File Edit Selection View Go Run Terminal Help
QR_WebCam.py - after - Visual Studio Code
EXPLORER
OPEN EDITORS
AFTER
QR_WebCam.py 3
QR_WebCam.py
QR_WebCam.py > scan
import threading
import cv2
import pyzbar.pyzbar as pyzbar
import tkinter as tk
#window = tk.Tk()
def scan():
cap = cv2.VideoCapture(0)
while True:
_, frame = cap.read(image=None)
decoded_objects = pyzbar.decode(frame)
for obj in decoded_objects:
thread1 = threading.Thread(target=windowx, args=(obj.data,))
thread1.start()
key = cv2.waitKey(1)
PROBLEMS 3 OUTPUT DEBUG CONSOLE TERMINAL
1: powershell
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.
Try the new cross-platform PowerShell https://aka.ms/pscore6
PS C:\Users\Bohar CEO\Desktop\after>
OUTLINE
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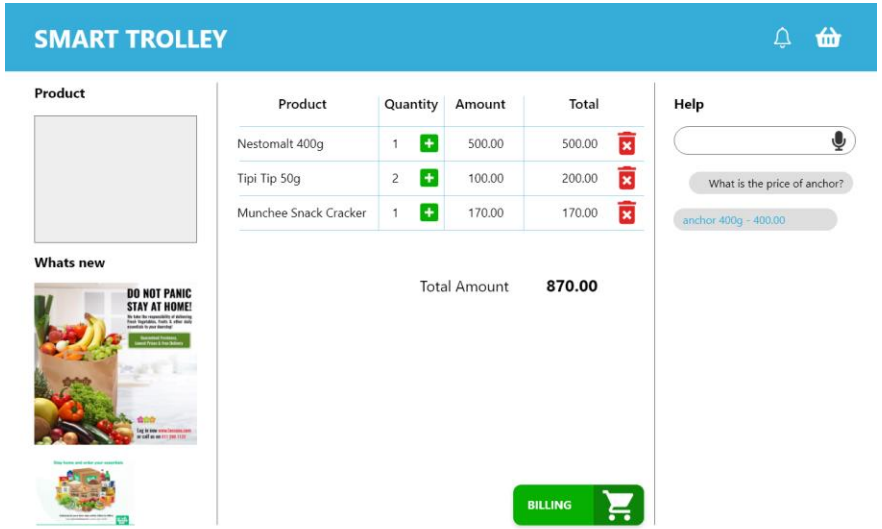
Achievement

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.



Achievement

Voice Assistant

IT17033374 | R.Priyanka

B.Sc. Special (Hons) in Information Technology

Background/Research Gap

- Implement the speech to text
- Implementing questions and answers
- Facebook sentence embedding

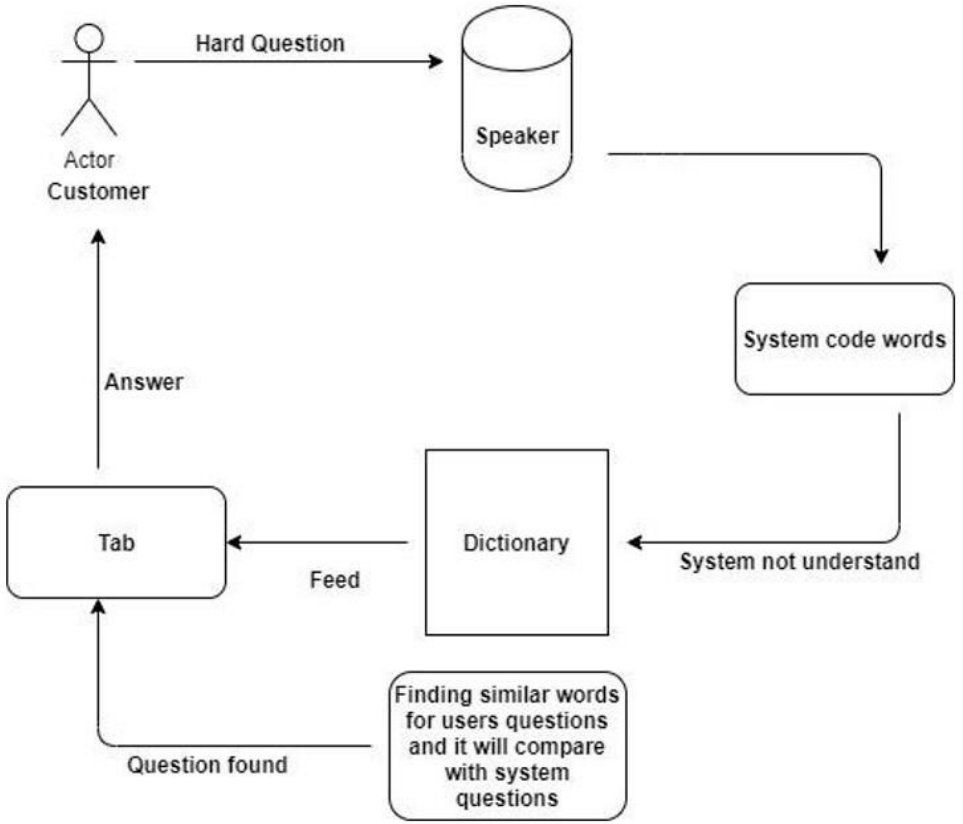
Research Question

- What are new technologies and advancements used in this system?
- How to promote and establish this system to real world?

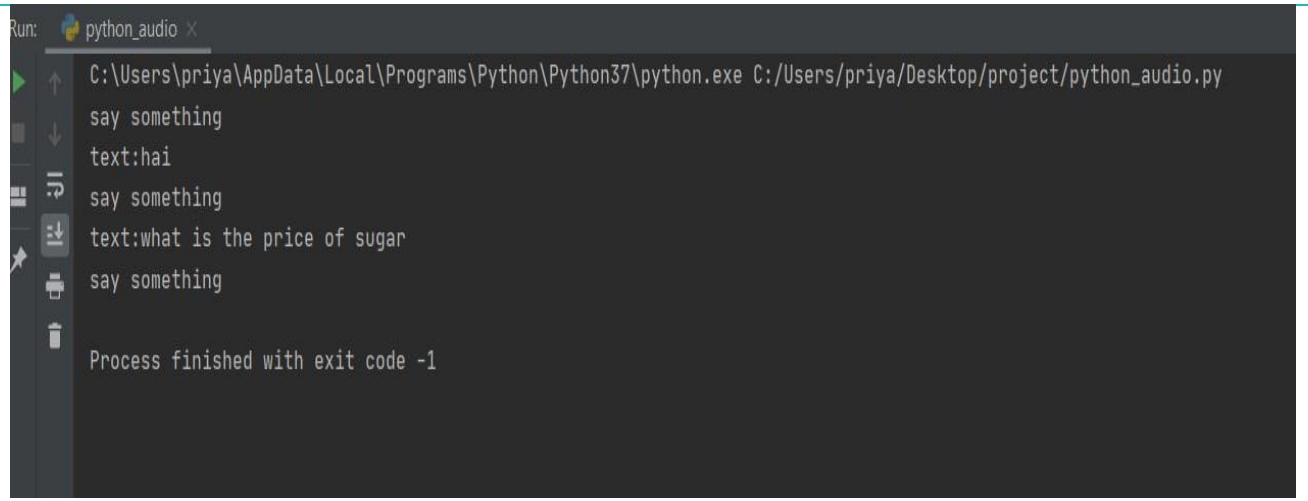
Specific and Sub Objectives

- Let the user to ask queries using microphone
- Voice assistant will check the queries with the answers already implemented in the database.
- If the user use similar words which cannot be identified by voice assistant it will check the dictionary connected to the voice assistant about the meaning and give the answers according to that and give answers with the text message
    - Ex: price =cost

Methodology



Achievement



- Speech to Text
- Creating a question and answer data bank through crowd sourcing
- Embed the questions using infer sent, a word embedding tool by face book
- Create different classifier models and empirically identify the best models.
    - infersent%s.pkl

Achievement

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