SMART TROLLEY FOR SUPERMARKET SYSTEM

Using Machine Learning and image Processing

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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

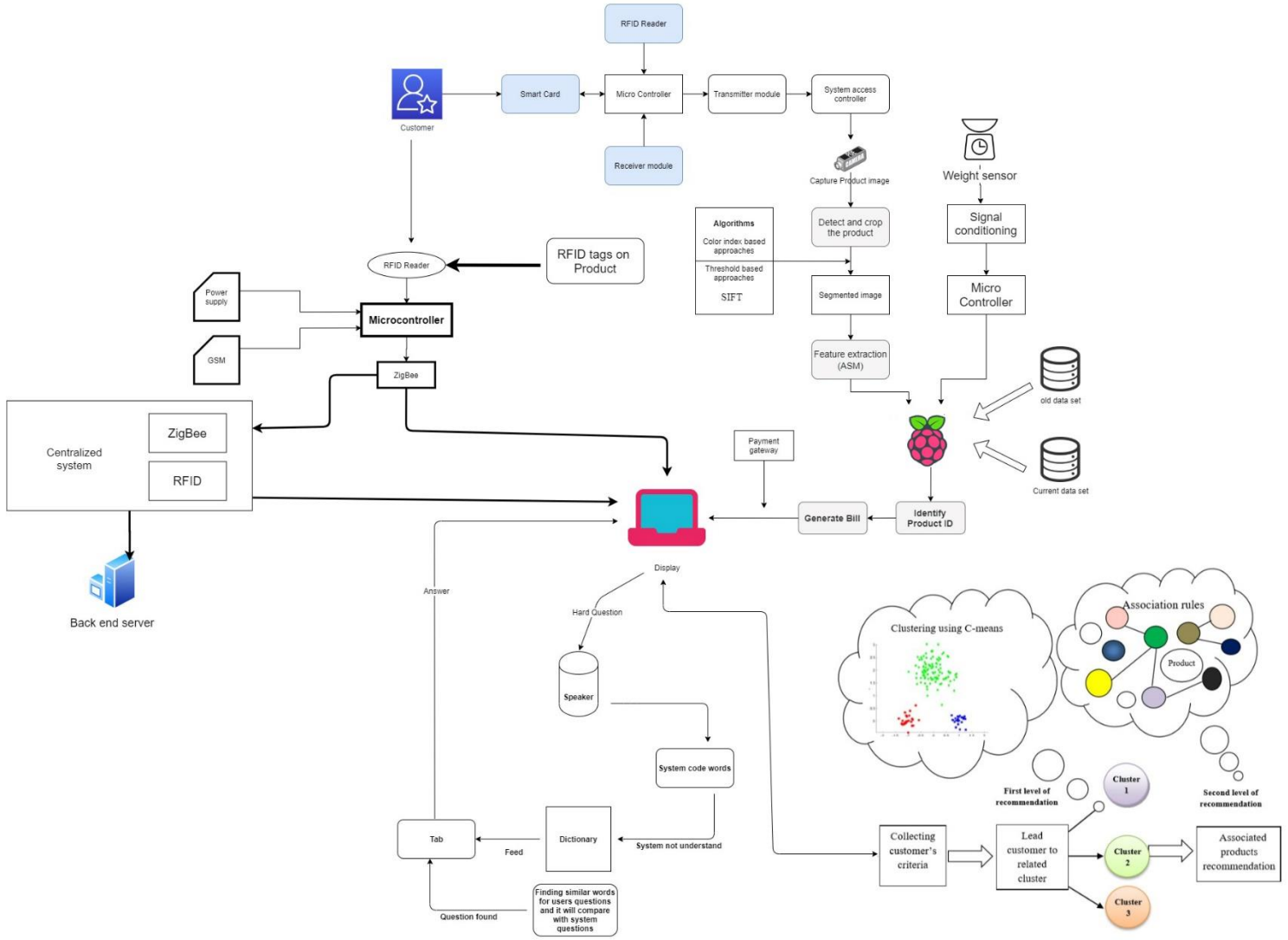
01 Loyalty Customer Program & Checkout Alert

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

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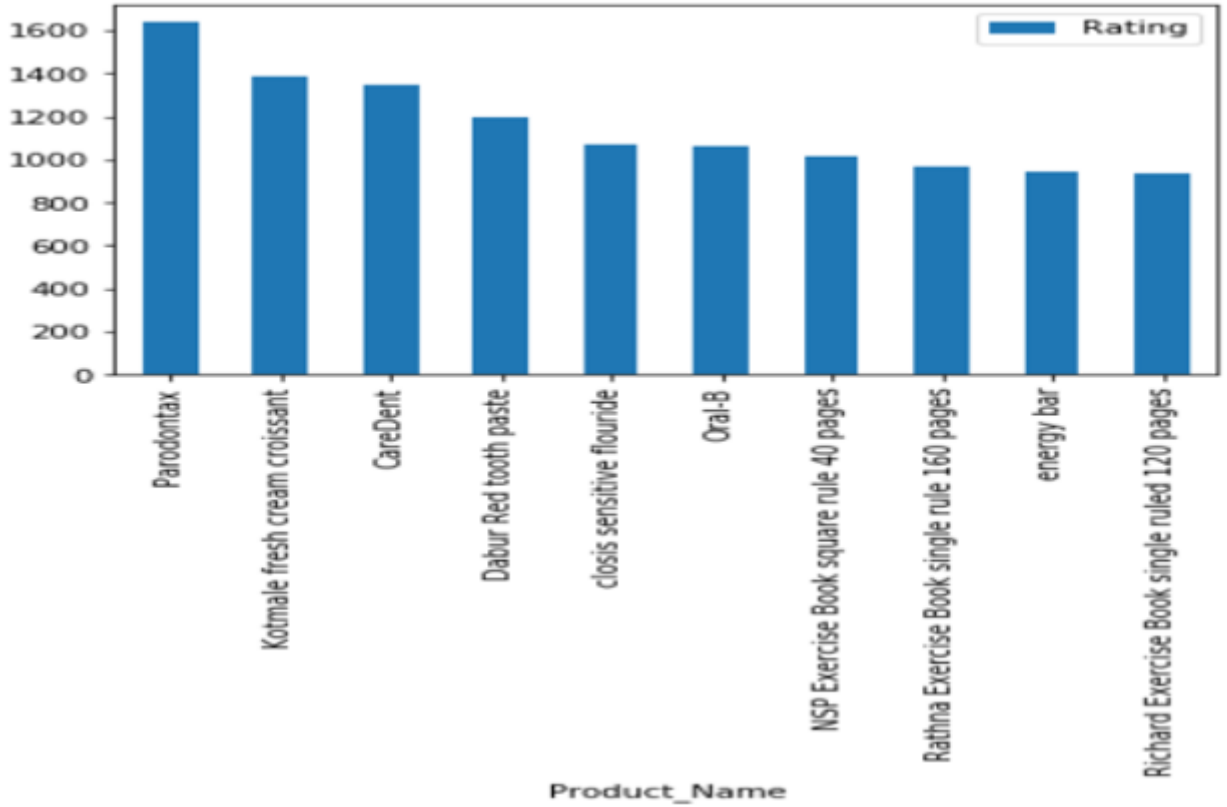
Two levels of Recommendation

- Before choosing product
- After choosing product

Recommendation for New Customers

- This recommendation is for the new customers of the supermarket.
- 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.

Recommended list for new customers



Recommendation using Product Description

- This product recommendation is applicable when new supermarket or new customer which means it has no purchase history and product

- The product recommendation based on textual clustering analysis given in product description.

- K-means clustering used in-order to find top words in each cluster based on product description
- In case a word appears in multiple clusters, the algorithm chooses the cluster with the highest frequency of occurrence of the word.
- The recommendation system display items from the corresponding product clusters based on the product descriptions.

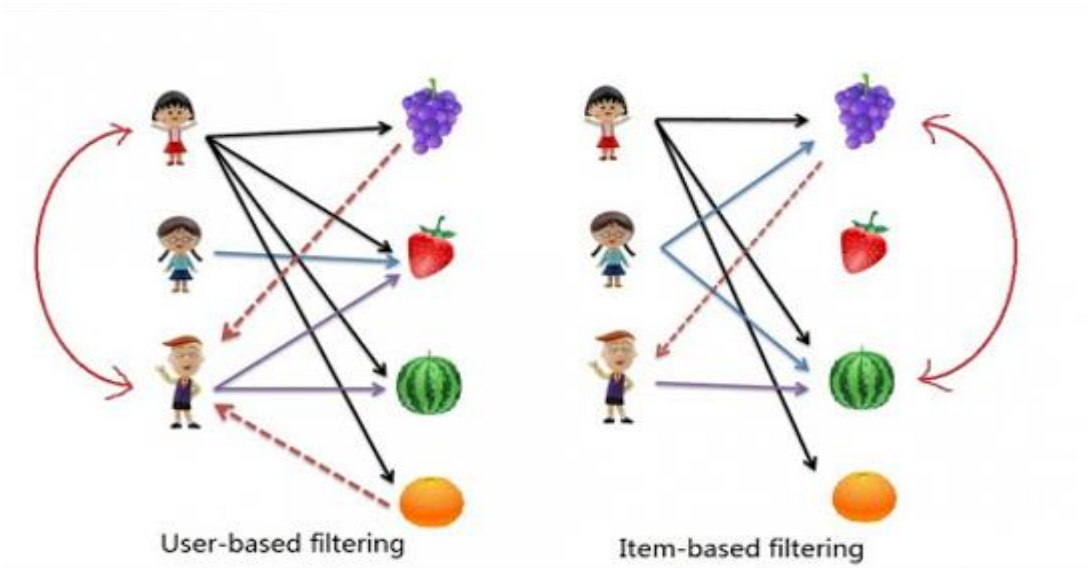
- In case if a customer searches "blue bowl" it first selects the best cluster and then recommend products from the corresponding cluster.

```
show_recommendations("blue bowl")
```

```
Cluster 0:
 Elephant house icecream strawberry
 Highland processed cheese
 Snack cracker
 body spray
 Promate Exercise Book single rule
```

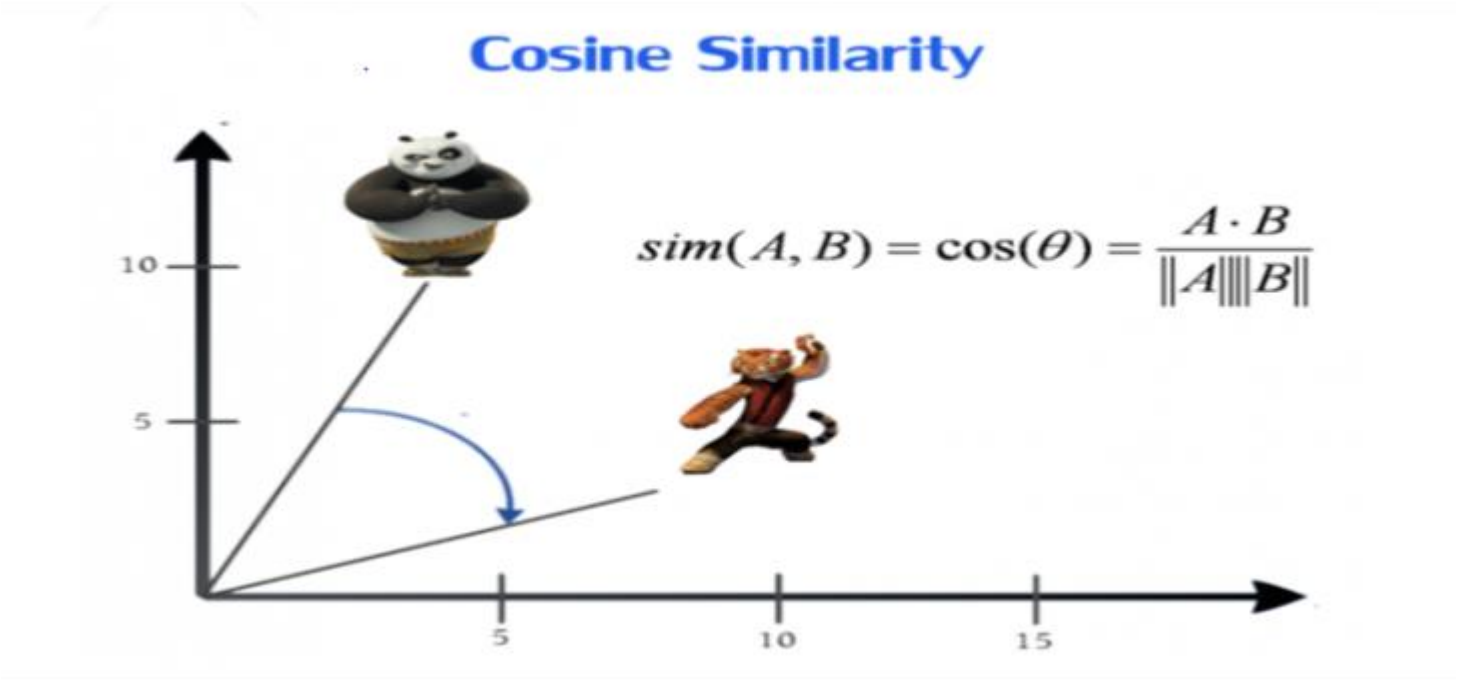
Recommendation using collaborative filtering

- 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-Item Matrix

- For both User-based filtering and Item-based filtering User-Item matrix is built first.

Product_ID	10002	10080	10120	10125	10133
Customer_ID					
1069	0	0	0	0	0
1113	0	0	0	0	0
1823	0	0	0	0	0
2189	0	0	0	0	0
3667	0	0	0	0	0

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.

Customer_ID	1069	1113	1823	2189	3667
Customer_ID					
1069	1.0	0.0	0.0	0.0	0.0
1113	0.0	1.0	0.0	0.0	0.0
1823	0.0	0.0	1.0	0.0	0.0
2189	0.0	0.0	0.0	1.0	0.0
3667	0.0	0.0	0.0	0.0	1.0

- Provide recommendation to User B depending on User A buying pattern.

- Items recommend to B= Items bought by A- Items bought by B

Recommended Product List

User A- CustomerID:1113

```
items_bought_by_A = set(customer_product_matrix.loc[1113].iloc[customer_product_matrix.loc[1113].nonzero()].index)
```

```
items_bought_by_A
```

```
{18007, 21088}
```

User B- CustomerID:1823

```
items_bought_by_B = set(customer_product_matrix.loc[1823].iloc[customer_product_matrix.loc[1823].nonzero()].index)
```

```
items_bought_by_B
```

```
{20724, 21055, 21210, 21801}
```

- Items recommend to B

```
items_to_recommend_User_B
```

```
{18007, 21088}
```

Product_Name
Coffee crisp
NSP Exercise Book square rule 240 pages

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.

Product_ID	10002	10080	10120	10125	10133
Product_ID					
10002	1.00000	0.0	0.000000	0.000000	0.008360
10080	0.00000	1.0	0.000000	0.000000	0.000000
10120	0.00000	0.0	1.000000	0.018831	0.013041
10125	0.00000	0.0	0.018831	1.000000	0.014735
10133	0.00836	0.0	0.013041	0.014735	1.000000

Recommended Product List

- Top 10 similar items for the product id :21873

```
top_10_similar_items = list(
    item_item_similarity_matrix\
        .loc[21873]\
        .sort_values(ascending=False)\
        .iloc[:10]\
    .index
)
```

Product_Name
Almonds
whole wheat rice
Signal
Blueberry jelly
captain fish
closis sensitive flouride
gillette vector
Listerine Essential care
Milk Shorties
Elephant house icecream berry 450ml

Percentage of progress

What is to be done Next…

Market Basket Analysis

- Recommending products to customers by determining the products which are bought together.

Loyalty Customer & Check-out Alert

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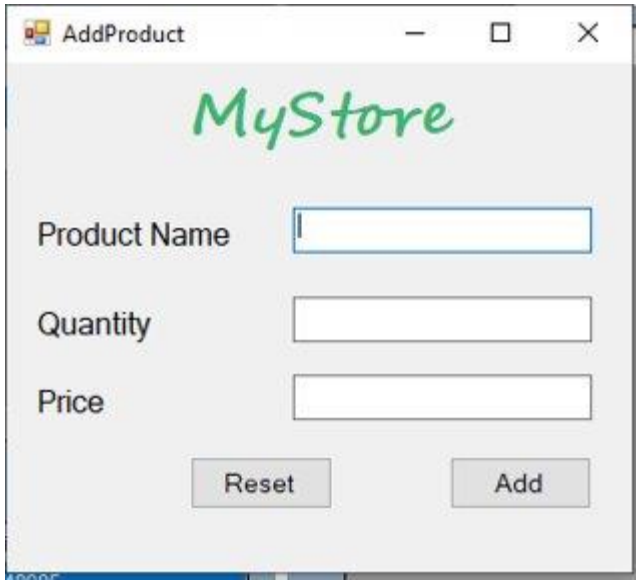
Loyalty Customer Program & Checkout

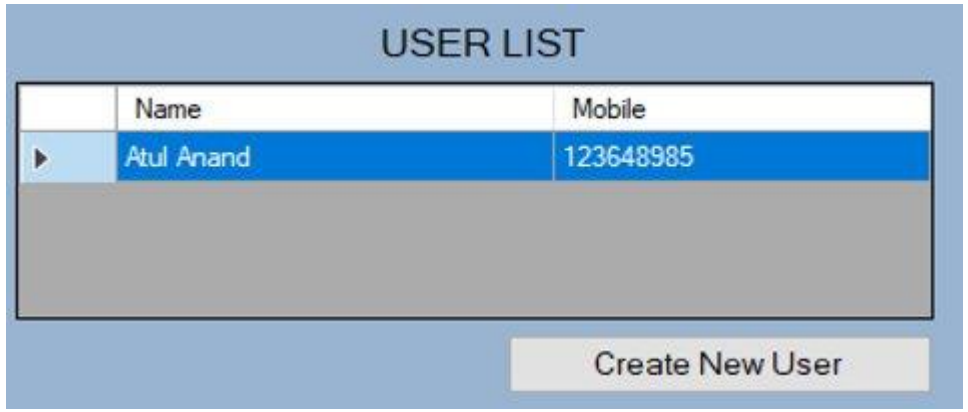
Methodology

Admin Login

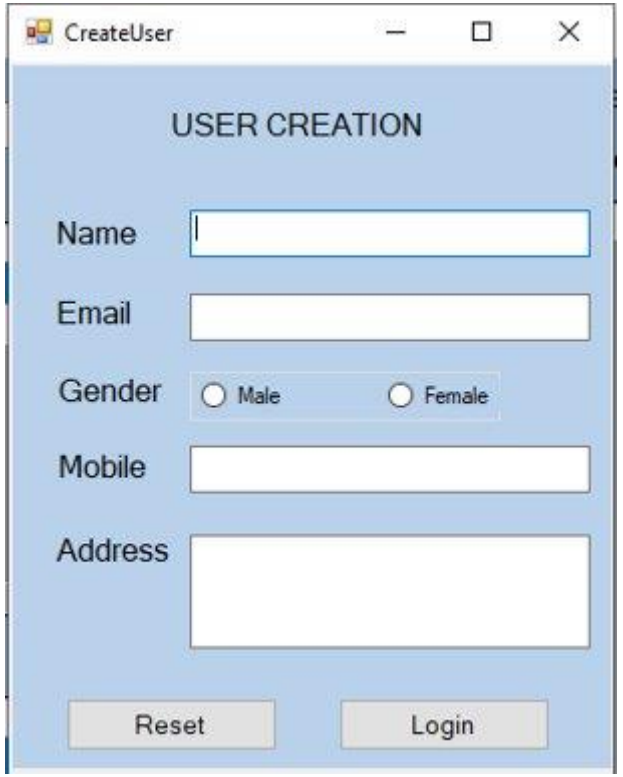


Product entering

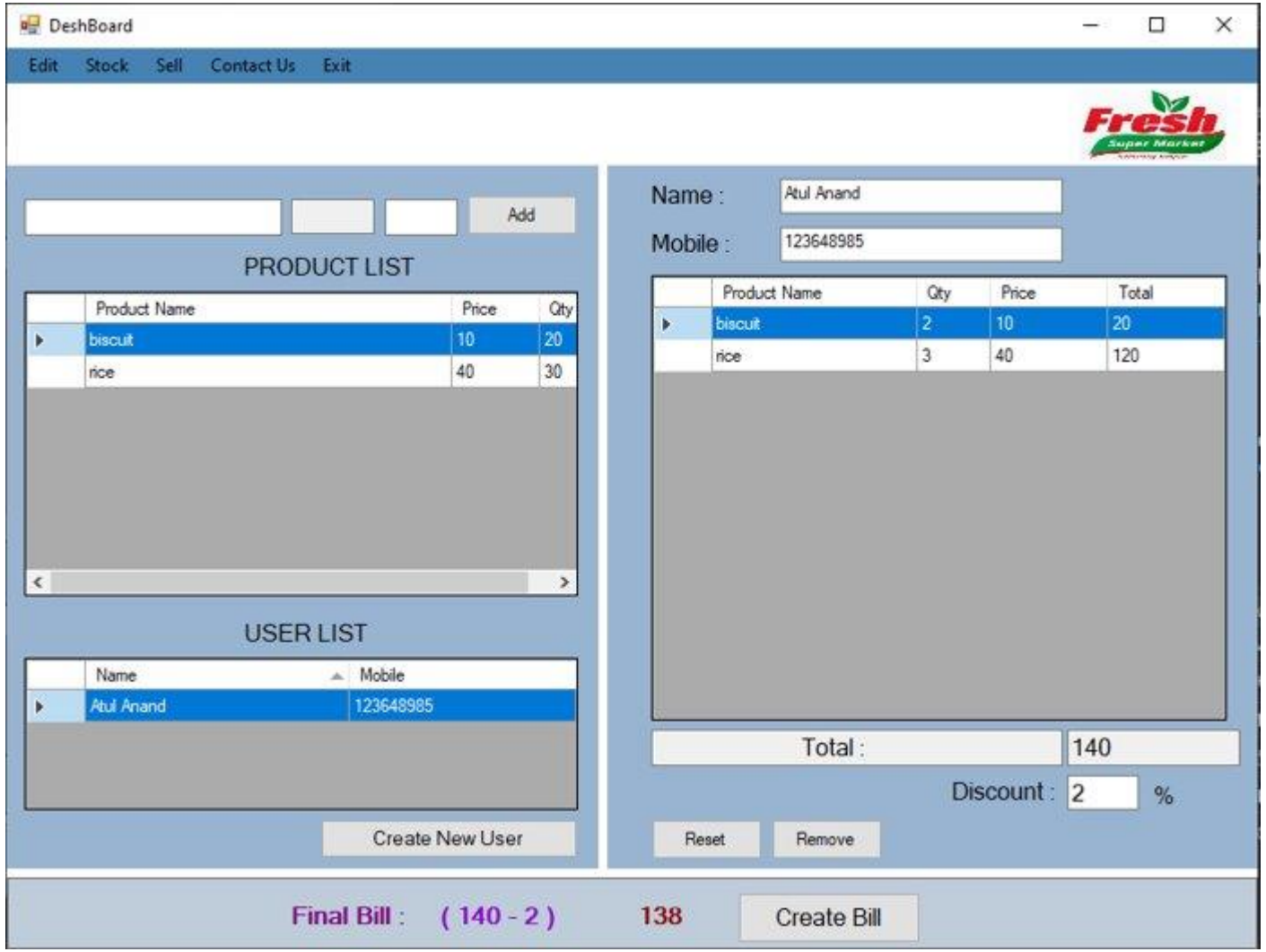
Product List



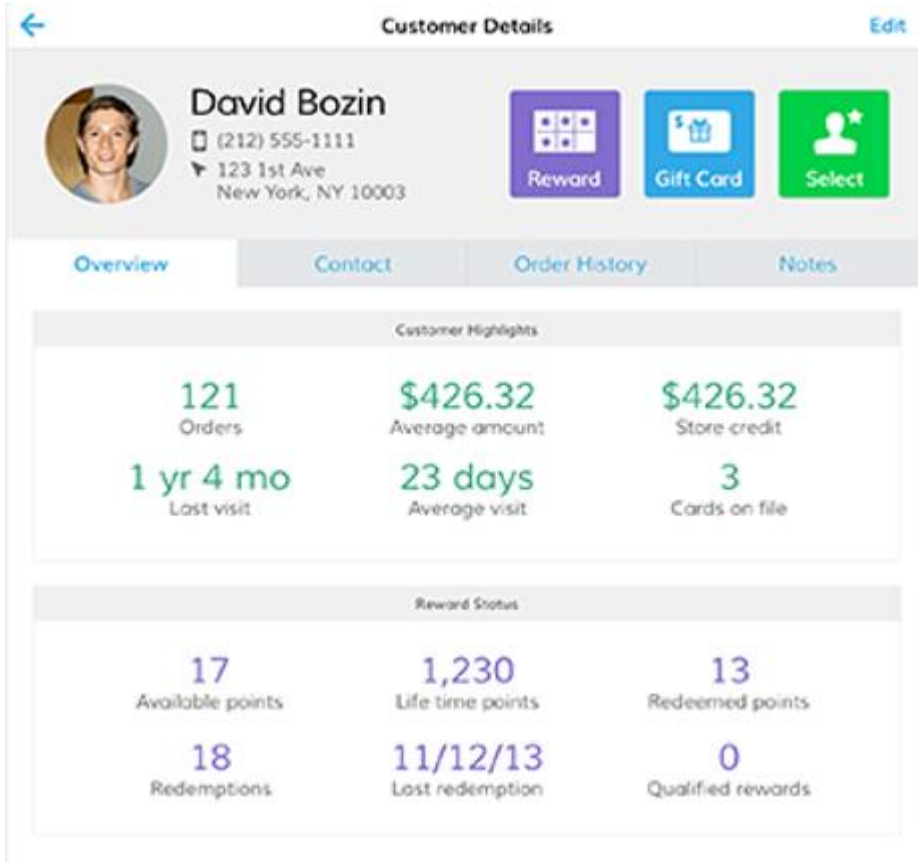
User List



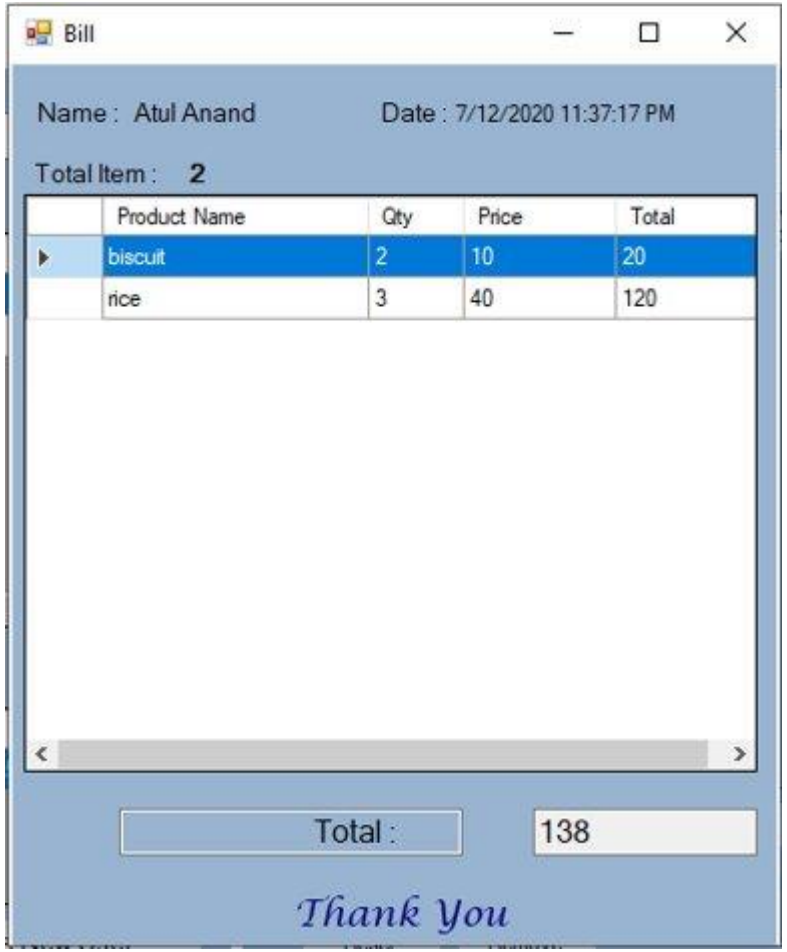
New customer creation



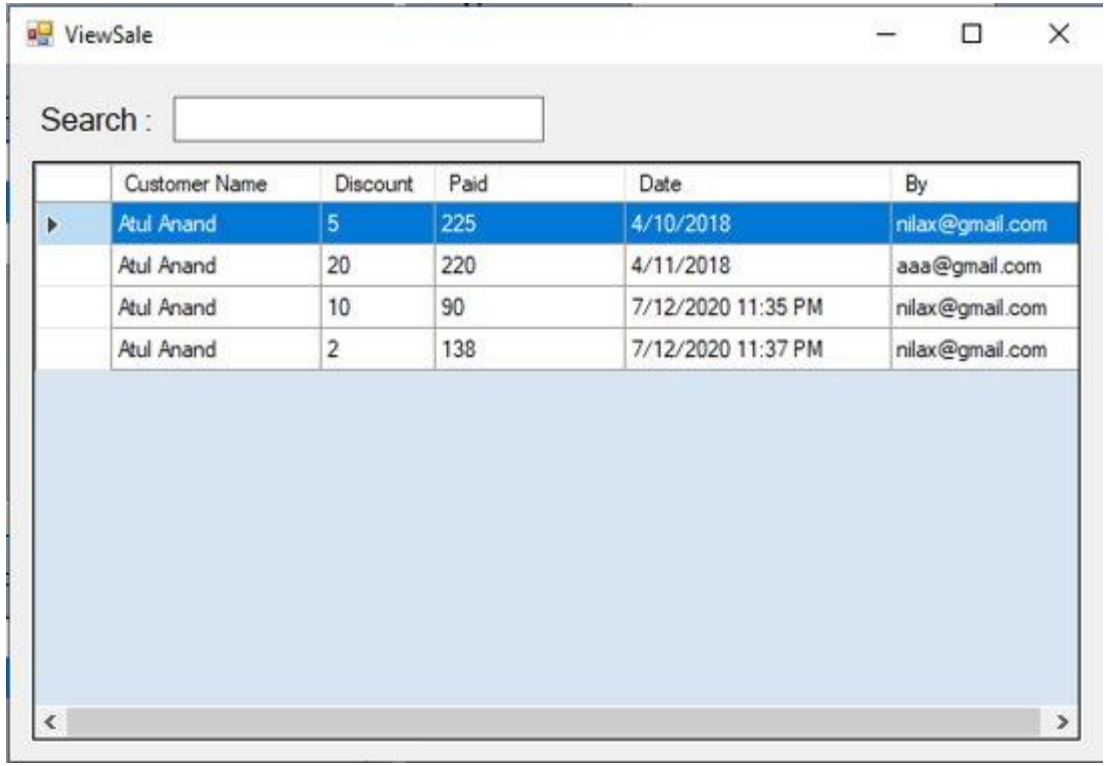
Product entering on bill



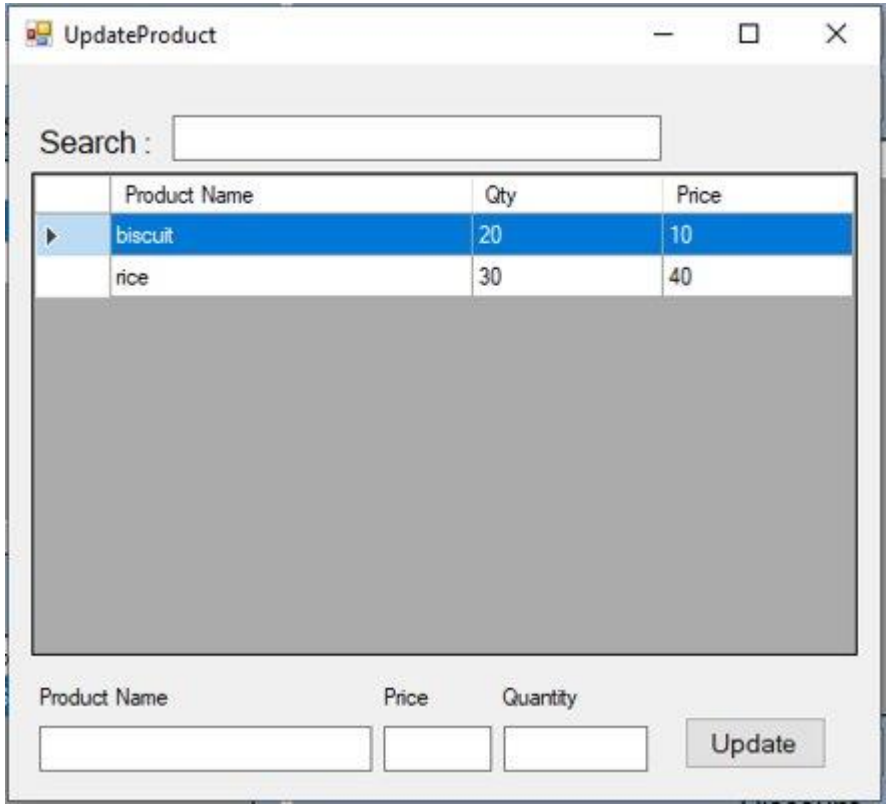
Customer Profile



Final Bill



Total sales Report



Products update & report

Pending Objective

- View the product location
- Connect the RFID with user profile application
- Access the trolley using RFID card
- Add a loyalty points in customer profile

Image Processing And Weigh Load

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01

02

03

Main Components

Product Detection

Calculate Weight

List the Products

Image Recognition & Weight Sensor

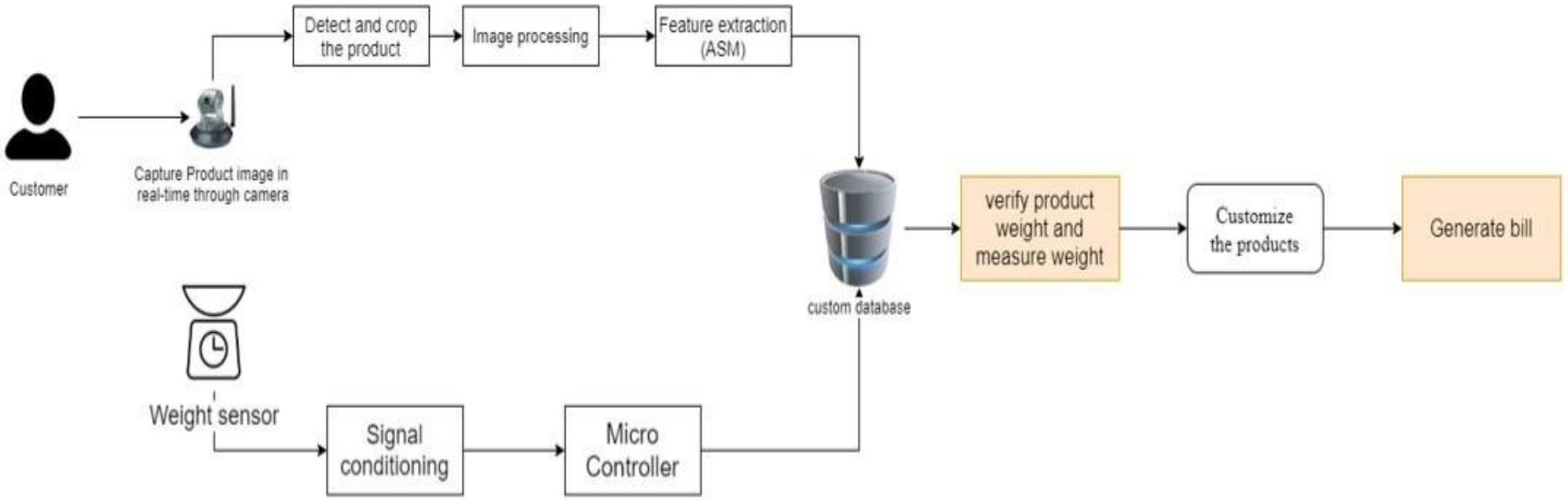
Research Objective

Reduce and eliminate time taken in billing counter in supermarkets

Designing an Intelligent Shopping Basket which uses Image scanners to allow users to self-checkout and increase productivity time

Methodology

High-Level Diagram



Problem

Can’t get hardware at this current situation.

Solutions

Using web cam for Raspberry pi camera

What's Next

I need to calculate the weight and connect with the database.

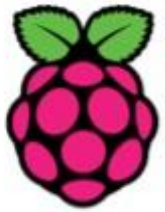
Research Expenditure

Rasberry pi 4

Rasberry camera

Weight load

Technologies



RaspberryPi

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Voice Assistant

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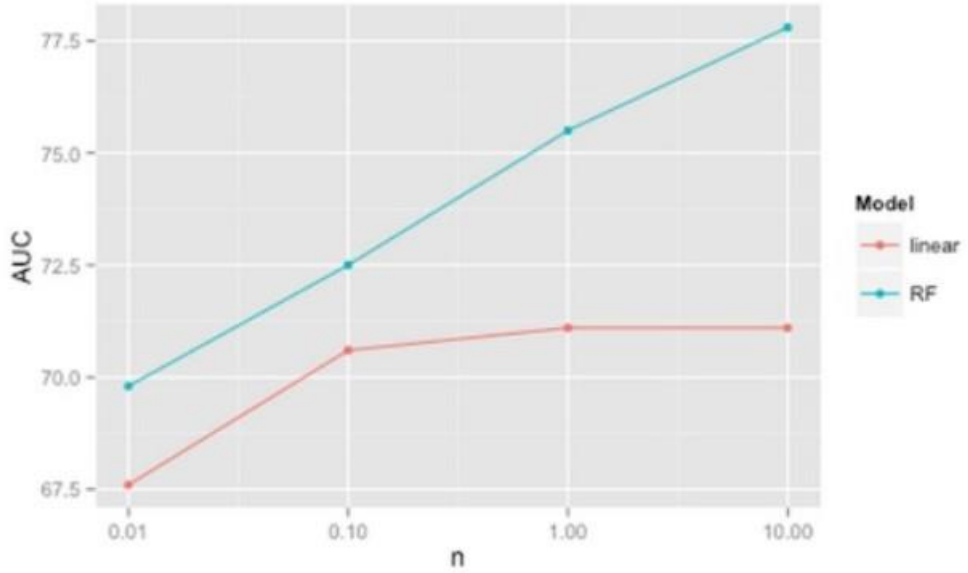
Background/Research Gap

- Implement the speech to text
- Implementing questions and answers
- Updating promotions and discounts

Algorithm Used –Random forest



- It is a better option for accurate predictions for multiple applications.
- Capacity to handle multiple input features.
- Effective on large datasets.

Tools &Technology

- Python
- Pycharm
- Jupiter notebook
- spacy

To - Do - Next

- Creating a question and answer data bank through crowd sourcing
- Embed the questions using infersent, an word embedding tool by face book
- Create different classifier models and empirically identify the best models.

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