eSmart

Your smart shopping station

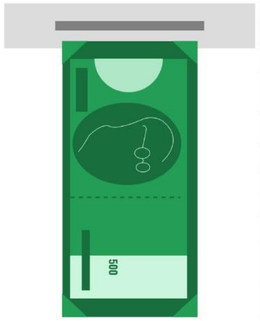
eSmart

1 2 3

Processing Payment...

eSmart

1 2 3

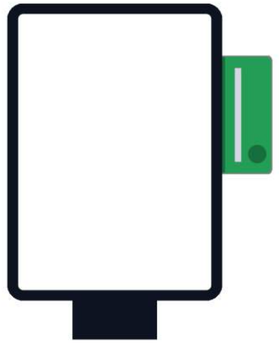


Put each note one by one inside the slot

Back

eSmart

1 2 3



Swipe your card through the slot on the side slowly

Back

eSmart

1 2 3

Total Scanned Items	6 Items
Subtotal	890.00
Discount	20.00
GST	40.00
Total	**950.00**

Item	Item Details	Price	Qty	Total
	Merlion Naturals Organic Raw Honey 300gm	~~150.00~~ 100.00	x 1	100.00
	Bingo! Tedhe Medhe Aloo Bhujia 50g	10.00	x 5	50.00

Scan Again

Proceed

art

1 2 3

Scan the QR code to process the payment

ack

Isha Mhatre

eSmart

Your smart shopping station

Technology is relentlessly transforming every aspect of our day-to-day lives. From education and communication to healthcare and retail, we are always seeking better, more efficient ways to do things. However, even amidst this flux of changes around us, the humble shopping mart has witnessed little change. The goal was to find a way to improve the shopping experience and help retail businesses drive additional revenue and learn more about the habits, preferences, and needs of their customers.

eSmart is a self checkout system that makes scanning, payment process for your groceries much faster, efficient and seamless all while reducing person-to-person contact.

Work Process.

01

Research

Literature review
Brainstorming
Affinity mapping
Competitive matrix

02

Analyse

Lean UX canvas
Questionnaire
User personas
Ideation
Mind mapping

03

Design

Story board
Proposed System
Information Architecture
High fidelity
Prototyping

04

Testing

Heuristic evaluation
Usability testing
SUS Evaluation

01. Research.

PROBLEM STATEMENT.

“To resuscitate the existing grocery mart checkout system into a better, faster and smoother system that has least of possible contact points with the staff.”

Literature Review.

Smart Shopping Cart for Automated Billing Purpose using Wireless Sensor Networks:

In an effort to reduce manpower and create better shopping experience, Smart Shopping Cart was introduced. The cart used Wireless Sensor Network, with a camera on top to identify the products placed in cart which were displayed on the screen.

- Barcode
- Cameras
- Weight sensors

An IOT Based Smart Shopping Cart for Smart Shopping:

The cart has barcode scanner to scan the products as they are placed in the cart, a weight sensor to make sure the customer is not cheating, a small computer for local processing. Customer's phone (connected to the smart cart) will be used as display to reduce weight on the cart and the cost. Once the customer finishes shopping, they can proceed to the payment counter.

Smart shopping cart with automatic billing system through RFID and ZigBee:

Each Shopping Cart has Product Identification Device that would read the Radio frequency tags of every product and transfer the data to main system. The data is processed by Billing System and total amount is displayed.

- RFID tags & scanners
- LCD monitors

IoT-Based Smart Shopping Cart Using Radio Frequency Identification:

The project works for big stores like Walmart, using a mobile app that helps user navigate, view earlier purhases, link shopping lists and view product details as they are added to the cart.

- RFID tags ans scanners
- Bluetooth & wifi connection
- Mobile application

Singapore SMART Supermarket:

Smart Mart in Singapore. You put everything you need in the cart. The checkout is done by automated machines behind the doors. So the user basically pushes the cart into the checkout section and pays via the store app. Then collects the products on the way out in a different section of the store. With less than 10 items, one can self checkout and pay.

RFID Based Automatic Shopping Cart:

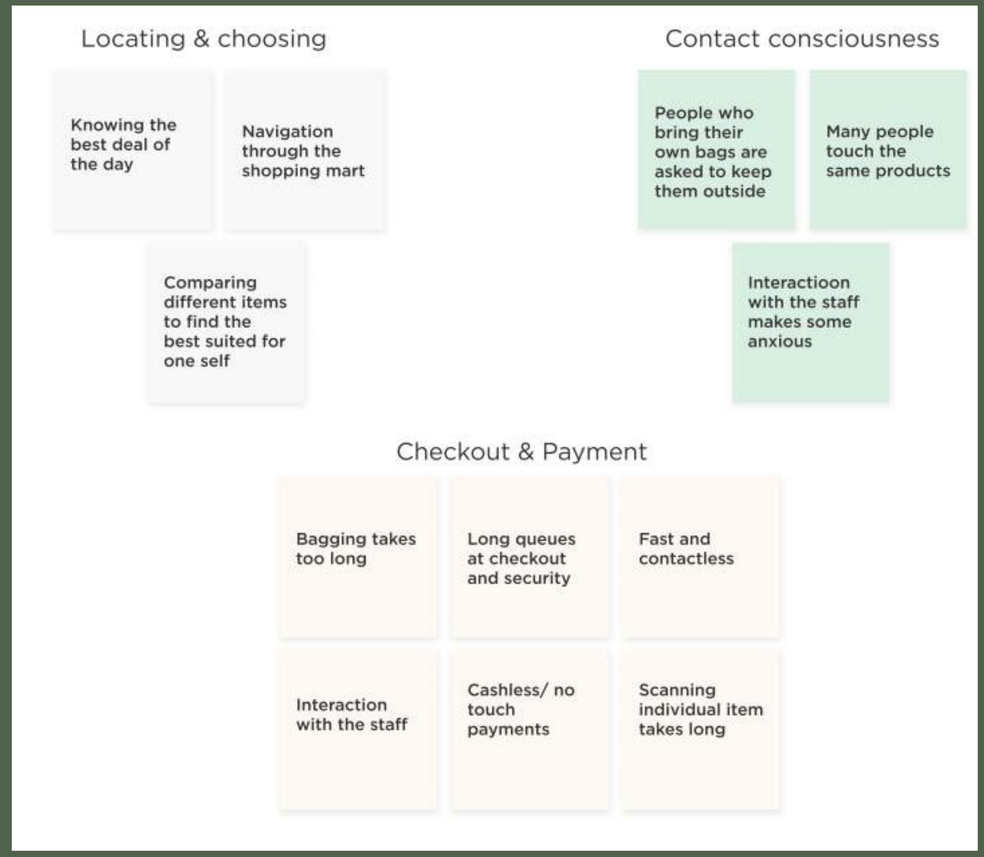
The cart has a smart touch screen that has a client card reader, a positioning transmitter and a product reader. The user can check their shopping list, location of products, advertisements and offers of products as they pass by the aisle. At the checkout, the monitor will display total amount which can either be payed in cash or the from the pre-linked bank account on the client card.

Brainstorming & Affinity mapping.

I tried to identify the major problems faced by costumers during grocery shopping, and then categorized them into three major domains:

- location
- contact
- checkout&payment.

I then chose checkout and payment as our main domain to work upon.



Competitive matrix.

I studied and analysed our competitors by generating a competitor's matrix after identifing different features, good and bad points of each. Then I familiarized myself, understood and analysed the existing products related to in-store smart shopping.

		IoT	AI	Cameras	Movement Sensors	Weight Sensors	Cashier less	Virtual cart	Digital cart interface	Payment flexibility	Multiple product errors	Mobile app	Electric reciept	Tally feature	Bagging	RFID tags	No code scanning	Locating and searching aids	Data monetization for traffic areas	Integrate shopping list	Transaction history	Theft prevention	Credit card swiper
Smart stores	Amazon Go																						
	SmartMart																						
	Future Store																						
Smart Carts	Dash Carts																						
	Caper carts																						
	KroGo																						
	SuperHii																						
Self checkout counters	Caper counter																						
	Kroger																						
	Walmart's																						
Mobile applications	Scan it!																						
Online shopping websites	Grofers.com																						
	Bigbasket.com																						
	Jiomart																						
	Amazon pantry																						

Link to detailed competitive matrix.

02. Analyse.

Lean UX Canvas

Title : Speeding up and enhancing the grocery shopping experience in food mart along with reducing interaction between the costumer and staff

Date : 11 August 2021

Iteration : 01

1. Business Problems

People are conscious about the physical contact with crowd now more than ever. How can we minimize the contact between the customer and a grocery mart's staff?

3. Users & Customers

- People who do not prefer online grocery shopping
- Shoppers who come in for a product or two because they need ran out and/or need it immediately
- People who like to buy their groceries in bulk
- People who like the experience of grocery shopping (Users who like to touch and feel the product before buying them)

7. Hypothesis

- We believe that minimal contact between user and staff without their experience being compromised will be achieved if the shopper doesn't need to worry about staff, mainly cashier, touching their groceries facilitated by automated bagging system and efficient checkout system that speeds up that process.

5. Solutions

- A self scanning cart
- Coherent payment system
- Mobile apps that can scan products
- An easier way to scan products
- All products have Radio Frequency identification that can be scanned
- Automate bagging system
- A digital cart
- Something to ensure security, an anti-theft system
- Digital interface for faster and safer checkout and payment process

8. What's the most important thing we need to learn first

- The best way to automate/ speed up the process of scanning products is using Radio Frequency Identification chips.
- Automated bagging methods will work well with our planned system.
- People will not cheat the system and if they do, the anti-theft system will
- Users are comfortable with cashless payments

2. Business Outcome

- Minimal contact between the staff and the customer
- Decrease in the amount of overall time spent by the customer in the mart
- Ease of payment and checkout
- No compromise in the comprehensive experience of the user in mart or in the sales or marketing strategies for the seller
- With lesser contact & help from the staff, user shouldn't feel lost or confused

4. Users Benefits

- User spends less time inside the mart but his grocery buying experience is not compromised
- User doesn't have to worry about staff or workers touching their groceries
- The process of becomes efficient
- Cashless payments
- Socially anxious people don't have to communicate with the cashier at payment section

9. What's the most least amount of work we need to do to learn the next most important thing

- Thorough study about the current self check-out system in Walmarts to identify the loop-holes
- User survey and observation
- Testing the prototype and the screens

Questionnaire Survey.

I collected a list of questions and conducted questionnaire survey using google forms and got 30 responses. *Click here to view the questionnaire along with responses.*

70% prefered buying groceries phsically from grocery marts. Most people didn't find locating specific product difficult. About half of the respondents took time to compare and choose amongst the products before buying; while other 50% had shopping list planned, hence didn't took them long to fill their carts. I also found that about 30% shoppers felt nervous or anxious while talking to the mart's staff of cashiers. And while 70% people prefered rolling carts over handheld baskets, 45% weren't satisfied with the ccurrent carts and prefered the cashier not touching their products.

Due to pandemic people have shifted to cashless payment modes. About 84% of our respondents prefered Paytm/Gpay/UPI or Debit/credit card payments in grocery marts. 93% shoppers weren't really satisfied with the current checkout system.

90% buyers gave positive review when we asked them if they would like a self-checkout system where the products are scanned automatically by advanced sensors, and they get the details on a kiosk and pay using e-wallet or debit/credit card.

Personas.

User personas helped design solutions by considering common user needs and understanding the main users in terms of their goals and capabilities.

Shabna

Age: 32

Status: Married

Occupation: Secretary to CEO

Bio

A working mom who doesn't have a lot of time. She is mostly in a hurry, buying things as she commutes to and from work. She is usually busy on the weekends with family errands and commitments, so she prefers buying daily groceries.

Goals

- to buy the daily groceries on her way back home
- to quickly go into the store, pick the necessities and checkout
- easily navigates through the store as she frequently visits it
- usually ends up buying things at the end moment as she tends to forget things

Frequency of visits to the store:

Quick, short visits to store frequenctly

Challenges

- doesn't have a lot of time to spend
- just to checkout a couple of products she has to wait in long lines
- needs to checkout and pay quickly

Habibi Hasmullah

Age: 24

Status: Unmarried

Occupation: Engineer

Bio

Habibi is a 24-year-old engineer who has recently started his job. He has always had social anxiety and feared human interaction. He is shy and introverted and doesn't have a lot of friends.

Goals

- to buy groceries from the local shopping mart at the weekend since he has a 9 to 5 job on weekdays
- to not have to talk to any staff/ cashier while shopping or at the checkout
- prefers to mind his own business and get work done quietly

Frequency of visits to the store:

Weekend visits to the grocery mart to buy week's worth groceries

Challenges

- marts are crowded more than usual on the weekends
- has to interact with the cashier at the product scanning counter
- has to interact with the security at the exit who tallies the bill
- avoids small talk with cashier/staff

Ahjuma Shetty

Age: 65

Status: Widow

Occupation: Unemployed

Bio

A 65 year old granny who like to cook for her grandkids and kids. She is not very familiar with apps and technologies. Although, her kids push her to use online app, she likes to stick to her own old ways.

Goals

- to examine the fruits and vegetables themselves before buying them
- to cook for her grandkids and kids
- to use fresh veggies and ingredients

Frequency of visits to the store:

long visits to the store

Challenges

- doesn't trust online shopping apps as you cannot really see exactly what fruit or vegetable piece you are getting
- long waiting lines at the checkout section tire her out
- cannot stay out for long because of old age fatigue, would prefer a quick shopping process

Asman Sikender

Age: 30

Status: Divorced

Occupation: Writer

Bio

Asman is a 30 year-old Mumbai resident who had a bad time recovering from covid a few months ago and has been concsious of his surroundings ever since. He prefers following the safe distance laws and wears masks religiously.

Goals

- to buy fresh, nutritious food for his health recovery
- to purchase sanitizers and anti-bacterial agents time to time
- to buy products from the mart with minimal contact with others
- prefers to pay cashless

Frequency of visits to the store:

Once in 10 days

Challenges

- checkout counters are not sanitized or cleaned a lot of times
- scanning products one by one takes time
- the staff touches each and every item as they scan it

Ideation.

Goals to be achieved with the proposed solutions:

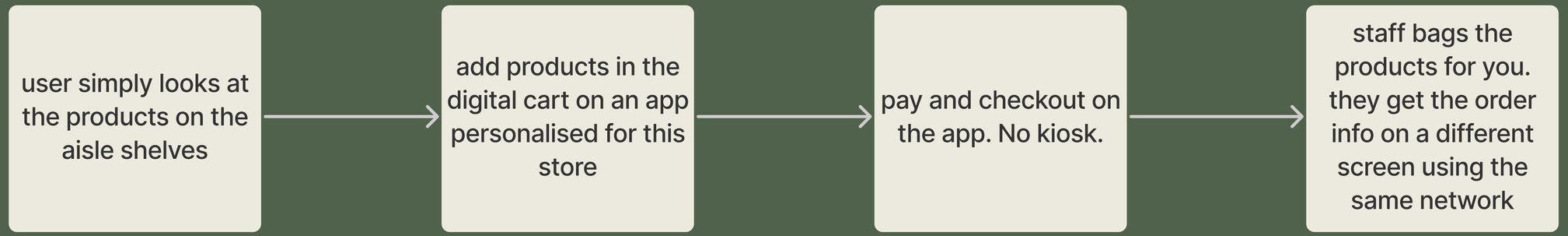
- Low cost
- Feasibility
- No touch/least contact
- Speed up checkout
- No smart cart

Possible Solutions ????

- A self scanning cart
- Coherent payment system
- Mobile apps that can scan products
- An easier way to scan products
- All products have Radio Frequency identification that can be scanned
- Automate bagging system
- A digital cart
- Something to ensure security, an anti-theft system
- Digital interface for faster and safer checkout and payment process

Mind Mapping.

Possibility 01: A digital cart system

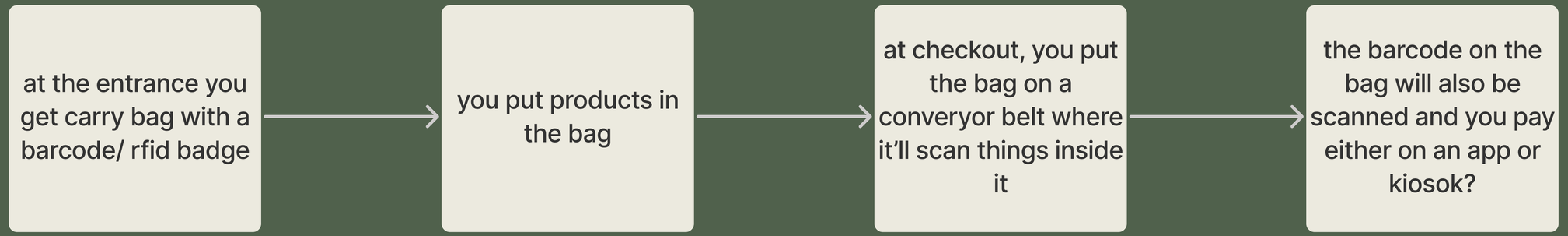


👎 Why won't this work?

- Users wouldn't be able to touch and feel the products.
- Doesn't reduce the manual labor.
- Manual bagging will delay the process.

Mind Mapping.

Possibility 02: Conveyor belt snanning

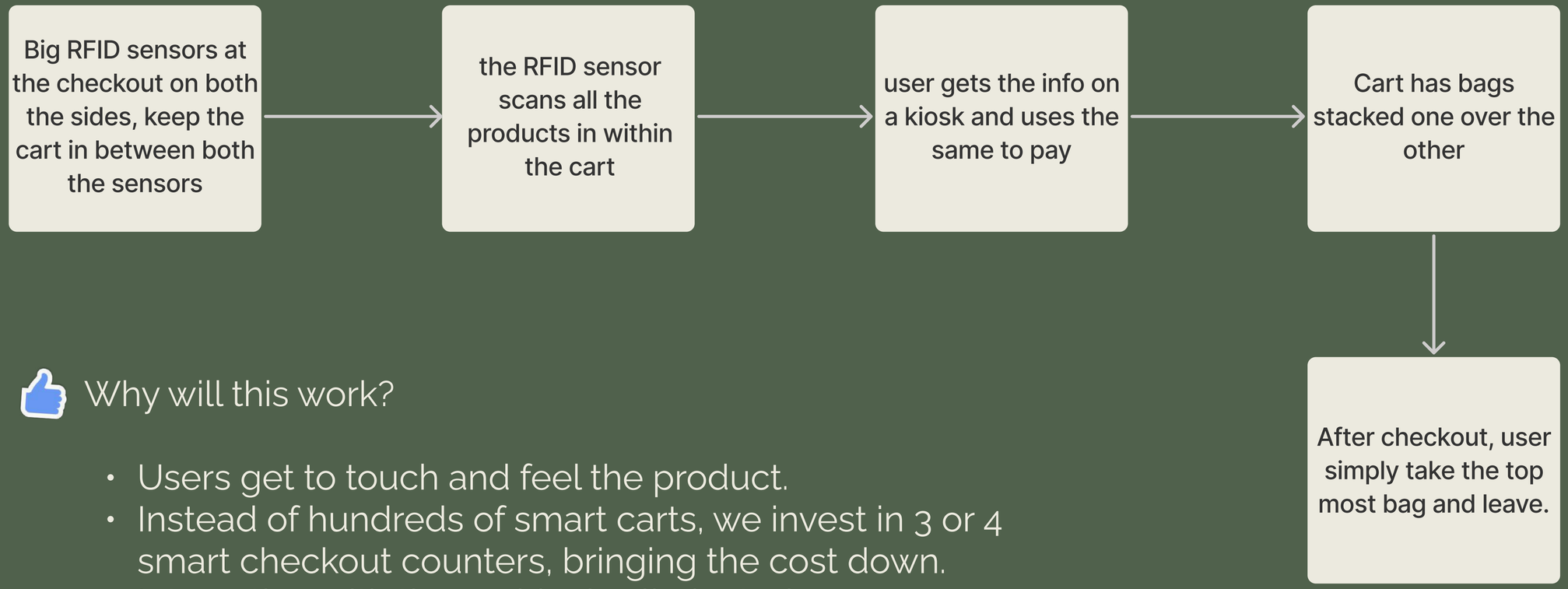


👎 Why won't this work?

- Conveyor belt would slow down the process.
- Conveyor belt would also cause a lot of confusion.
- It would be easy to cheat the system.

Mind Mapping.

Possibility 03: RFID scanners and self-bagging



👍 Why will this work?

- Users get to touch and feel the product.
- Instead of hundreds of smart carts, we invest in 3 or 4 smart checkout counters, bringing the cost down.
- Interaction with the cashier is eliminated.
- Self checkout kiosk should take considerably lesser time.

03. Design.


Collect a cart with pre-filled polybag.
Top view of cart
NO MORE LONG CHECK-OUT LINES!!
Kiosk
RFID Scanner
USER-FRIENDLY INTERFACE
PAYMENT SUCCESSFUL
Collect Cart
EASY-POLYBAG COLLECTION
Contactless!
Safer!
Faster!
and
Easy!

Proposed System.

RFID scanners and self-bagging:

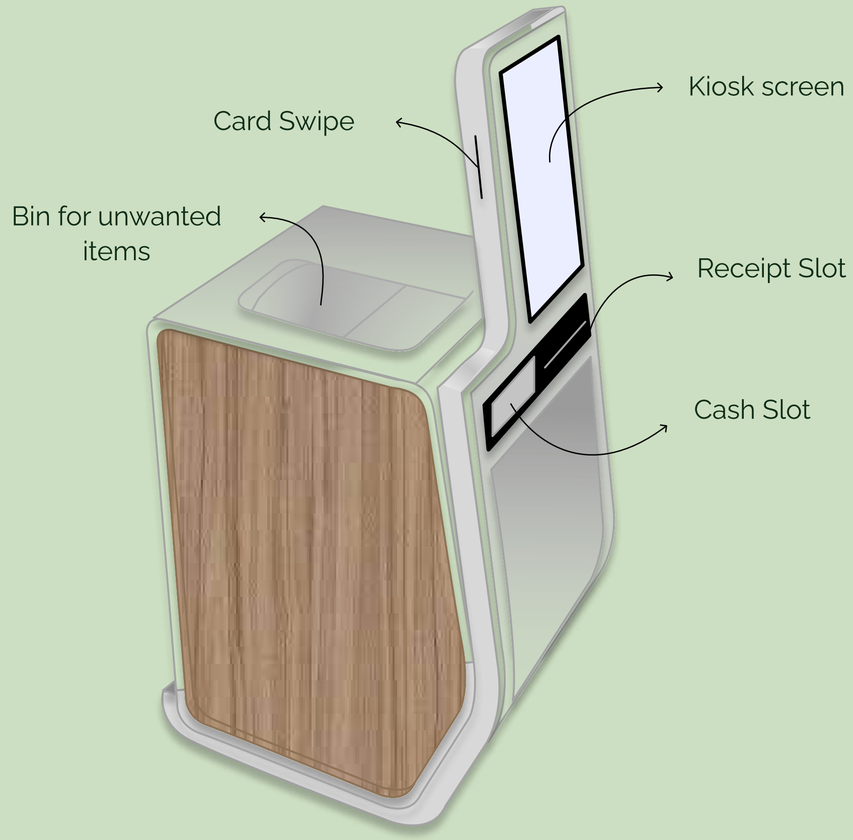
All the products will have RFID tags. RFID (radio frequency identification) will use radio frequency to identitify and track the products in the cart. Unlike **barcodes**, the tag need not be placed infront of the scanner to be recognised by the system. The scanners will be placed not more than 3 feet away from the cart, in order to ensure proper scanning of the items in the cart.

The average read time for a RFID tag is less than 100 milliseconds while for a barcode, the read time is half a second or more per tag.

The user will park the cart between the RFID scanners and within seconds, all the items will be scanned. The information will be reflected on a kiosk screen linked with the scanners.

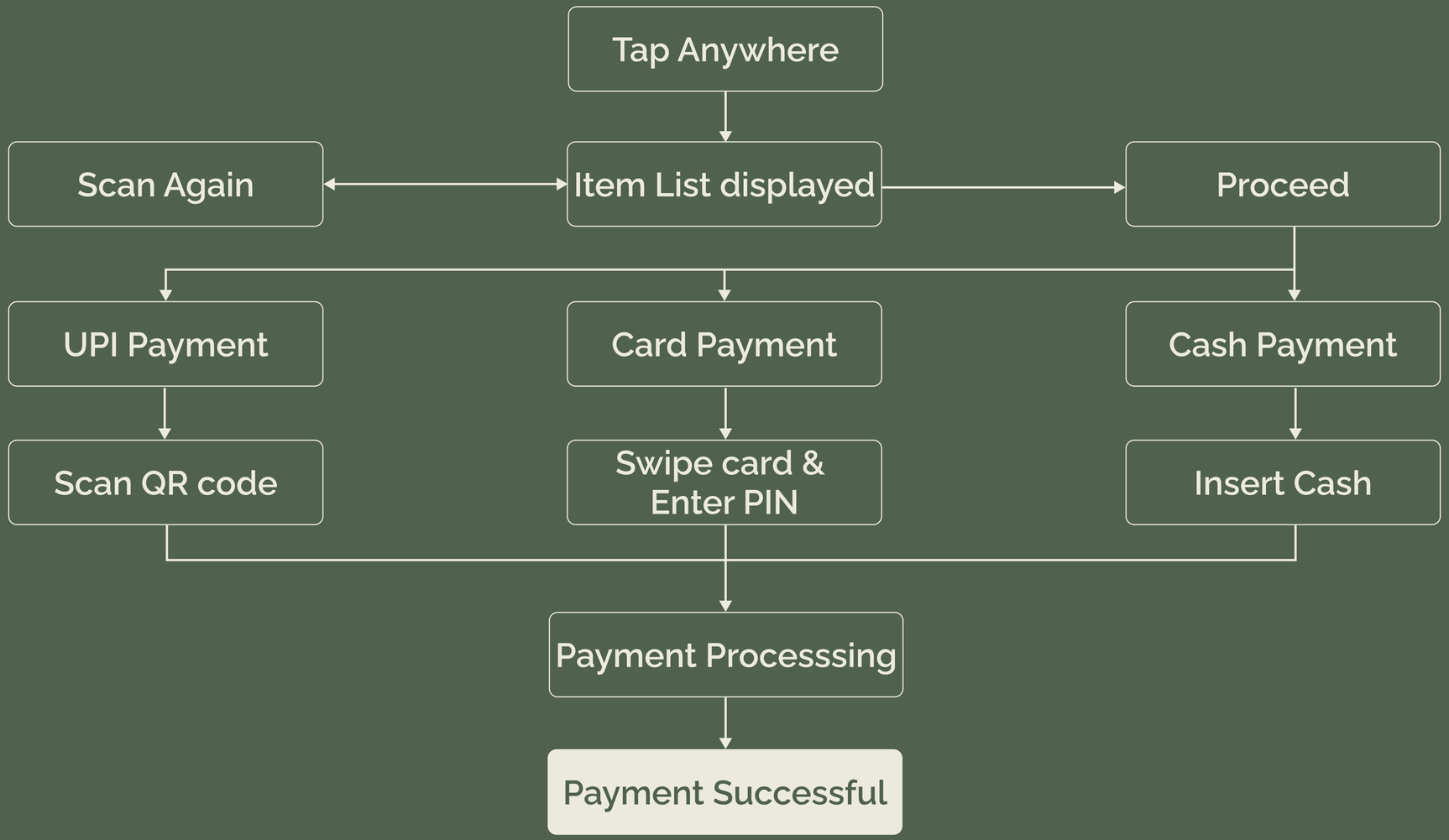
Proposed System.

RFID scanners and self-bagging:

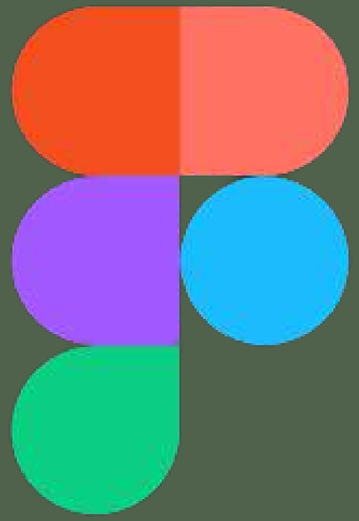


- The user can use the kiosk to verify the item details and checkout themselves.
- The **receipt slot** will light up when the receipt will be printed, prompting the user to take it before they leave.
- The **cash slot** and **card swipe slot** will also light up whenever user will select the respected payment options.
- After scanning, if the user doesn't want any item they can **dispose it in the bin** attached to the kiosk.
- The cart will have polybags attached so the user just needs to pick up the polybag and walk out of the store after checking out.

Information Architecture.



High fidelity & Prototyping.



This UI has GIFs and Animations which might lag as they load. Kindly check your connection and patiently give time for the file to load.

View the prototype at Fit- Scale down to fit for best experience.

Click here to access the prototype.

04. Testing.

Heuristic Evaluation

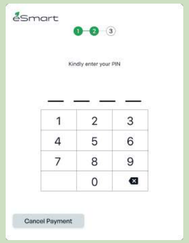
Recognition Rather than Recall

- The system allows the user to depend on the interface rather than their memory.

01

User Control and Freedom

- The system allows the user to cancel the payment.



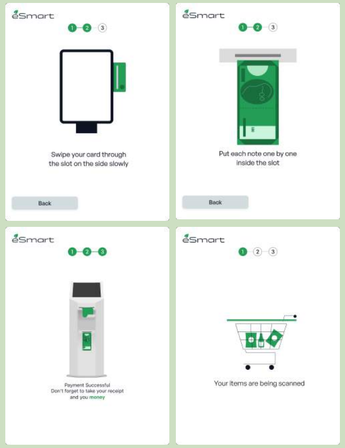
03

Error Prevention

- The system pops up a message to prevent any errors that might occur when the user taps on cancel payment by mistake.

05

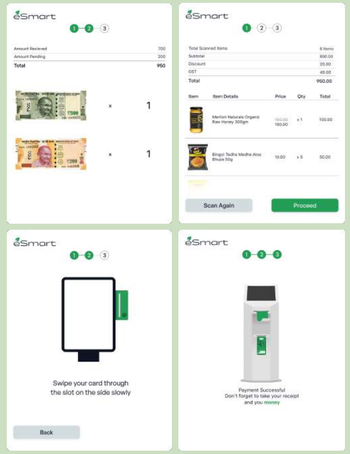
02



Visibility of System Status

- Every screen has a top bar showing where the user is.
- Every loading page has animation and message to keep the user informed of the process.
- Processes like Insert Cash, Swipe Card have animations to prompt the user to take action.

04



Match Between System and Real World

- The imagery used for cash and Item List matches real life currency.
- The illustrations present real life actions.

Usability Testing.

For testing the usabilty and functionality of the system , I went to grocery stores and observed the current cashier system. I then compared the existing checkout cashiers against the proposed system by comparing the average time required for scanning and payment process. Data for 10 costumers was collected. Later I converted it to average time required for 10 products for each costumer.

Average time of 10 costumers for 10 products came out to be 113 seconds. Similary I collected the time required for 10 users to test the prototype for 10 products. Average time of 10 users for 10 products came out to be 50 seconds.

By comparing it was observed that the system prototype required less than half the amount of time required at the current check out cashiers.

Data for the same 10 costumers was collected for scanning 10 items. Average time of 10 costumers for 10 products came out to be 65.

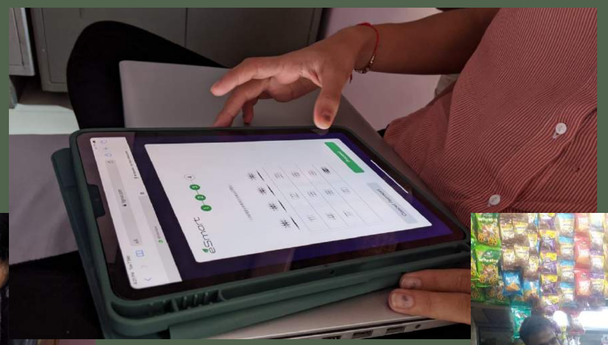
Readtime for RFID tags is less than 100 milliiseconds per tag. which means 10 products will take 1 second to get scanned.

By comparing it was observed that the system scanners are 10x faster than te barcode scanners at the current checkout cashiers.

	No. Of Products	Scanning	Average scanning time for 10 products	Processing & payment + bagging	Average Processing & payment for 10 products	Prototype testing time for 10 products
Costumer 1	12	1:20	66.66	1:40	83.33	51
Costumer 2	27	3:10	70.37	4:37	102.59	30
Costumer 3	20	2:05	62.5	3:50	115	48
Costumer 4	04	0:30	75	2:00	300	43
Costumer 5	16	1:50	68.75	1:56	72.5	63
Costumer 6	10	1:00	60	1:30	90	56
Costumer 7	15	1:30	60	2:20	93.3	57
Costumer 8	07	0:45	64.28	1:10	100	50
Costumer 9	23	2:15	58.69	3:30	91.3	37
Costumer 10	30	3:10	63.33	4:20	86.6	66
AVERAGE			64.95		113.46	50.1

Usability Testing.

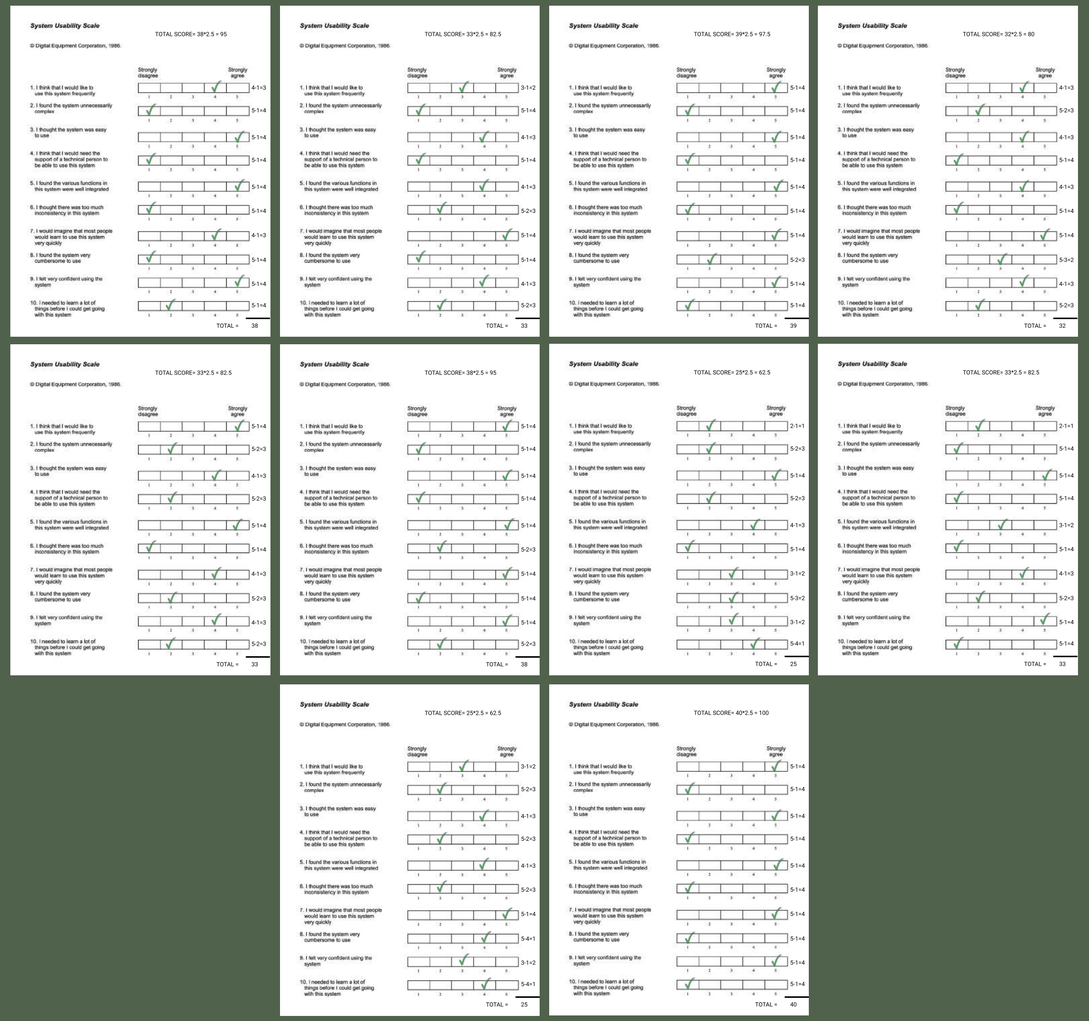
A few glimpses from the usability testing study!



SUS (System Usability Scale).

The users who tested the UI of eSmart kiosk were also requested to fill SUS. The scores are compiled in a table below. This table shows that 8 out of 10 users had an excellent experience with eSmart kiosk.

	Total Score	SUS Grade
Costumer 1	95	A
Costumer 2	82.5	A
Costumer 3	82.5	A
Costumer 4	95	A
Costumer 5	82.5	A
Costumer 6	62.5	C
Costumer 7	80	A
Costumer 8	100	A
Costumer 9	62.5	C
Costumer 10	97.5	A



Conclusion: eSmart perfomed better than traditional cashier system in terms of speedy processing. The interface of the kiosk also proved to be easy to use for the users. Hence, the proposed system would be an efficient upgrade from the exsiting system.

"Covid gave us a pause, but also motivation to roll out the technology."

Thank You!
Isha Mhatre