

UKRAINIAN CATHOLIC UNIVERSITY

BACHELOR THESIS

**Designing user interface for "Automated
convenience store" mobile application
based on user experience**

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*A thesis submitted in fulfillment of the requirements
for the degree of Bachelor of Science*

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Declaration of Authorship

I, Oksana OLENIUK, declare that this thesis titled, "Designing user interface for "Automated convenience store" mobile application based on user experience" and the work presented in it are my own. I confirm that:

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- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.
- Where I have consulted the published work of others, this is always clearly attributed.
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- I have acknowledged all main sources of help.
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by Oksana OLENIUK

Abstract

In the retail grocery market, there is a high level of competition, redundancy in trading space and a high threat from online stores. In the struggle for buyers, stores are looking for ways to improve the quality of work using innovative technology.

What is innovation? It is a way an entrepreneur creates new resources which generate revenue or provides existing resources with increased potential for profit multiplication.

One of the most well-known innovations in the retail sector is self-service technology (SST). SST is a technology that allows the buyer to get the service regardless of the direct involvement of the shop staff in providing this service. At the moment, there are many successful examples of shops that implement modern technologies, and with them, they wholly or partially automate the traditional flow of activities.

Good examples are projects from Amazon ([AmazonGo](#)) and Auchan ([Auchan minute](#)).

There are many options for such implementation. For example, a registered user can log in to the store using the mobile application. Scan QR Code on products with a smart-phone, pay via the app, and after confirming leave the store. Also, the payment problem could be solved with the self-service cash register, which reads the product bar code.

Potentially, such a store in Ukraine could use men and women from young adult to middle-aged how are familiar with the smartphones and desire to buy 2-3 on-the-go products. Such solutions will give people the opportunity at any time to get the purchases in a modern way with a user-friendly UI / UX interface, with virtually no queues.

From a financial point of view, such retail sales reduce the cost of maintaining the store and make it impossible to steal purchases and cash by cashiers. Also, showing confidence in the buyer branding the network as open, honest and modern, which can be interesting to potential users.

Analysis of existing solutions, working examples, technologies and patterns could provide the answer if it is relevant to run the business of this area or provide automation generally or partly.

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Contents

Declaration of Authorship	iii
Abstract	v
Acknowledgements	vii
1 Related works	1
1.1 Self-service technology	1
1.2 Decision-making model for using innovations	1
1.3 RFID	1
2 Food Retail Problems	3
2.1 Perspective of the Store	3
2.2 Perspective of the Customer	3
2.2.1 Problems	3
2.2.2 Analysis of customer perception of technological innovation	4
2.3 Conclusion	4
3 Existing Solutions	5
3.1 RFID	5
3.2 Mobile solutions	5
3.3 Another self-service equipment	5
4 The proposed solution	7
4.1 Registration	7
4.2 Exit	7
4.3 Add a product to the grocery basket	7
4.4 Payment	8
4.5 Entrance	8
4.6 Additionally	8
4.7 Trust system	8
4.7.1 Bank of court decisions	8
4.7.2 Receiving personal data	10
4.7.3 Questionnaire	10
4.8 Economic feasibility	10
4.8.1 Mathematical model	11
4.8.2 Net profit	13
4.8.3 Payback period	13
4.8.4 IRR	14
4.8.5 NPV	14
4.8.6 Conclusion	15
4.9 Additionally	16
4.9.1 Equip several traditional cash desks	16

4.9.2	Staff Assistance	16
4.9.3	Increasing the effectiveness of surveillance cameras	16
4.9.4	Loyalty program	16
4.10	Requirements	17
4.10.1	Registration	18
4.10.2	Login	19
4.10.3	Profile update	19
4.10.4	Password reset	20
4.10.5	Add credit card	21
4.10.6	History	22
4.10.7	Shopping	23
4.11	Low fidelity prototypes	24
4.12	Design	28
Bibliography		29

List of Figures

4.1	Feature model Diagram	17
4.2	Flowchart: Registration	18
4.3	Flowchart: Log in	19
4.4	Flowchart: Profile update	19
4.5	Flowchart: Password reset	20
4.6	Flowchart: Add credit card	21
4.7	Flowchart: History	22
4.8	Flowchart: Shopping	23
4.9	UserFlow: Login	24
4.10	UserFlow: Menu	25
4.11	UserFlow: Register	26
4.12	UserFlow: Shop	27

List of Tables

3.1	Comparative analysis: RFID - Bar code - QR code.	6
4.1	Assumption of financial model	12
4.2	CAPEX: 1st Traditional Store	13
4.3	CAPEX: 1st Automated convenience store	13
4.4	Net Profit: Comparison between Automated Convenience Store and Traditional Shop	13
4.5	Payback period: Comparison between Automated Convenience Store and Traditional Shop	14
4.6	IRR: Comparison between Automated Convenience Store and Traditional Shop	14
4.7	NPV : Comparison between Automated Convenience Store and Traditional Shop	15
4.8	CAPEX: N Traditional Store	15
4.9	CAPEX: N Automated convenience store	15
4.10	Net Profit for 10 shops: Comparison between Automated Convenience Store and Traditional Shop	16
4.11	Payback period for 10 shops: Comparison between Automated Convenience Store and Traditional Shop	16

List of Abbreviations

SST	Self - Service Technologies
RFID	Radio - frequency identification
ATM	Automated Teller Machine
SMS	Short Message Service
CVV	Card Verification Value
QR code	Quick Response code
PL	Profit and Loss
NPV	Net Present Value
IRR	Internal Rate of Return

Chapter 1

Related works

1.1 Self-service technology

The most critical factor for the success of innovation, and especially innovation in the self-service field and others in which a person works closely with innovation, is the need to study the human perception of technology and its current knowledge and skills in this topic. "**Intentions to Use Self-Service Technologies: A Confluence of Multiple Attitudes**" (Curran, Meuter, and Surprenant, 2003) conducts an in-depth study of how consumers relate to technology, as well as the attitude of service providers to the use of this technology. The research described and tested three structural models that describe the consumer behavior patterns, their intentions to use technologies. Having verified such models, one can understand which the user will select and which ones they will be most familiar to use.

1.2 Decision-making model for using innovations

The next step is to communicate and integrate the innovation to future consumers in the proper way using the most effective procedure. The problem is that typically in a case with innovation there is no one unique way to provide the success of the innovation. "**Decision-making model for using innovations**" (Rogers, 1995) give us the most important steps of diffusion of innovation which should be counted. This paper describes Everett Rogers four main elements in the diffusion of innovations, such as the innovation itself, communication channels, time, and a social system. The study corrects the steps to introduce innovation in the grocery retail business, as it explains the psychology of the consumer.

1.3 RFID

"**RFID handbook fundamentals**" provides information about the functionality of RFID technology at physical and IT-related principles underlying this field. Also, books provide an overview of various technologies which could be applied for food retails (Finkenzeller, 2010).

The aim of this paper "**Radio frequency identification and food retailing in the UK**" (Jones et al., 2005) is to provide an overview of radio frequency identification (RFID) technology and describe the advantages and disadvantages of using technology for food retailers. The main focus of this paper is the use of RFID on different stages throughout the supply chain, accurately to monitor temperature and food safety in the food industry.

Chapter 2

Food Retail Problems

2.1 Perspective of the Store

The first impetus of implementing self-check technology is the need to change the work process of the retail network.

The inner store needs:

- Reduce maintenance costs for store personnel;
- Increase in user loyalty. The user who has found the profit of using the SST will encourage other buyers;
- Increase sales volume of the intimate goods;
- Reduce store dependence of fast staff changing process;
- Increase speed of paying for goods;
- Increase the space for goods in the store;
- Reduce the number of shoplifting crimes. (Ivanov and Mayorova, 2015)

The external store needs:

- Limitation of the staff work during the weekend and the holidays by law.
- Limitation of understanding between the staff and customers through language barriers.

2.2 Perspective of the Customer

2.2.1 Problems

When introducing SST, an important step is to study the user's desire in the retail field. Example:

- Faster service;
- Getting pleasure from buying ("wow effect");
- Purchasing without the help of the staff (Davidson, Bates, and Bass, 2002).

2.2.2 Analysis of customer perception of technological innovation

According to E. Rogers, potential consumers of innovation can be divided into five categories based on personal inclination for innovation: innovators, early followers, early majority, late majority.

According to Rogers, for successful innovation, the interconnection between different groups of consumers is required, as when communication between the groups is exchanged information about the innovation.

Therefore, adaptation during the work of the newest organizations is important. For a better understanding of the process of user perception of innovation, the model of innovation diffusion by E. Rogers is considered. This model consists of 5 stages:

- Value - the consumer receives information about innovation;
- Recovery - the consumer formulates positive or negative changes to innovations based on previous experience of such technology (for example, an ATM) and knows about current innovation;
- Decision - the consumer decides on who will use the innovation;
- Testing - the consumer uses innovation;
- Approval - the consumer conducts analysis and knowledge of the roads of his correct decision on the use of innovation.

According to E. Rogers, the diffusion rate of innovation depends on five factors at the stage of decision making on the use of innovation:

- Relative advantage - innovation is perceived as an improved version of the traditional alternative;
- Compatibility - the level of perception of innovation in the existing system of consumer values based on cultural differences, experience, demographic indicators (level of education, gender, age) and present needs;
- Complexity - the complexity of learning and the use of innovation;
- Simplicity of testing - the ability to divide innovation into parts and conduct a consumer test of a separate part or reduced model;
- Communicative - the possibility of distributing innovations among consumers through communication.

2.3 Conclusion

During the research for a relevant SST, you need to analyze the popularity of the selected technology in the market under investigation. This indicator is essential for the company at the stage of integrating the SST to search for software and additional equipment, and the level of consumer awareness in the chosen technology allows the company to reduce the cost of training for the use of SST. It is also essential to inform about the benefits to the consumer when using the SST, to provide a test version and training the staff in the early days.

Chapter 3

Existing Solutions

3.1 RFID

Today grocery retailers use bar codes that denote products. This technology has greatly simplified the system of product identification and accounting. They are very cheap, but they have disadvantages: insufficient memory and inability to re-program. The best solution for data transfer is a microprocessor smart card, which allows you to place the chip in a plastic card for further interaction with the reader. However, mechanical contact is not appropriate in the case of TC. Contactless data transmission between the device and the reader is more flexible. Technology that implements this procedure is called RFID.

As with any new technology, there are challenges and opportunities associated with RFID technology. Some of the major challenges in implementing this technology include its unreliability in the retail environment, readability range, readability accuracy, heterogeneous standards, costs and problems of processing. Despite all challenges, RFID is a promising technology that can be used in a variety of ways: supply management, temperature monitoring and food safety in the food industry. Using RFID technology can increase efficiency and productivity by providing better inventory to reduce food spoilage. Integration of RFID tags with sensors can provide food processors with a means of controlling the temperature or quality of food products. Establishing common standards and the cost-effective implementation of this technology can lead to widespread use of RFID in the food industry. (Bose et al., 2009)

3.2 Mobile solutions

Using this solution, the user scans the product with the help of a mobile phone during the purchase selecting process. With a mobile phone, the user can scan products and put them in a virtual basket. During the payment process, the user may be offered to bring the phone to the reader and pay with additional software, or add a bank card to the mobile application and pay from a mobile phone. Conclusions. With the help of this solution, the capacity of the shop increases substantially, as there is no need to outline the goods on the cash register.

3.3 Another self-service equipment

The self-service cashier assumes scanning and payment of the goods without the intervention of the shop staff. One of the solutions is cash register equipment controlling weights, checking the pressure of goods. Weights compare the actual weight of the purchase with the weight of all products pre-entered into the database. There

are also examples of introducing RFID technology in conjunction with self-service cash desks. Such cash desks have unique places for messaging with products and devices for reading RFID tags that are on these products. In this way, reading the labels from all the products takes place in seconds.

Characteristics of technology	RFID	Bar code	Qr code
The need for a label in direct visibility	Reading even hidden tags	Reading without direct visibility is not possible	Reading without direct visibility is not possible
The amount of memory	From 10 to 512,000 bytes	Up to 100 bytes	Up to 3,072 bytes
Ability to overwrite data and reuse	Possible	Impossible	Impossible
Reading range	Up to 100 m	Up to 4 m	Up to 1 m
Simultaneous identification of several objects	Up to 200 labels per second	Impossible	Depends on the reader
Resistance to the environment: mechanical, temperature, moisture	Increased durability and resistance	Depends on material to be applied	Depends on material to be applied
The expiration date of the label	More than 10 years	Depends on printing method and material	Depends on printing method and material
Security and counterfeit protection	Possible, but not simple	Felt easily	Felt easily
Damaged label work	Impossible	Complicated	Complicated
Identification of objects in motion	Possible	Complicated	Complicated
Propensity to interference in the form of electromagnetic fields	Possible	Impossible	Impossible
Dimension (size)	Medium and small	Small	Small
Price	Medium and high	Low	Low
Independent manufacturing	Impossible	Possible	Possible

TABLE 3.1: Comparative analysis: RFID - Bar code - QR code.

Chapter 4

The proposed solution

The proposed solution is a combination of several existing solutions, namely, the concept of "mobile shopping", RFID technology and traditional access control systems (turnstiles and anti-theft gate). The presence of a mobile phone with a high-quality camera is required. The presence of a mobile application on the phone is needed. User Journey-stages:

- Registration;
- Exit;
- Adding a product to the grocery basket;
- Payment;
- Entrance.

4.1 Registration

Pre-registration of a potential Automated convenience store user is required to reduce the risk of penetration into the shop of thieves or other suspicious persons who may cause material or reputational harm to Automated convenience store. Registration is a necessary step to enter the store. When registering, the buyer must indicate: Mobile phone (verified by entering into the application code with SMS); Personal data: name, surname, date of birth, city (verified by writing off and returning 1 UAH from the bank card account); Bank Card number, CVV code, expiration date); The user may be refused for registration and creating a personal profile wherefore the user can be refused within the permission to enter the store. In the case of completing the registration, the user obtains the appropriate % of the trust.

4.2 Exit

While entering the store, the user should open the application. The application generates a unique secret key that is transmitted from the user's application in Mace Reader in the form of a QR-code or transmitted through the Bluetooth connection protocol. After the successful opening of the session, the authorized user passes through the turnstile.

4.3 Add a product to the grocery basket

Adding a product to the grocery basket can be done by scanning the QR code for the QR reader in the mobile application.

4.4 Payment

The payment is made using a mobile application. Registration guarantees at least one bank card in the application. Optionally, the user can add another bank card.

4.5 Entrance

On the Output, the system must identify the user account and close the session. So we know who goes out of the store. The process is carried out with the following verification. The application shows a unique secret key that is transmitted from the user's application in Mace Reader in the form of a QR-code or transmitted via the Bluetooth connection protocol. After a successful closing session, an authorized user passes through the turnstile and Anti-theft Shop System ("frame").

4.6 Additionally

The responsible person could select the products of the higher class and some of the goods which could be marked with RFID tags. After passing the identification on the output, the system knows the list of paid goods, which may include products with RFID tags. Accordingly, if the frame sees a product that has an RFID tag, and there is no product affixed to this RFID tag in the list of paid goods, an alarm will trigger. After successful passing of the Buyer, who has an RFID-tagged product in the list of paid purchases, the system finds the goods on the unique id RFID-tag and deactivates its operation.

4.7 Trust system

4.7.1 Bank of court decisions

It is advisable to conduct a preliminary registration, without which buyers can not enter the store. It could reduce the risk of penetration of thieves or other suspicious persons into the store.

In most countries (including Ukraine:[State Register of Court Decisions](#)), there are open registries of court cases, through which it is possible to obtain information about court decisions regarding citizens of this country by name, surname, date of birth, etc. It is worth to understand that there are different types of proceedings:

- Criminal
- In cases of an administrative offense
- Civilian
- Household
- Administrative
- Constitutional [5]

According to the type of offense, it is advisable to make your system for assessing the potential danger from the buyer's side for the store. Having information about past violations of the buyer's store may refuse the buyer in the registration or inform

the security guard after passing through the identification at the entrance that the dangerous buyer is in the store.

Let's consider an example Obtaining public information about a person, for her name: presence in search of the Ministry of Internal Affairs, the presence of the party defendant in the case in administrative, criminal and economic processes (since February 2016), the presence of debtors on alimony.

API used: [OpenDataBot API](#)

Information about the person: "Ткаченко Катерина Володимирівна"

```

1 import json
2
3 name = input()
4
5 key = "MwMPuQhW" # temporary API key
6
7 resp = requests.get("https://opendatobot.com/api/v2/
8 person?apiKey=" + key + "&pib="+name)
9
10 data = resp.json()
11
12 wanted = 'W'
13 sessions = 'S'
14 corrupt = 'C'
15
16 # parser
17 def filter_by_name(received_name):
18     if name in received_name:
19         return True
20
21 def parser(data, identificator):
22     data_list = []
23     for item in range(0, len(data)):
24         values = list(data[item].values())
25         person_name = find_name(values, identificator)
26         if filter_by_name(person_name):
27             tr = trust_counter(values[1], identificator)
28             data_list.append(values)
29             data_list.append(tr)
30     return data_list
31
32 def find_name(data, identificator):
33     if identificator == wanted or identificator == corrupt:
34         person_name = data[1]
35     elif identificator == sessions:
36         involved = data[3].split(',')
37         person_name = involved[1].split(':')[1]
38     else:
39         person_name = []
40     return person_name
41
42 def trust_by_forma(forma):
43     # add yours custom counter
44     return counter
45
46 def trust_by_identificator(identificator):
47     counter = 0
48     if identificator == wanted or identificator == corrupt:
49         counter += 100
50     return counter
51
52 def trust_counter(forma, identificator):
53     return trust_by_forma(forma) + trust_by_identificator(identificator)

```

```

54
55 def write_file(identificator , out_data , file):
56     file . write ( i )
57     file . write ( str ( out_data ) )
58     file . write ( "\n" )
59
60
61 if __name__ == '__main__':
62     main()

```

LISTING 4.1: Python example

As a result, we will get a document with user information:

```

wanted[['43336870', 'Ткаченко Катерина Володимирівна', '02.04.1983', '13.05.2014',
'female', 'СТ.408 Ч.1', ], 'ГОЛОВНЕ УПРАВЛІННЯ НАЦІОНАЛЬНОЇ ПОЛІЦІЇ
В АВТОНОМНІЙ РЕСПУБЛІЦІ КРИМ ТА М. СЕВАСТОПОЛІ', 'лицо, скривающеся
от органов прокуратуры', 'не застосовувався, ', 'В розшуку з 13.05.2014', '1'], 100]
sessions[['Степаненко О.М.', 'Цивільні справи', '711/2512/17', 'Позивач: Підгорецький
Євген Валентинович , відповідач: Ткаченко Катерина Володимирівна', 'про розірвання
шлюбу ', '2017-05-16 12:00:00', 'active'], 0]

```

4.7.2 Receiving personal data

The user audit is conducting in the judicial decision database. Before the review, it is necessary to obtain personal data of the user. With the help of this data, the system will create a request for the judicial decision database. These data can be obtained by adding fields at registration form: name, surname, city, date of birth. But there is a risk that the user can make incorrect data in error or knowingly. To minimize the risk and increase the quality of the user experience of using a mobile app, you can apply the practice of Authorization hold. The authorization hold or pre-authorization is a practice of checking electronic transactions initiated by a debit or credit card and keeping that transaction inaccessible at check-in. The main reason for using such a practice is that there is a two-step process in the payment process, consisting of permission and settlement with the time lag between them. For example, this system uses hotels that can freeze the amount on the card and pay after. In our case, the amount of the transaction will change to the time of calculation. Accordingly, we can make a flat-rate check, for example, 1 dollar, to make sure the card is legal and that the customer has the funds. With this check, you can also get personal information about the user (name and surname).

4.7.3 Questionnaire

To ensure that the shop is visited only by honest buyers, it is also possible to use the practice of banks in lending, namely, classic scoring. This model allows you to understand how much a person in the future may be able to repay the lending and its potential risk to the store. Built on socio-demographic parameters of the buyer, such as age, gender, education, seniority, time of residence in the region.

4.8 Economic feasibility

In order to determine the appropriate equipment it is necessary to calculate the profitability of the implementation of innovation. Determining the main economic indicators will help you find out if the company is benefiting from the introduction of innovations.

To date, more than a half of thefts in stores are held with the participation of shop staff. Regard this, in store without staff, the higher profitability of the store is forecasted.

Also, with the removal of cash from the store room there is free space for the layout of an additional range of goods compared with the traditional store. Which leads to:

- Reducing the markup on the product, by reducing the cost of the store
- Wider assortment
- Increase the average check

4.8.1 Mathematical model

Description of the mathematical model. A comparative mathematical model was made to compare important parameters between the Automated Convenience Store and the Traditional Shop.

Standard conventions. We consider that all the parameters in two types of stores are the same, except those that are compared. They are irrelevant, and we do not consider them into details due to the uselessness (see Table TABLE 5.1: Assumption of financial model). We consider that the two stores that were analyzed are in the same places on the streams of potential buyers, have the same area, the same range, the equal payments for rent, communal, electricity, etc.

It is also significant that, in comparison, the difference is not only the difference between a single ordinary store and a single Automated Convenience Store and a comparison of the networks of such stores.

Name	Automated Convenience Store	Conve-	Traditional Store
Average check:	\$ 4		\$ 3,7
Number of customers (DAY):	100		100
Average salary for shop employees (MONTH):	\$ 296		\$ 296
Average salary for developers (MONTH):	\$ 3000		-
Time for application development (WEEKS):	16		-
Employment at the time of application development:	6 employees		-
• IOS developer	1		
• Android developer	1		
• Backend developer	1		
• Tester	1		
• Embedded developer	0.5		
• Project Manager	0.5		
• Designer	0.5		
• Devops engineer	0.5		
Employment at the time of work of the store:	5.5 employees		8 employees
• Technical support	0.5		0.5
• Cleaner	0.5		0.5
• Warehouse commissar	0.5		0.5
• Accountant	0.5		0.5
• Marketer	0.5		0.5
• Call Center Operator	1		1
• Merchandiser	1		1
• Guardian	1		1
• Cashier	-		3

TABLE 4.1: Assumption of financial model

TABLES 5.2 and 5.3 compare amounts that the owner should spend for goods and/or services that will be used for more than one year.

Name	Price per item	Number of items	Total sum
Fiscal registrar	\$370	3	\$1,111
ash register	\$259	3	\$778
Cash boxes	\$37	3	\$111
POS terminal	\$556	3	\$1,667
Cashier's box	\$1,037	3	\$3,111
Barcode scanner	\$111	3	\$333
Customer display	\$100	3	\$300
Total sum			\$7,411

TABLE 4.2: CAPEX: 1st Traditional Store

Name	Price per item	Number of items	Total sum
Application	\$15,360	1	\$15,360
Security system	\$6,698	1	\$6,698
Turnstile	\$1,481	2	\$2,962
Total sum			\$25,021

TABLE 4.3: CAPEX: 1st Automated convenience store

4.8.2 Net profit

Net profit shows the number of earnings for the store for a year. It is measured in money.

Per YEAR, USD	Automated Convenience Store	Conve-	Traditional Store
Revenue	\$ 146,667		\$ 133,333
Trade margin, percentage	5 %		5 %
Net profit	\$ 7,333		\$ 6,667
Employees	- \$ 1,630		-\$ 2,370
Profit	\$ 5,704		\$ 4,296

TABLE 4.4: Net Profit: Comparison between Automated Convenience Store and Traditional Shop

4.8.3 Payback period

The payback period is inversely proportional to the IRR. Measured in time - year, month. Shows the period for which the project earns the capital invested in it. Or this is the period from the date of capital investment to the time of the return of that capital through profit.

Per YEAR, USD	Automated Convenience Store	Traditional Store
Investments	\$25,021	\$7,411
Payback	4,3	1,7

TABLE 4.5: Payback period: Comparison between Automated Convenience Store and Traditional Shop

4.8.4 IRR

IRR - The rate of return on investment, measured in percentages per annum, shows the percentage of income earned by an investment per year. It is inversely proportional to the payback period. $1 / \text{IRR} = \text{payback period}$ or $1 / \text{payback period} = \text{IRR}$

Per YEAR, USD	Automated Convenience Store	Traditional Store
IRR	22.80 %	57.97 %

TABLE 4.6: IRR: Comparison between Automated Convenience Store and Traditional Shop

4.8.5 NPV

NPV is the current value of the investment for the period. The calculation formula takes into account:

- The initial investment in money
- The domestic interest rate of discounting which takes into account inflation or the alternative internal cost of money
- Dimension % per annum. (10% per annum)
- Investment horizon - the period in years for which the NPV is calculated in the model (5 years)

The fate of the project on a distant horizon may be the liquidation or sale of a business. And our model of business sales on the far horizon for the cost of 5-year profits. (Market value of the business in Ukraine). The NPV is measured in cash and shows how indicated the method of investing is better than the baseline (we have 10%).

Per YEAR, USD	Automated Convenience Store	Traditional Store
NPV 10%, 5 YEARS & SOLD		
0 YEAR	-\$ 25,021	-\$ 7,111
1 YEAR	\$5,704	\$4,296
2 YEAR	\$5,704	\$4,296
3 YEAR	\$5,704	\$4,296
4 YEAR	\$5,704	\$4,296
5 YEAR	\$5,704	\$4,296
SELL COSTS	\$ 22,815	\$ 17,185

TABLE 4.7: NPV : Comparison between Automated Convenience Store and Traditional Shop

4.8.6 Conclusion

Taking into account assumptions, we can make conclusions that there is no economic feasibility to open one Automated Convenience Store in comparison with the Traditional Shop. The most significant factor in our business mathematical model is the shift from comparing single stores to network comparisons. Already with the number of stores in the network larger than 10, the apparent advantage of the store is the trust in the traditional model. With an increase in the number of stores, the benefit of the new over the old-fashioned is becoming more and more evident.

TABLES 5.8 and 5.9 compare amounts that the owner should spend for goods and/or services that will be used for more than one year.

Name	Price per item	Number of items	Total sum
Fiscal registrar	\$370	3	\$1,111
cash register	\$259	3	\$778
Cash boxes	\$37	3	\$111
POS terminal	\$556	3	\$1,667
Cashier's box	\$1,037	3	\$3,111
Barcode scanner	\$111	3	\$333
Customer display	\$100	3	\$300
Total sum			\$7,411

TABLE 4.8: CAPEX: N Traditional Store

Name	Price per item	Number of items	Total sum
Turnstile	\$1,481	2	\$2,962
Total sum			\$2,962

TABLE 4.9: CAPEX: N Automated convenience store

As you can see, the cost of opening each subsequent Traditional Store is equal to the opening price of the first store of this type. In the opening of a Automated convenience store, costs will be significantly reduced.

The result of the investigation and the building the financial model shows us that creating Automated Convenience Store has no economic feasibility. If we are sure that we are doing a chain of stores - Automated Convenience Store is one of the best solutions in innovations and food retail automatization (see Tables 5.10 and 5.11).

Per YEAR, USD	Automated Convenience Store	Conve-	Traditional Store
Revenue	\$ 1,466,6677		\$1,333,333
Trade margin, percentage	5 %		5 %
Net profit	\$73,333		\$66,667
Employees	- \$16,296		-\$ 23,704
Profit	\$ 57,037		\$42,963

TABLE 4.10: Net Profit for 10 shops: Comparison between Automated Convenience Store and Traditional Shop

Per YEAR, USD	Automated Store	Convenience	Traditional Store
Investments	\$54,651		\$81,522
Payback	0,04		1,9

TABLE 4.11: Payback period for 10 shops: Comparison between Automated Convenience Store and Traditional Shop

4.9 Additionally

4.9.1 Equip several traditional cash desks

The development of new technology can cause stress to buyers, therefore the store should be equipped with several cashiers with traditional cashiers. This will allow the store not to lose customers who do not have cashless money, with a low battery in the phone, in a hurry, etc.

4.9.2 Staff Assistance

At first, buyers may have difficulty studying new technology, so it is advisable to consider training and customer support by shop staff.

4.9.3 Increasing the effectiveness of surveillance cameras

According to statistics, 73 percentage of the thieves do not plan to steal something in advance. The buyer is stealing when he sees the opportunity to take something left unnoticed. To increase the effectiveness of surveillance cameras, you can set a screen with a broadcast from the surveillance cameras or set the camera at the entrance to the store in a prominent place to indicate that the person is being monitored. You can also add personalization items after scanning a QR code at the entrance, which may also be helpful in pushing the idea of getting something for free.

4.9.4 Loyalty program

Having extensive marketing information about a group of buyers, you can sell it further. Getting information from the buyer's receipt can learn about his habits and tastes. In the future, the buyer offers goods of related categories with targeted discounts. For example, when purchasing information on cigarettes, the buyer can offer goods in this category with a discount (alternatives to tobacco products).

4.10 Requirements

Feature model Diagram - the high-level forward design diagram (drawing before coding the application) providing in the software features.



FIGURE 4.1: Feature model Diagram

User Story is a short description of a software feature from an end-user perspective which is focused on the aim or result which the feature will provide to the user. A User Story template often uses the following type of format: As a <role>, I want <feature> so that <reason>.

Usually, User Story is she is paired with Acceptance Criteria. They are the conditions that a software product must satisfy to be accepted by system level functionality. User Story is present with the help of the flowchart. The flowchart is a block diagram is a common type of schemes describing algorithms or processes in which individual steps are depicted as blocks of various shapes.

4.10.1 Registration

As a User I want to be able to register so that I have access to the application content. The system registers the user by phone number, a third party must send a confirmation code, the user enters the code, and the system determines the correctness of the code match and confirms the possession of the person by this phone number. The user must create and confirm a password. User must add at least one credit card. The system should send a request for withdrawal of 1 UAH to check the account status and validity of card data. When adding a new card and personal information, the system determines the name and surname and requests the base of court decisions. When detecting artillery damage, the user account is blocked. The phone is entered in the ban.

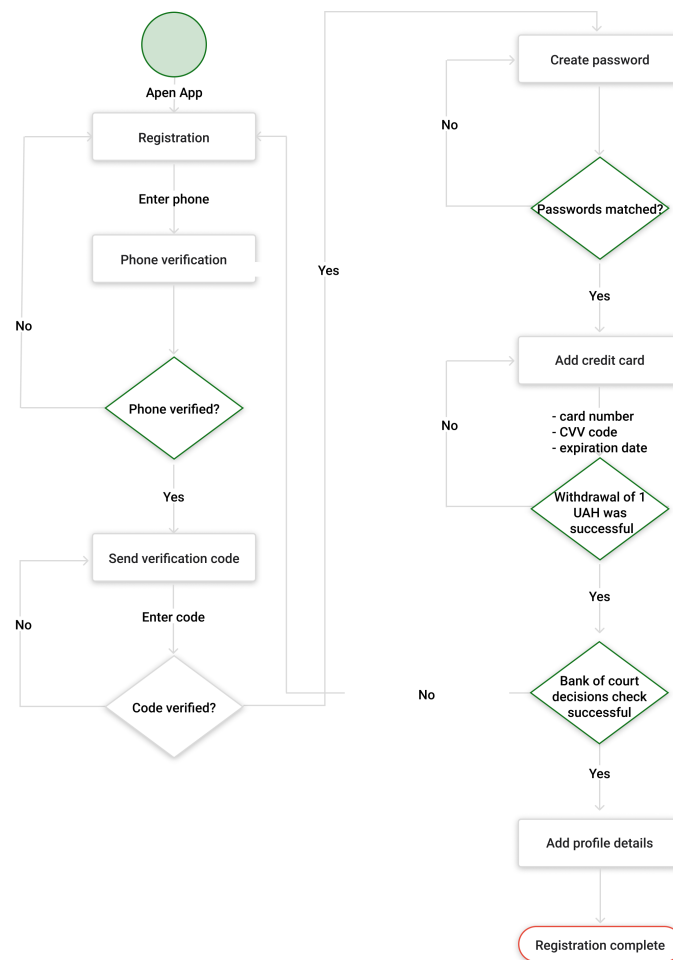


FIGURE 4.2: Flowchart: Registration

4.10.2 Login

As a User I want to be able to log into app so that I have access to the application content. The system should authenticate the user when he log in using his password and phone number.

in.png in.png in.png

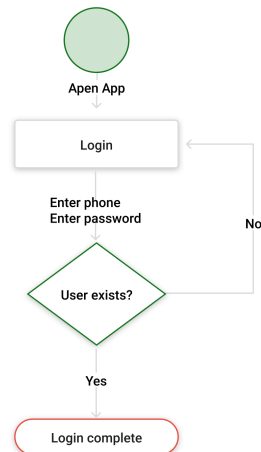


FIGURE 4.3: Flowchart: Log in

4.10.3 Profile update

As a User, I want to be able to update my personal information so that it is going to be up to date. The system should provide the possibility to update information.

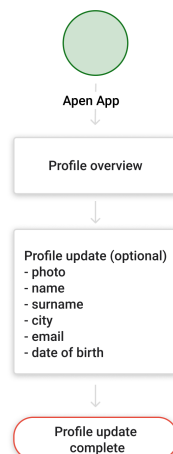


FIGURE 4.4: Flowchart: Profile update

4.10.4 Password reset

As a User I want to be able to recover my password. The system provides the possibility to change password by phone number, a third party must send a confirmation code, the user enters the code, and the system determines the correctness of the code match and confirms the possession of the person by this phone number. The user must create and confirm a password.

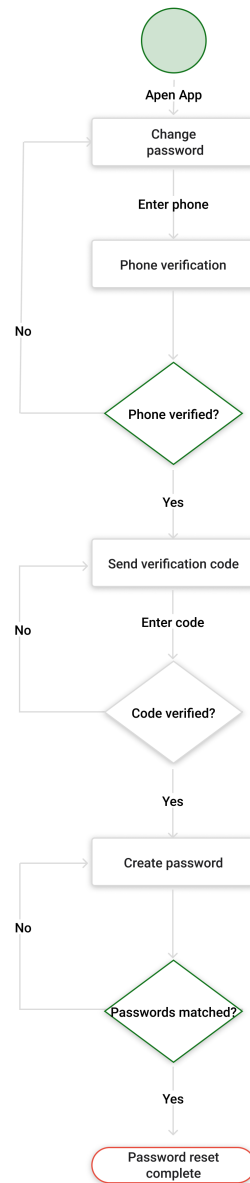


FIGURE 4.5: Flowchart: Password reset

4.10.5 Add credit card

As a User I want to be able to add several payment cards so that I can pay by one of them for purchases. The system should provide the possibility to enter the: card number, CVV code, date. The system should send a request for withdrawal of 1 UAH to check the account status and validity of card data. When adding a new card, the system determines the name and surname and requests the base of court decisions. When detecting artillery damage, the user account is blocked. The phone is entered in the ban.

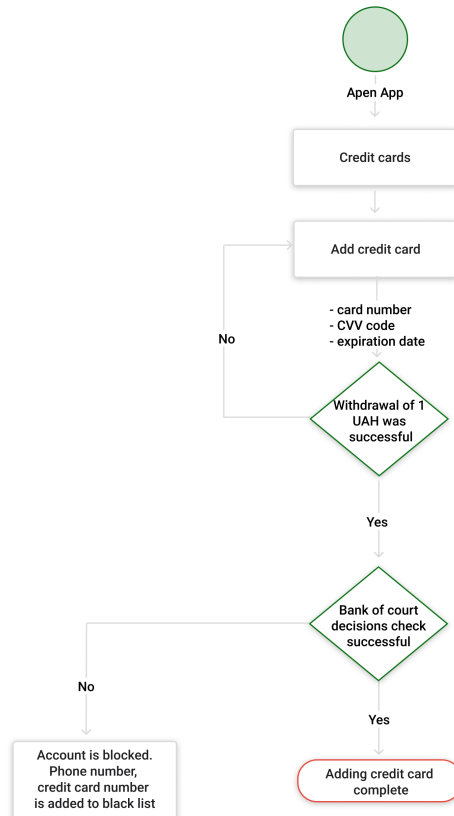


FIGURE 4.6: Flowchart: Add credit card

4.10.6 History

[h] As a User I want to be able to observe information of my completed orders so that I see all completed orders details sorted from newest to oldest one. The system should provide a possibility to observe the list of orders.

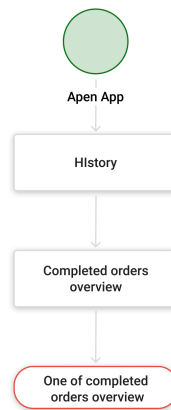


FIGURE 4.7: Flowchart: History

4.10.7 Shopping

As an User I want to be able to enter the store using my phone and an app Using an app after authentication user can enter the store through scanning QR-code by mace reader As a User I want to be able to use the scanner so that I can scan the QR code of the purchases via application so that I can observe the added items in the list of purchases. System should provide the possibility to delete items from the list. As a User I want to be able to pay for the purchases with desired payment card so that I can choose the payment card from the list of added credit cards.The system should provide a possibility to choose the payment card before the withdrawal of payment. As an User I want to be able to exit the store using my phone and an app.Using an app after authentication user can enter the store through scanning QR-code by mace reader.

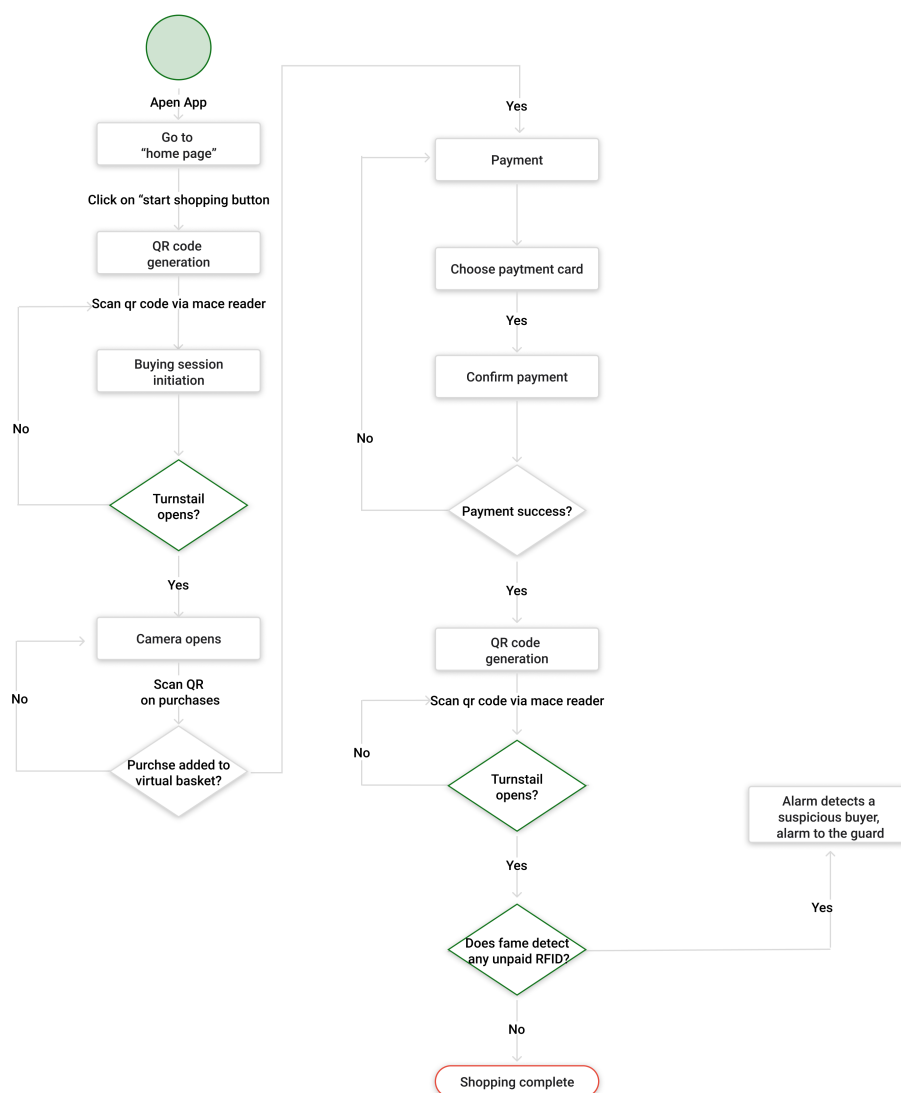


FIGURE 4.8: Flowchart: Shopping

4.11 Low fidelity prototypes

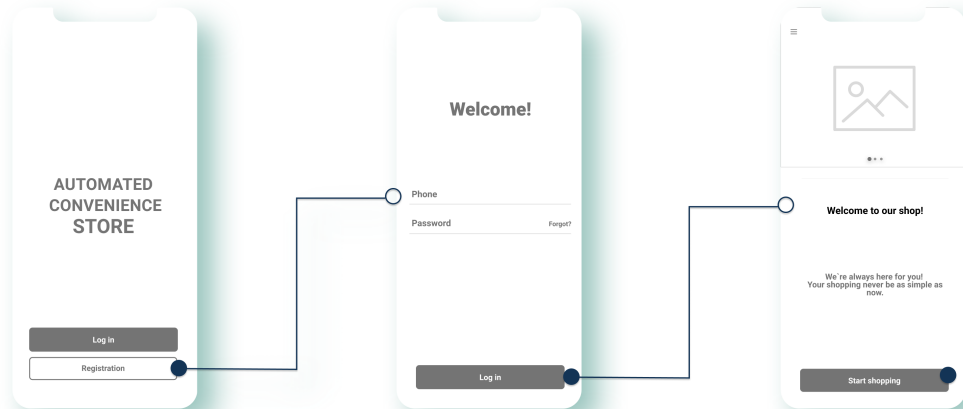


FIGURE 4.9: UserFlow: Login

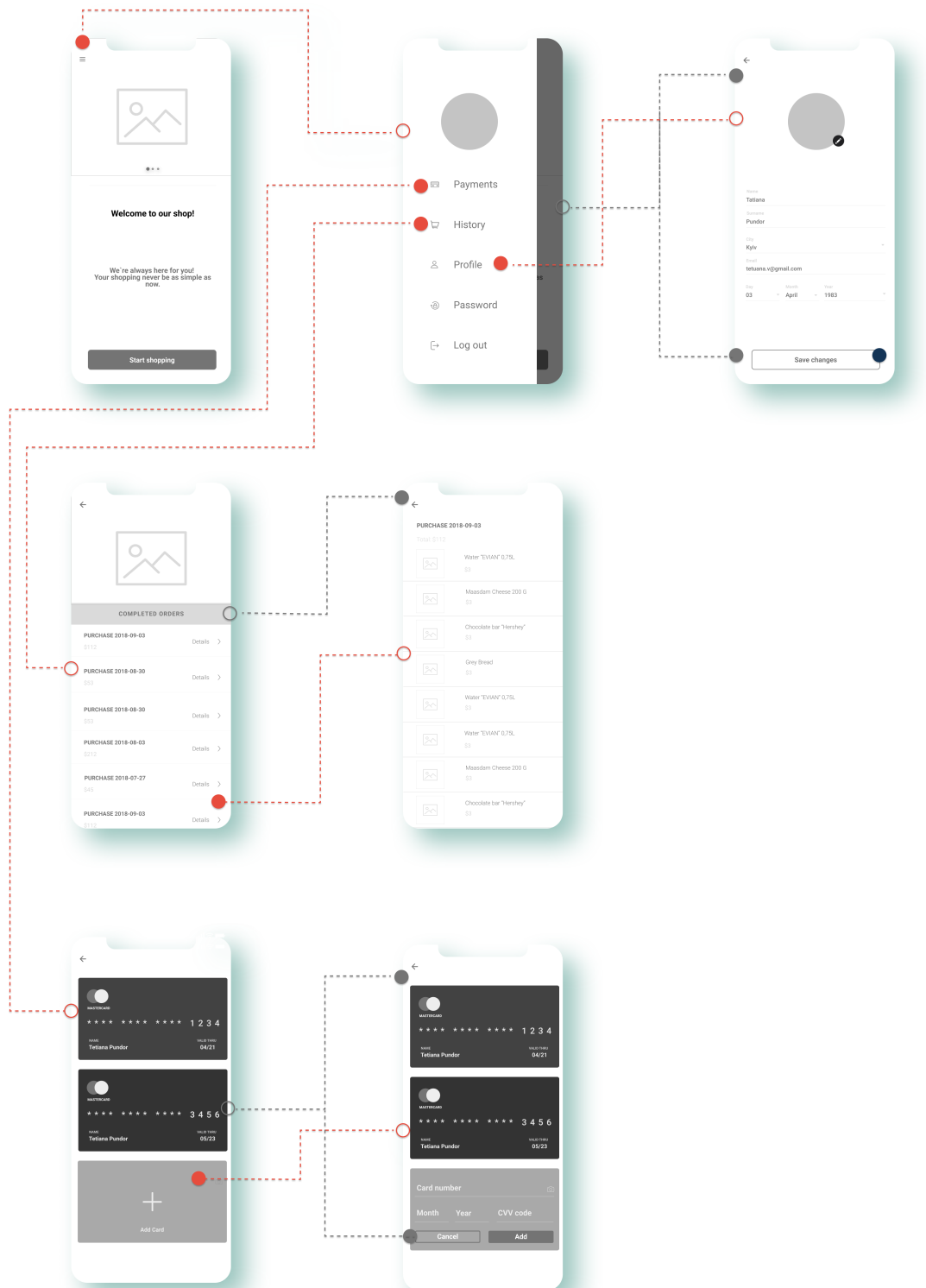


FIGURE 4.10: UserFlow: Menu

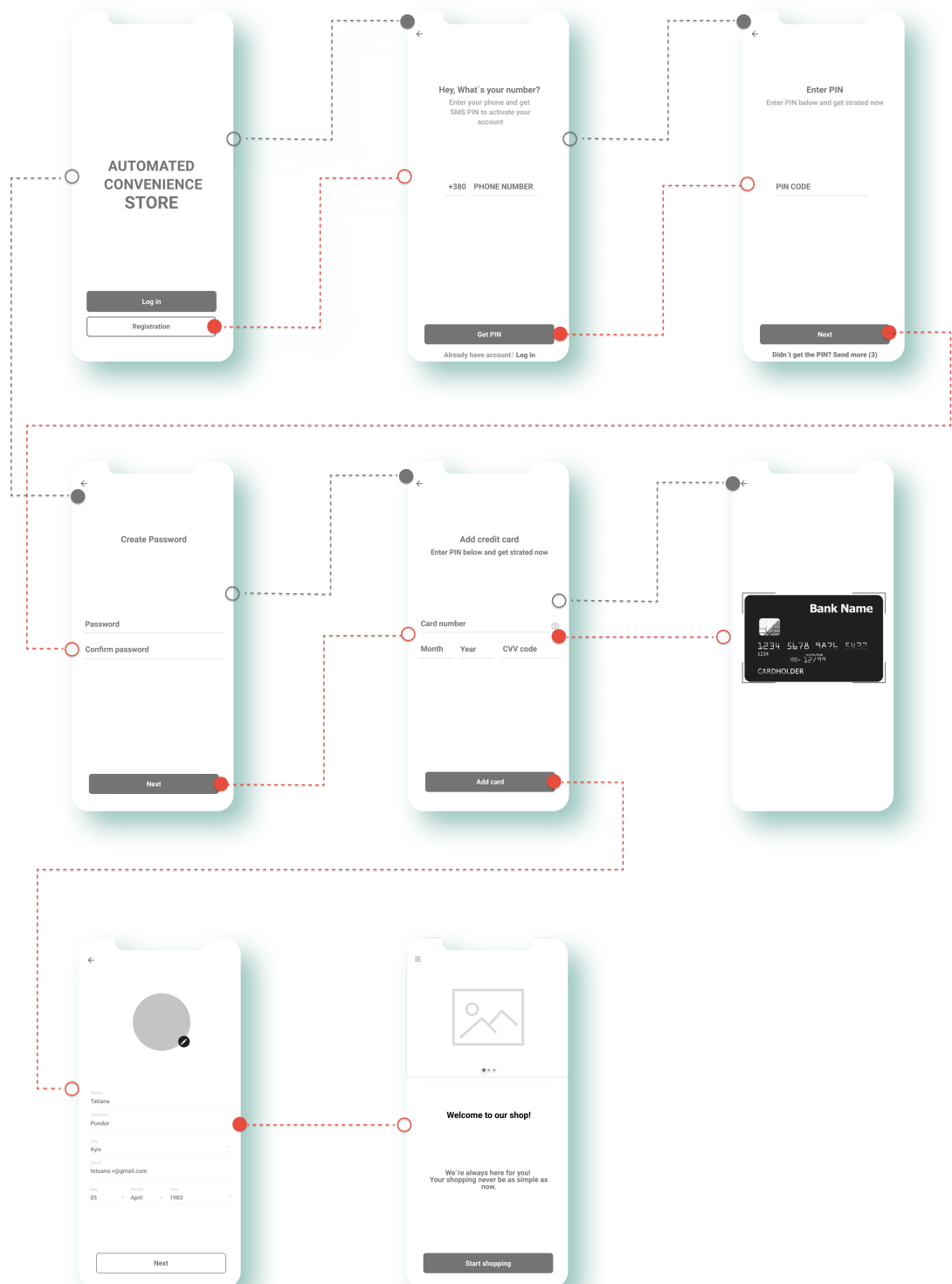


FIGURE 4.11: UserFlow: Register

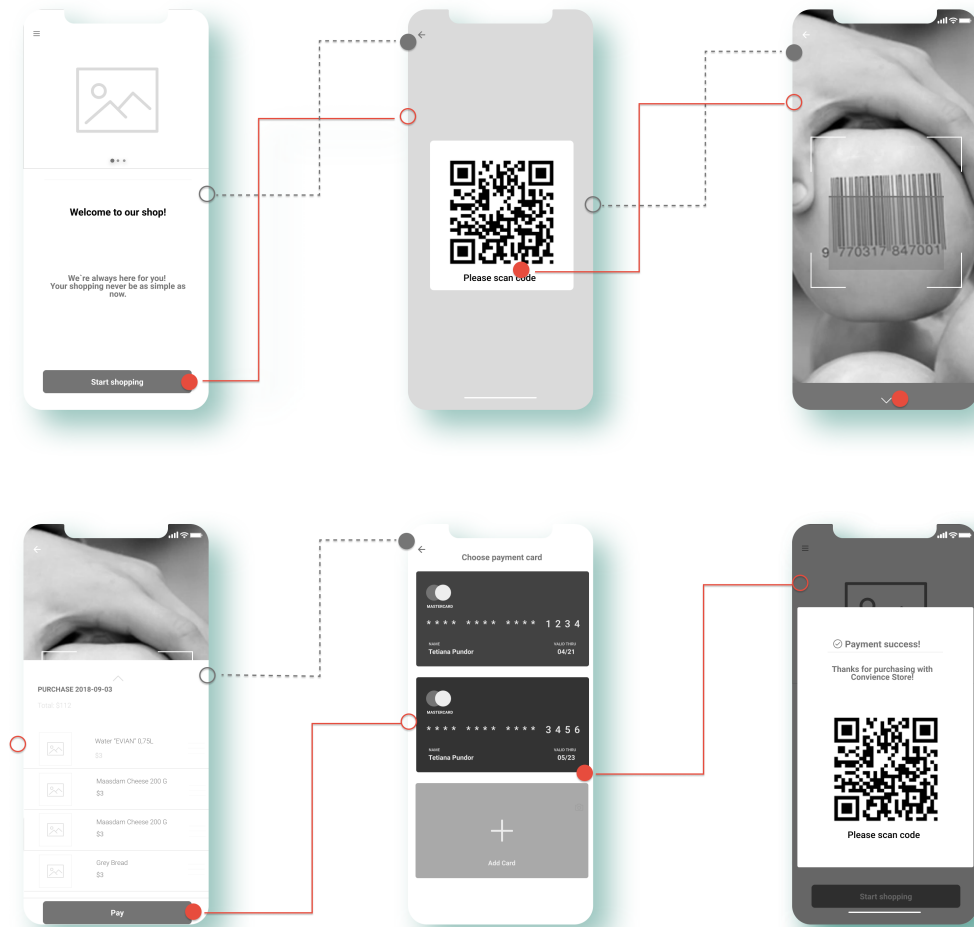


FIGURE 4.12: UserFlow: Shop

4.12 Design

Application for design Automated Convenience Store Application is available by reference "[Automated Convenience Store](#)"

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