

DEVELOPMENT OF A SMART WALLET

MARIA Geni¹, CHISELEFF Alexandru-Nicolae¹, CREȚA Gheorghe-Cosmin¹, PĂUN Ionuț-Alexandru¹, PAȘAVEL Sînzian-Albert¹, POPA Bianca-Alexandra¹, SPIROIU Marius Adrian², ABAZA Bogdan Felician³ and DIJMARESCU Manuela-Roxana³

¹Faculty: Industrial Engineering and Robotics, Study program: Engineering and Management of Complex Projects, Year of study: 2, e-mail: maria.geni98@yahoo.com

²Faculty of Transports, Railway Vehicles Department, University POLITEHNICA of Bucharest

³Faculty of Industrial Engineering and Robotics, Manufacturing Engineering Department, , University POLITEHNICA of Bucharest

ABSTRACT: Today, electronic payments are used in large numbers, in some cases you do not even need physical cards to make them because you can pay directly by phone at contactless POS or online in e-commerce. However, cash does not appear to be disappearing from the sale-purchase of goods and services too soon. Therefore, there is a need for an object to help store and transport payment instruments - the wallet - the best solution to keep these objects safe. Present research work includes development regarding a product to meet the need for permanent security payment instruments and identity documents, and at the same time, to keep up with technology that is in constant development.

KEYWORDS: smart wallet, secure opening, fingerprint sensor, security

1. Introduction

The security branch is constantly evolving, with humanity using technology to ensure the highest possible security of both people and personal property. Examples that reinforce this statement are commonly found and used.

Technology is extremely important for improving security. Without cameras, detectors and alarms, businesses would not be able to identify threats and respond appropriately. For today's organizations facing current threats, it is essential to have a complete view of operations and at the same time in detail, at all times.

Having as a starting point this constant need for security that each of us has, it is proposed to develop a product that will help meet this need. Therefore, the following will be the developments made in order to obtain a product called SECURITY WALLET, a smart wallet that has a different locking system than a regular wallet and a warning system to ensure the owner more security of valuables stored in it.

2. Business strategy

Business strategy is the detailing of the complete method by which the organization achieves its objectives. It includes elements related to: the company's vision and mission, market positioning, work systems and internal processes, quality and skills of the team, how to manage financial issues. The strategy is long-term oriented and is the most important ally of the manager throughout the business cycle [1].

Following the research, the needs of potential buyers were identified and centralized, needs synthesized for the product to be developed as shown in Table 2.1.

Table 2.1 Need analysis

Need expressed	Need Characterized	
	Parameter	Associated value
To be cheap	Price	<500 lei
Easy to use	Detection matrix	450-550 DPI
To have a small size	Overall size	145 x 100 x 30 mm
To have a low weight	Weight	220 - 250 gr
Nice look	Design	Leather / Black / Brown
Long period of use (Autonomy)	Minimum	Minimum time 48h / charge

Need expressed	Need Characterized	
	Parameter	Associated value
		for use of the product at least 15 times a day
	Battery capacity	3350 mAh
Be durable	Material	Aluminum
Stop contactless	function Lock function	Lock 100%
Locate	GPS	Application (Maximum range = 1000 km)
	BUZZER	3900 ± 500Hz
Connectivity	pairing	Bluetooth
Charge quickly	Time	40-80 min
Know the location and percentage of the battery	Application	Real time
Be durable	Product durability	10,000 openings
Efficient	Number of compartments	3-10 compartments
Have a single user	Fingerprint sensor	192 * 192 pixels

Data in Table 2.1. served as estimates of the performance that the product proposed for development should meet.

The environmental elements and the interfaces of these elements with the *SECURITY WALLET* are presented in the following table:

Table 2.2. Environmental elements and their actions

Environmental elements	Actions of the environmental element
User	Helps to perform the main function
Surfaces	Ensures the storage of the wallet
Charger	Ensures the loading of the wallet
Goods / Objects stored	Helps to perform the main function
Eyes	Helps to identify the design
External environmental elements	Helps to identify materials and their protection
Physical objects	Helps to identify external material
GPS	Helps to locate the wallet
Rules and regulations	Helps to comply with norms and regulations

When defining the functions of the system, the system's relations with the environmental elements were followed, as shown in figure 2.1.

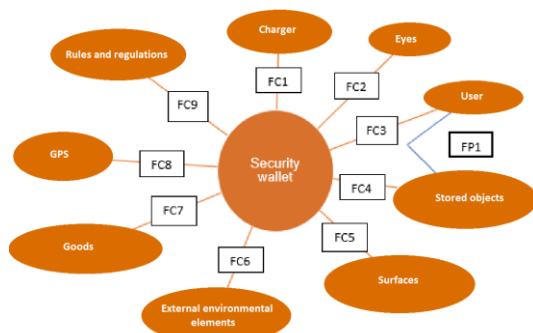


Fig. 2.1. Relationships of the system with the environmental elements

- FP1 - Ensures the protection of personal property;
- FC1 - Allows to load your wallet;
- FC2 - Be aesthetic;
- FC3 - Easy to use;
- FC4 - It adapts to stored things;
- FC5 - It adapts to different surfaces location;
- FC6 - Resist the elements of the environment outer;
- FC7 - Be resilient;
- FC8 - Allows the user to locate wallet;
- FC9 - Rules and regulations;

Following the ranking and analysis of these functions, it turned out that the first function, which ensures the user the protection of personal property is the most important, and to achieve the concepts related to the project will respect this function.

Market segmentation is a marketing term that refers to the division of customers into groups or segments with common needs [2]. Depending on the age of potential customers, we segmented the market into several sub-criteria, as shown in Table 2.3.

Table 2.3. Market segmentation

Age	16-20 years	21-45 years	> 45 years
Occupation	Pupils, students	Students, Skilled workers from different fields of industry	Unskilled workers, Skilled workers from different fields of industry, Retirees
Income	500-1500 lei	2600-6500 lei	1500- 3500 lei
Open to technology	Quite interested	Very interested	Less interested
Lesson contents	Identity card, Health card, Means of transport card, Banknotes	Identity card, Driving license, Health card, Bank cards, Banknotes, Business card, Subscription, etc.	Identity card, Health card, Pension coupons, Banknotes, Means of transport card, Driving license
Frequency of use	<5 times / day	6-10 times / day	1-3 times / day
Design / Quality	Important	Very important	Not important
The degree of necessity of the product	from time to time	Constant need to use the product	Sometimes
Availability of this product	Medium	Large	Small

According to statistics, both females and males have the same degree of interest. regarding the purchase of such a wallet because I feel the need to keep their belongings safe. Women buy their wallets more often, having a more developed sense of diversity than men, who choose the model of the wallet according to the colors of the bags or outfits they wear, while men prefer to buy a wallet less often, but with more advanced security features such as the product proposed for development.

In conclusion, we can say that the most favorable market segment for the sale of the product proposed for development is made up of potential customers in the age category 21-45 years, because they have a much higher degree of interest than the other categories, having a much greater openness to technology.

The customer profile essentially refers to a description of the type of customer the business wants. By creating a customer profile, it is easier to identify which products and services are best for him and how they can be presented effectively [3].

Following the analysis resulting from the market segmentation and the choice of the target segment, the customer profile presented in table 2.4 was developed.

Table 2.4. Target customer

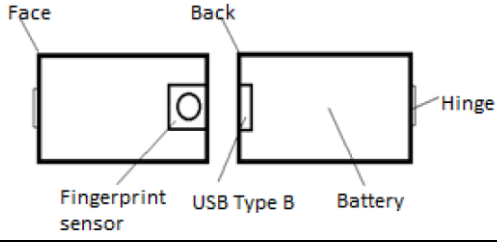
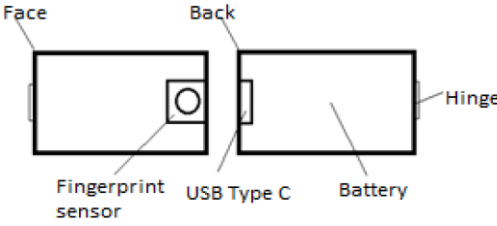
Customer profile	
Age	21-45 years
Payment method Most commonly used	Bank card
Make the most of purchases	In stores
Use wallet	Yes
Goods / Items stored in wallet	Identity card, Driving license, Health card, Bank cards, Banknotes, Service Card, Subscriptions, Etc.
Openness to technology	Very interested
The importance of the appearance of the wallet	Very important
The importance of the need for security	Very important
The purchase of a security wallet	Yes
Frequency of use	6/10 times a day
Expectations	Quality / Easy to use

3. Concurrent concepts

A product concept is the answer to a request product for specific target customers, which meets basic needs and a coherent set of other needs, where the product is defined, the differentiation fields and the benefit profile. [4]

Six technically possible solutions have been developed to fulfill the functions of the product. Below are 2 of them, the ones that best meet the requirements.

Table 3.1. Technically possible solutions

Nr.crt.	Fig.	Outline	Description
1	3.1.	 <p>Face Back Hinge Fingerprint sensor USB Type B Battery</p>	The wallet will be powered by a USB Type B charger, with energy stored in a battery. The wallet will be opened with the help of the fingerprint sensor, which stores the user's fingerprint, and then the user can store their money, cards, etc. inside the wallet. It can only be accessed by recognizing the user's fingerprint.
2	3.2.	 <p>Face Back Hinge Fingerprint sensor USB Type C Battery</p>	The wallet will be powered by a USB Type C charger, with energy stored in a battery. The wallet will be opened with the help of the fingerprint sensor, which stores the user's fingerprint, and then the user can store their money, cards, etc. inside the wallet. It can only be accessed by recognizing the user's fingerprint.

Following the analysis of the criteria (production costs of components, security of objects / goods, battery charging time, energy storage method for power supply, ease of use of the product) and analysis of concepts and their comparison, we chose for further development, concept number two, which takes into account most of the expressed needs of consumers.

4. Technical solution development

The "Security Wallet" product is a gadget that uses technology to amplify the security need that each person has. The product consists of subsystems that make it easy to use, but also efficient. Figure 4.1 shows the numerical model of the product developed with the help of CATIAV5 software, and the list of its main components can be found in table 4.1.

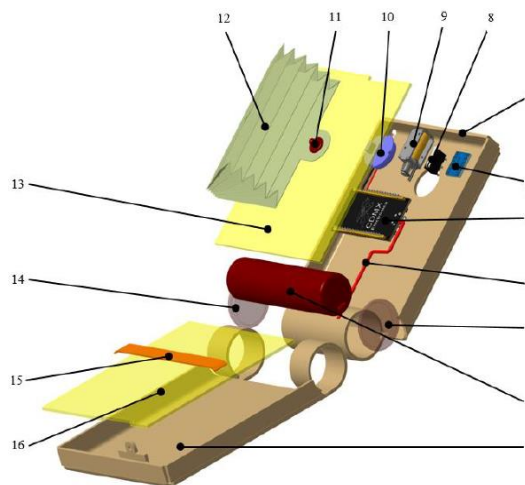


Fig. 4.1. Presentation technical solution components

Table 4.1. Component list

No. crt.	Name	No. Buc .	Specifications		Function / Role
1, 7	Housing	2	145 x 100 x 30 Material: Aluminum		Provides protection and support of goods and components
2	Battery	1	Capacity: 2600-4999mAh Interface: USB	Weight: 74.5g Size: L91 * D25	Ensures wallet autonomy
3, 14	Plug	2	26 x 4 x 30		Ensures battery protection / Fixing
4	Wires	≅10	-		Ensures connections between components
5	Motherboard	1	Max Input Voltage: 24V Model: ESP 32 GPIO pins: 11 1 pin ADC (0V to 3.3V)	Frequency of operation: 80/160 MHz Flash memory: 4MB Size: 34.2 x 25.6	Ensures wallet operation and functions
6	Logic converter	1	-		Allows the connection of two logic components even if they have different electrical potential
8	Micro-switch	1	Material: Plastic and lamella Aluminum		Shutter release solenoid
9	Solenoid	1	Voltage: 5V : 1 sec	27 x 29 x 18 mm Shock absorber height: 10mm	Secures wallet lock and unlock
10	Fingerprint sensor	1	Voltage: DC 3.3 V Module size fingerprint: 22 mm	Detection matrix: 192 x 192 pixels LED control: Yes	Ensures the protection of the goods inside the wallet and its opening
11	Staple	1	-		Ensures the catching of the fan for the cards
12	Support fans	1	Capacity: ≅ 8-10		Ensures the storage of the cards
13, 16	Plate	2	120 x 100 x 2 Aluminum		Provides support for the card fan and the elastic band
15	Elastic band	Material	5 x 110		Provides support for goods

- The prototype ensures an increased security compared to an ordinary product, both through the locking systems, which allow only the user to open it with the help of the fingerprint sensor and by locating it, in case of theft / loss;
- The user places his finger on the fingerprint sensor (10).
- After recognizing the wallet holder's fingerprint, the battery-powered solenoid (9) retracts (2), unlocking the housing hinge (1/7), allowing them to open the wallet and access the stored goods, or in the fan support card (12). , or stored on the opposite side, supported by the elastic band (15).
- When the user wants to close the wallet, it brings the two sides of the case closer (1/7), allowing the solenoid (9) to return to its original position.

5. Prototyping and testing

On the prototyping and experimentation side, the components necessary to make the product were purchased and the program for its functionality was developed.

In the first stage, the components have been tested with each other, and we are currently working on the program for the functionality of the product.

We also went on to 3D print the wallets of the wallet to have a better view of the space and the positioning of the components.

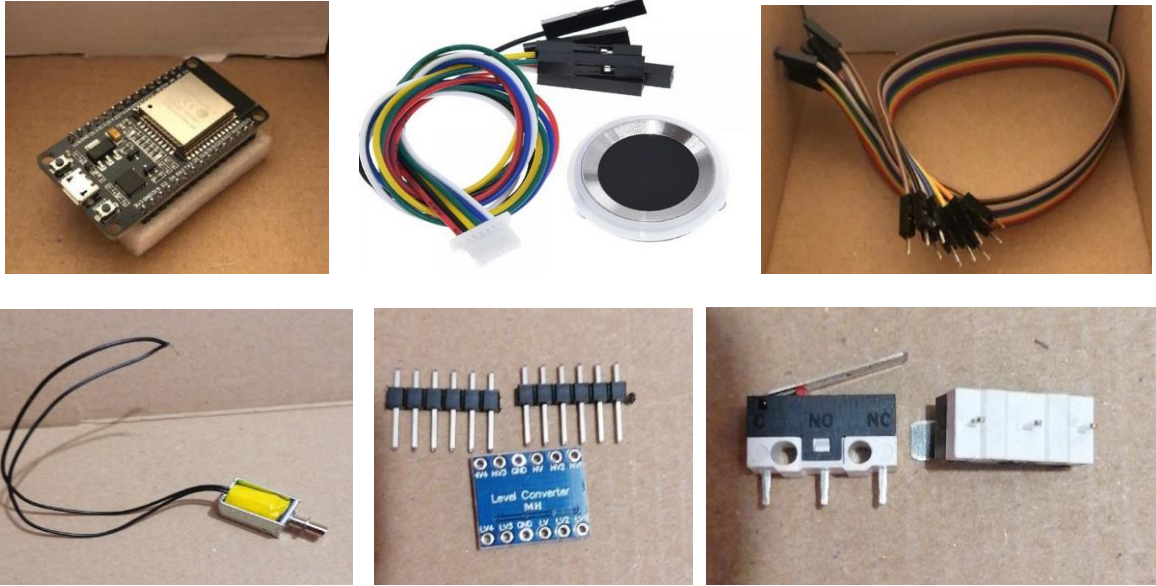


Fig.5.1. Purchased components necessary for the production of the product

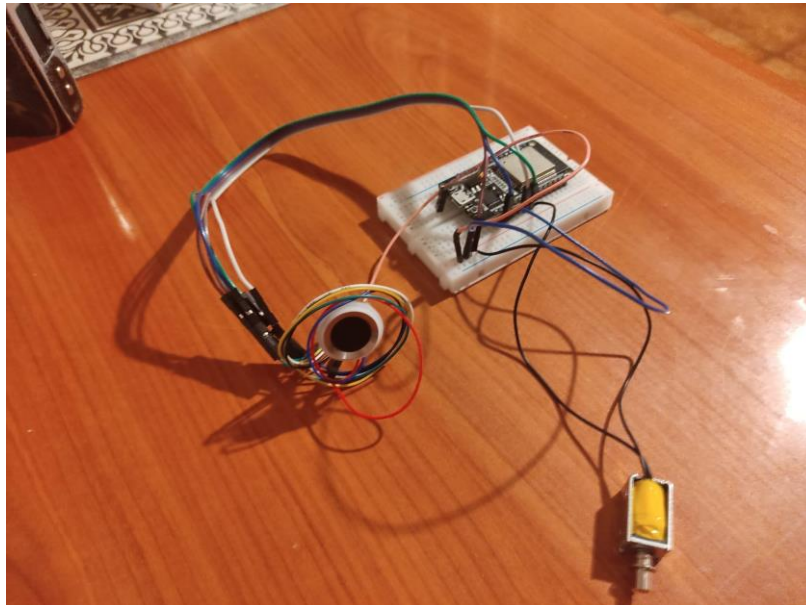


Fig.5.2. Functional realization of the product

6. Economic analysis

Following the research carried out for the acquisition and production of the necessary components, the costs necessary for the production of the product were identified (production costs, selling price, break-even point).

Table 6.1. Costs

Type of cost	Value	U.M.
Fixed costs	38161	Lei / month
Variable expenses	303	Lei / piece
Total unit cost	458	Lei / piece
Sales price	641	Lei

Analyzing the costs, we will reach the break-even point in August of the current sales year, therefore we will make a profit. These things are shown in the image below:

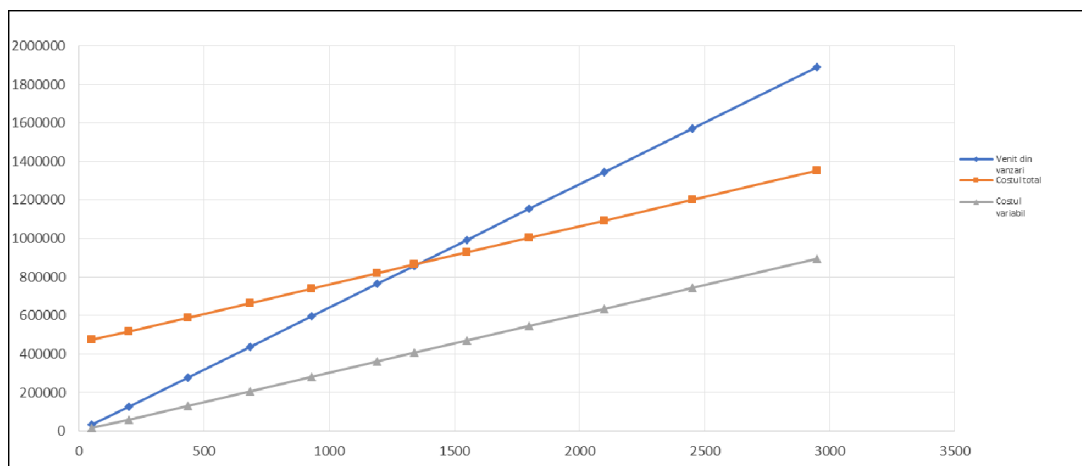


Fig. 6.1. Break even

6. Conclusions and perspectives

The research paper highlighted the developments made so far in the project that the authors are carrying out during years I and II of the master's program Engineering and Management of Complex Projects. The project focuses on the development of a smart wallet product that keeps up with technology in the field of security.

The main objective of this product was to base the research conducted in the master's program on the development of an innovative product that integrates three main subsystems - mechanical, electrical / electronic and software.

The research paper started from the presentation of the needs expressed by the respondents of the questionnaire and those resulting from studies conducted by specialists in the field of security and technology, which are carefully analyzed to obtain a good characterization of them. Analyzing the needs they have, we have identified the functions that our product should fulfill.

Following the analysis resulting from the market segmentation and the choice of the target segment, we made the profile of the target customer, according to well-established criteria.

Analyzing all these needs, we have developed six technically-possible solutions to fulfill the functions established for our product, and after analyzing the ranking of criteria and concepts and comparing them, we chose for further development the concept number two, taking into account the opinion expressed by consumers.

In order to make the prototype of the technical solution, research was carried out to find the components necessary to satisfy the functions and needs, their compatibility and their realization.

In the experimentation phase, the components were purchased, tested individually and the aim is to make a functional prototype.

The last section of the paper presents the costs related to the production of the product and the break-even point, which will be reached in August of the current sales year and a profit will be obtained.

As a final conclusion we can say that we tried to bring in tune with technology, an object that each of us uses almost daily.

Future developments will focus on the prototype of the proposed product.

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