



**Escola Politècnica Superior  
de Castelldefels**

UNIVERSITAT POLITÈCNICA DE CATALUNYA

# MASTER THESIS

**TITLE:** Business plan for a provider of access control systems based on fingerprints.

**MASTER DEGREE:** Master in Science in Telecommunication Engineering & Management

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**DATE:** October 11, 2010

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## Overview

This master thesis consist on a business plan that describes a technology business idea planning to make an access and time attendance control service based on fingerprints through a remote system. The main characteristics of this product are a low cost system and low installation impact on client's premises, respect to existing systems on biometric market.

Although some of main competitors are beginning to offer more portable and wireless technology devices, there is a market gap to cover, taking a low cost and a easy installation as core values to apply this technology in different sectors, in order to offer a good value for money ratio product to attract potential clients who intend to use biometric systems (associated with a high security, economic cost and installation impact) respect traditional access and time attendance control technologies as magnetic cards, passwords usage..etc.

The aim is to provide a product to attract clients requiring these services in environments where previously this wasn't considered for their high cost and installation impact to realize shifts control and other complementary functions as authentication for a photocopier usage, meeting rooms access...etc.

Therefore the product offered is not focused in offering a high security system for critical environments like an airport for example, but it's directed to those environments where the purpose is to make a flexible and economical access and/or time attendance control, providing an optimal security level through a low-cost fingerprint system with low impact in their installation (easy installation in client premises to the system work) that can be consulted through an Internet connection.

The objective of this thesis is to develop a business plan, where it's seeking a business opportunity that implies a technological analysis to offer a profitable solution for a company capable of performing the requirements described, taking into account all intermediate steps to get there.

Finally, after analyzing all important parameters of a business plan evaluation, we can say that it's a profitable business idea.

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# INTRODUCTION

This master thesis consist on a business plan that describes a technology business idea planning to make an access and time attendance control service based on fingerprints through a remote system. The main characteristics of this product are a low cost system and low installation impact on client's premises (easy installation in client premises to the system work), respect to existing systems in biometric market.

Chapter 1 presents an executive summary that gathers all the most important aspects to define the business plan.

Chapter 2 starts explaining the main motivations for making this business plan and the business model proposed (products and services offered).

In chapter 3 a technology watch will be done to meet all current applications, alternative technologies and patents.

In chapter 4 a market analysis will be done to ascertain such systems demand (which are the market trends? what kind of products are needed? what are the values that client demands?...etc.), the existing competition (products / services that main competitors offer), market dimension (annual economic benefit in fingerprint industry) and the position adopted by this business idea inside the market.

In chapter 5 we present the company model to explain the service delivery process and the position inside value chain.

Chapter 6 will be a marketing plan to define the sales and product channels distribution, advertising and all necessary actions to bring the product to the end client.

In chapter 7, taking into account a potential market, we present the suppliers, resources and the operational model needed to achieve it.

Chapter 8 defines the future growth lines of the company and analyses the main business characteristics trough a SWOT and Porter's five forces analysis.

Chapter 9 presents an economic study to a financial plan forecast development, taking into account a feasible potential market.

Finally chapter 10 presents final conclusions about the business plan to highlight the aim of this thesis: make a business plan, where it's seeking a business opportunity that implies a technological analysis to offer a profitable solution for a company capable of performing the requirements described, taking into account all intermediate steps to get there.

In chapter 11 a brief reflect on the environmental impact of the project is made.

# CHAPTER 1. EXECUTIVE SUMMARY

## Motivations

The main companies in biometric industry offer access and time attendance control systems subject to a high economic cost and a strong installation impact, although some of these companies are beginning to offer more portable and wireless technology devices, there is a market gap to cover, taking a low cost and a easy installation as core values to apply this technology in different business environments, in order to offer a good value for money ratio product to attract potential clients who intend to use biometric systems (associated with a high security, economic cost and installation impact) respect traditional access and time attendance control technologies as magnetic cards, passwords usage..etc.

The aim is to provide a product to attract clients requiring these services in environments where previously this wasn't considered for their high cost and installation impact to realize shifts control and other complementary functions as authentication for a photocopier usage, meeting rooms access...etc.

## Market overview

The revenues for the global biometric recognition market are projected to grow from about US \$2,1 billion in 2006 to US \$5,7 billion in 2010 [3] and fingerprint and AFIS (Automated Fingerprint Identification System) technology has 58 % market share on biometric industry actually [4], is to say, a market share of US \$3,3 billion or 2435 millions € in 2010 for fingerprint industry.

NEC, SAFRAN and L-1 Identity Solutions are among market leaders [49]. Fingerprint equipment market shares indicate NEC is the main worldwide leader around 60% market share actually [6].

The possibility of applying this technology in a more cheaply and efficiently manner in different business environments causes a market growth forecast for the coming years through a low cost and wide applicability of the technology to drive their use in every industry.

## Business model and growth strategy

The idea of the business plan offered is to provide an access control and time attendance fingerprint service eliminating the high impact on client's company premises and also offer a low cost service.

For that, use a combination of existing and disseminated technologies; to avoid the impact of wiring and the need of having a PC associated with each fingerprint terminal, we propose the use of simple, portable and cheap fingerprint scanners with wireless technology; that depending on the environment, whether it's a place with Internet access, can be Bluetooth, or in a isolated area without Internet access, can be a cellular data connection as UMTS.

On the growth strategy several possibilities are evaluated as promote R & D for continuous improvement and development in all system elements in order to have intellectual property that increase the company's value, and offer new products with greater mobility, comfort and low cost, such as the possibility of developing a system based on user's mobile phones or PDAs as fingerprint scanners belonging to system infrastructure.

## **Economic impact**

In the economic forecasting realized, earning a net profit of 122.349,30 € the fourth year of exercise, resulting in a NPV (Net Present Value) of 226.671,04 € and an IRR (Internal Rate of Return) 45%, with 55.000 € as initial investment (considering a company residual value of 10 years with the net result obtained in the fifth year of exercise as reference)

Finally, after analyzing all important parameters of a business plan evaluation, we can say that it's a profitable business idea.

## **Project team**

The team related to this project is a multidisciplinary team with complementary profiles with a very clear idea of the most important aspects to enter to the market exposed:

**Commercial/manager:** is responsible for client's direct relationships, general management and financial operations, a person with know-how in biometric industry, he will be in charge of client contacting to set the projects specifications and monitor their satisfaction and potentials service improvements that can be introduced, looks for new clients and establishes the marketing policies required.

**Engineer:** Will be responsible for systems design and solve technical consultations, engineers with knowledge in biometric industry and in the electrical engineering field for devices design / modification.

**Worker/installer:** Responsible for device assembling, repair & modification and carrying out the necessary installations and configurations.

## CHAPTER 2. BUSINESS DESCRIPTION

Currently the use of biometric technology has many applications such as forensic and government applications (passports, ID cards, driver's licenses...etc.) and commercial applications relating to persons identification and control through their fingerprint recognition (physical access control, network and computer logins, e-Commerce, time attendance...etc.).

In previous years fingerprint systems had been related with a high economic cost to provide high security, being also expensive systems in installation and maintenance. Nowadays the possibility to apply this technology in a more cheaply and efficiently manner, thanks to low cost fingerprint sensors and wireless technology devices, opens the door to use this technology in different business environments. This new trend can already be seen in some products to replace passwords or PIN codes, to log onto a laptop or mobile phone for example, using a fingerprint sensor embedded in these devices.

The main companies in biometric industry offer access and time attendance control systems subject to a high economic cost and a strong installation impact, although some of these companies are beginning to offer more portable and wireless technology devices, there is a market gap to cover taking a low cost and a easy installation as core values to apply this technology in different sectors, in order to offer a good value for money ratio product to attract potential clients who intend to use biometric systems (associated with a high security, economic cost and installation impact) respect traditional access and time attendance control technologies as magnetic cards, passwords usage..etc.

As a note, a Forrester Research study found that 40% of calls to a company's help desk are password-related. The cost of maintaining a password in the corporate computing environment has been pegged at \$100 to \$400 per user per year [5]

The aim is to provide a product to attract clients requiring these services in environments where previously this wasn't considered for their high cost and installation impact to realize shifts control and other complementary functions as authentication for a photocopier usage, meeting rooms access...etc.

Therefore the product offered is not focused in offering a high security system for critical environments like an airport for example, but it's directed to those environments where the purpose is to make a flexible and economical access and/or time attendance control, providing an optimal security level through a low-cost fingerprint system with low impact in their installation (easy installation in client premises to the system work) that can be consulted through an Internet connection.

### **Business model**

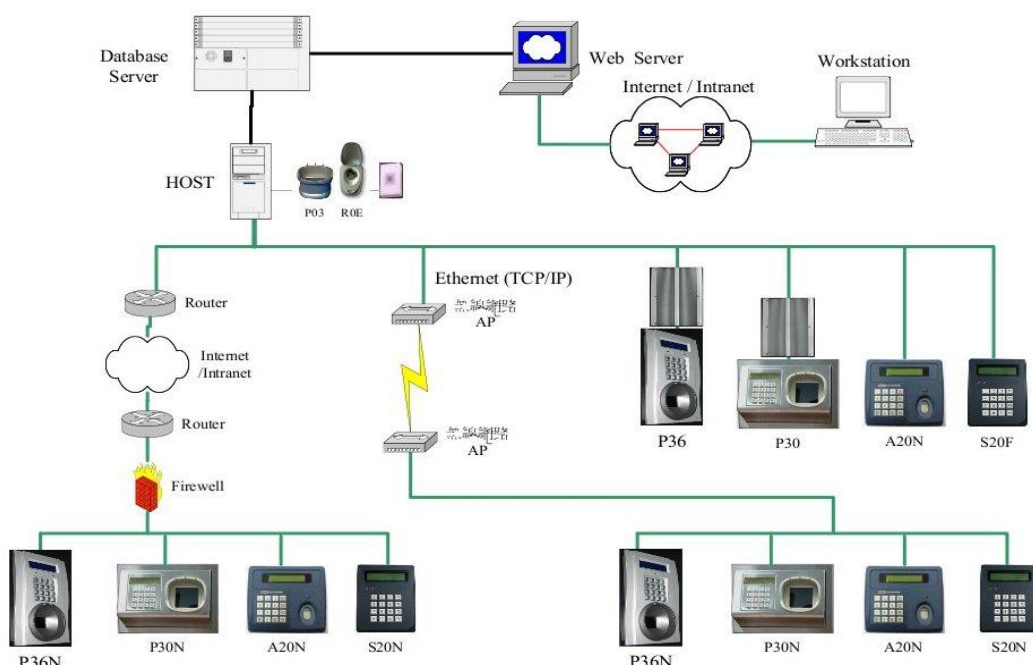
These business plan model presentation describes the technologies, elements and methods to define a company that covers the business opportunity described.

When talk about access control mean carry the approval or denial of a person to a device or location by an automatic system which uses as reference the fingerprint to verify their identity in a database. As for time attendance control refers to the registration of input and output workers operations in company premises with an automatic fingerprint verification system.



Currently there are several companies in the market, including main competitors (see chapter 4 for details), that offer solutions to implement access and time attendance control fingerprint systems. These systems are subject to fingerprint scanners terminals associated to a wired connection; either associated with a PC or individually, connected to the Ethernet network. Although three of the main Spanish competitors offer the possibility to access to some fingerprint devices models via Wi-Fi through an external adapter module (requiring an additional power connection for each adapter module) represent a high impact on client's company premises [24] [28] [32].

An example of present systems, that involve a heavy impact on their installation for their wired infrastructure and/or for their dimensions, can be seen in system implementation proposed by Gauss Computer Company (figure 2.1).



**Figure 2.1** Gauss computer fingerprint system (extracted from: <http://www.gausscom.com.tw/20080425new/web/en/system.html>).

There are also companies that offer autonomous terminals that have to be connected to any data distribution network, but internally manage their own database, as for example terminals offered by the company Fingertech [1], the drawback on these devices is a high economic cost respect to those discussed in the previous paragraph, which grows proportionally to the number of devices and locations to do fingerprint checks.

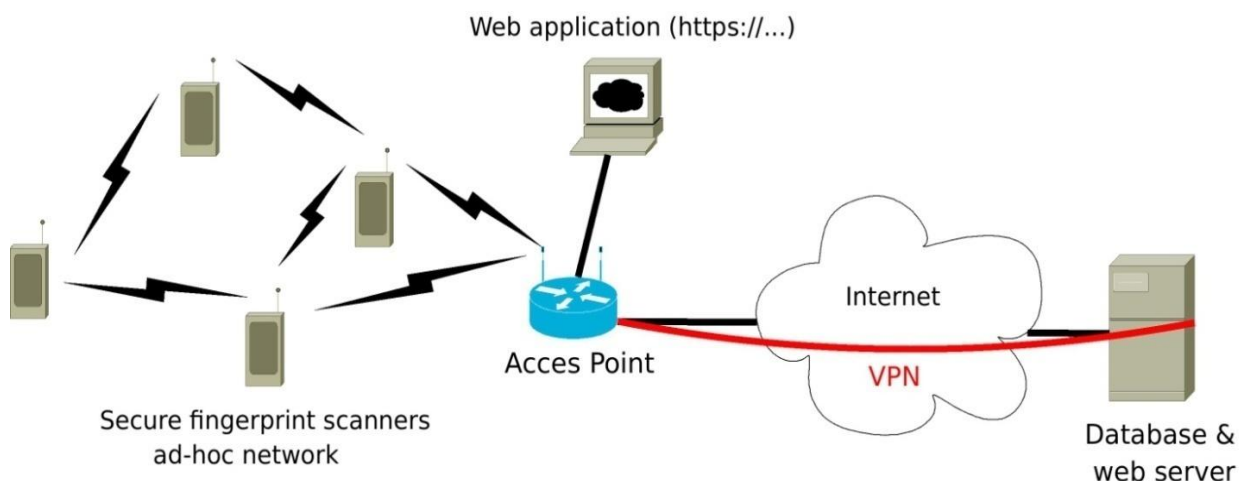
The idea of the business plan offered is to provide an access control and time attendance fingerprint service where a high security is not a relevant factor, eliminating the high impact on client's company premises, seen in the examples above, and also offer a low cost service.

For that, use a combination of existing and disseminated technologies; to avoid the impact of wiring and the need of having a PC associated with each fingerprint terminal, proposes the use of simple, portable and cheap fingerprint scanners with wireless technology; that depending on the environment, whether it's a place with Internet access, can be Bluetooth, or in a isolated area without Internet access, can be a cellular data connection as UMTS (for a more detailed technical aspects of the system see annex A).

- Internet access environments: In this case with secure Bluetooth technology (encryption), fingerprint scanners are connected through an ad-hoc network typology, which is characterized by a network of fixed and mobile terminals, or only mobile terminals, that are not dependent on existing infrastructure, unfolding in a spontaneous, adaptive, decentralized and configurable mode [2], that is to say, fingerprint scanners, acting both nodes, forming its own ad-hoc network communication.

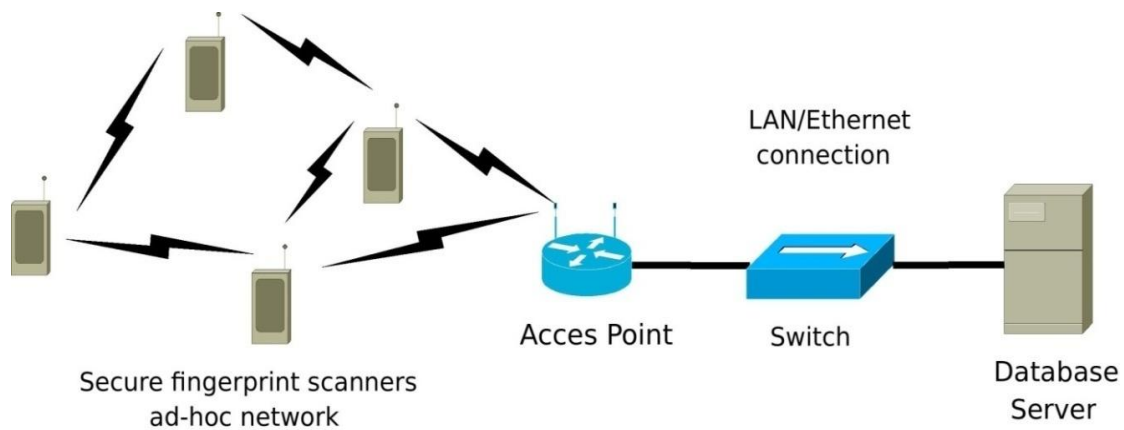
The computing power for fingerprint verification resides on a database server or group of servers located in the company exposed in this business plan (remote service) or placed in the client company, according to client interests.

In the case of providing remote service, with a VPN (Virtual Private Network) over the client company Internet connection (an ADSL connection for example), would connect with the servers responsible for fingerprint verification in the database, providing also, through a secure web application HTTPS, a real time view of the records relating to system transactions, thereby obtaining a very good value for money ratio service, in figure 2.2 can view the schema that describes the scenario proposed.



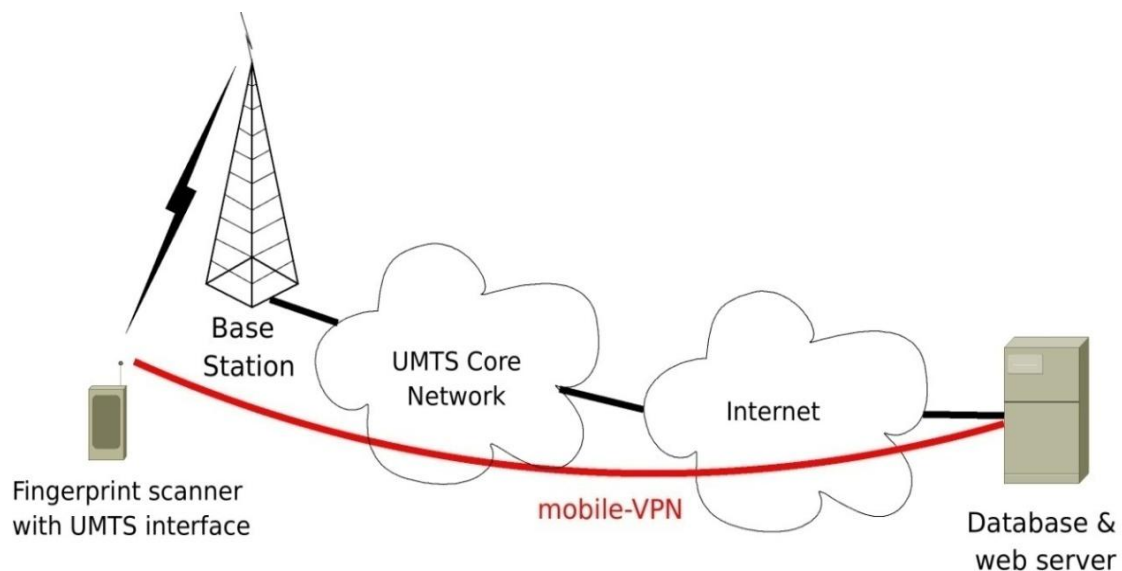
**Figure 2.2** Internet access environments with remote service.

In case the database server is located within client's company building, operation would be the same as above, but accessing the server located in the company LAN (Local Area Network) through an Ethernet connection for example (figure 2.3).



**Figure 2.3** Internet access environments without remote service.

- **Isolated area without Internet access:** This solution is designed for those places where no exist network infrastructure and is necessary an access or/and time attendance control, for example, could be a material warehouse in a construction, for this the fingerprint scanner would be provided with a UMTS interface to send data to Internet via cellular network through a secure connection (mobile-VPN connection), to communicate with the server (see figure 2.4).



**Figure 2.4** isolated area without Internet access service.

One of the main worldwide competitor in biometric industry offers a solution similar to the one presented here, with the difference that is needed, in addition to the fingerprint scanner, a compatible PDA, which is responsible for making the connection [11]; and two of the main Spanish competitors gives a GSM communication solution with autonomous terminals [22] or GPRS communication through an external adapter module [32], thus giving in this business plan a simplest and economic solution (see chapter 4 for details).

## CHAPTER 3. TECHNOLOGY WATCH

### Applications and alternative technologies

Information and communications technologies advances and lower cost equipment availability have smoothed the way for automated biometric recognition systems. Biometric applications can be grouped into the following groups [43]:

- Forensic applications: corpse identification, parenthood determination...etc.
- Government applications: passports, ID cards, driver's licenses, border and immigration control, social security and welfare-disbursement...etc.
- Commercial applications: physical access control; network and computer logins; e-Commerce, mobile phones, PDA's, e-Health...etc.

Currently, access control fingerprint systems are an alternative to the traditional technology in these types of functions, as the use of PIN, passwords, cards...etc. In this section we will analyse potential alternative technologies inside the biometric field [33].

- DNA: Deoxyribo Nucleic Acid (DNA) is the one-dimensional ultimate unique code for one's individuality, except for the fact that identical twins have identical DNA patterns. Its main drawbacks are that is easy to steal a piece of DNA from another person, presents automatic real-time recognition issues and privacy issues (genetic information).
- Ear: It's known that the shape of the ear and the structure of the cartilaginous tissue of the pinna are distinctive. The main drawback is that the features of an ear are not expected to be unique to an individual.
- Face: The face is one of the most acceptable biometrics because it's one of the most common methods of recognition that humans use in their visual interactions. The main drawback is very challenging to develop face recognition techniques that can tolerate the effects of ageing, facial expressions, slight variations in the imaging environment and variations in the pose of the face.
- Facial, hand, and hand vein infra-red thermograms: The pattern of heat radiated by the human body is a characteristic of each individual body and can be captured by an infra-red camera. The main drawback is the very high cost of infra-red sensors.
- Gait: It's the peculiar way one walks and is a complex spatio-temporal biometric. Gait-based systems use a video-sequence footage of a walking person to measure several different movements The main drawback is that isn't very distinctive and it's only allow verification in some low-security applications.

- Hand and finger geometry: Some features related to a human hand are relatively invariant and peculiar to an individual. The main drawback is that isn't very distinctiveness.
- Iris: Visual texture of the human iris is distinctive for each person and each eye. Capturing an iris image involves cooperation from the user. This technology is believed to be extremely accurate and fast.
- Keystroke dynamics: It is hypothesized that each person types on a keyboard in a characteristic way. The main drawback is that this biometric behavioural is not expected to be unique to each individual, although offers sufficient discriminatory information to permit identity verification.
- Odour: It's known that each object exudes an odour that is characteristic of its chemical composition and could be used for distinguishing various objects. The main drawback is that it's not clear if the invariance in the body odour could be detected despite deodorant smells and varying chemical composition.
- Retinal scan: The retinal vasculature is rich in structure and is supposed to be a characteristic of each individual and each eye. It's claimed to be the most secure biometric characteristic. The main drawback is that the image acquisition requires a conscious effort on the part of the user and can reveal some medical conditions.
- Voice: may be the only feasible biometric in applications requiring person recognition over a telephone. The main drawback is not expected to be sufficiently distinctive to permit identification of an individual.

Although there are several technologies, the strength of fingerprints systems are that are very distinctive, fingerprint details are permanent, even if they may temporarily change slightly due to cuts and bruises on the skin or weather conditions. Live-scan fingerprint sensors can easily capture high-quality images and have become quite small and affordable. A proof of this, as mentioned above, is that fingerprint and AFIS technology has 58 % market share on biometric industry actually [4].

Usually companies offering products based on biometric technologies offer multi-biometric devices, either through terminals that combine several technologies or separately. The companies surveyed as major competitors, which also offer these products are (see chapter 4 for details): NEC, Sagem Sécurité, L-1 Identity Solutions, Abymatic, Kimaldi, Saima and Technomais.

## Patents

Nowadays are many patents related to the fingerprint technology field (sensors, devices, procedures...etc.), so we will focus on worldwide patents on access and time attendance control fingerprint systems implementation methods.

There are a total of 12 patents (the most related to the business exposed) [44] between 2002 and 2009, according to the European Patent Office database [45].

These patents don't affect the system proposed here, since its purpose is to optimize a specific part of the system using a proprietary technology that is not used in the proposed product.

On the other hand, the system presented in the business plan, due a combination of existing and disseminated technologies utilization, don't have any patentable component, for that is evaluated as growth line to promote R & D for continuous improvement and development in all system elements, in order to have intellectual property on some technologies and procedures.

The following is a list of the companies behind the patents mentioned:

- Paladin Electronic Services, Inc (USA): It's a privately held research and development company (<http://pes1.com/>).
- Chi Mei Communication Systems, Inc (China): It's a corporation dedicated to wireless communication technology R&D and manufacture (<http://www.cmcs.com.tw/en/index.html>).
- Yantai Haide Science and Technology Co. (China): a technological Chinese company.
- Sense Technologies (USA): Sense is a company dedicated to the design, development, manufacturing and marketing of biometric identification products and systems (<http://www.senseme.com/>).
- Biocentric Solutions (USA): Biocentric is a company that utilizes a combination of patented technologies and proprietary software to tools design that enable fingerprint based solutions for corporate, government, healthcare, law enforcement and e-Commerce applications (<http://www.biocentralsolutions.com>).
- Zhong Kong Furniture CO (China): a scientific management company (<http://www.zk-furniture.com>).
- Suprema Inc. (Korea): Suprema is a biometric company offering core fingerprint technologies for PC and embedded applications (<http://www.supremainc.com>).
- NEC (Japan): Nec is a multinational which focuses in IT (Information Technologies), networking and semiconductors (see chapter 4 for details).
- Plus One Technical Solutions Co. (Korea): Plus One Tech provides consulting expertise for eCommerce solutions, custom and integration applications (<http://www.plus1tech.com/>).

## CHAPTER 4. MARKET RESEARCH

### Market characteristics

The revenues for the global biometric recognition market are projected to grow from about US \$2,1 billion in 2006 to US \$5,7 billion in 2010 [3] and fingerprint and AFIS (Automated Fingerprint Identification System) technology has 58 % market share on biometric industry actually [4], is to say, a market share of US \$3,3 billion or 2435 millions € in 2010 for fingerprint industry.

The emerging requirements of reliable and highly accurate personal identification in a number of government and commercial applications (international border crossings, building access, computer and network logins...etc.) have served as an impetus for a tremendous growth in biometric recognition technology [3]. All this, and the possibility of applying this technology in a more cheaply and efficiently manner in different business environments causes a market growth forecast for the coming years through a low cost and wide applicability of the technology to drive their use in every industry.

### Competitors analysis

#### Main worldwide competitors

NEC, SAFRAN and L-1 Identity Solutions are among market leaders [49]. Fingerprint equipment market shares indicate NEC is the main worldwide leader around 60% market share actually [6].

- NEC Corporation : NEC is a Japanese multinational which focuses in IT (Information Technologies), networking and semiconductors, with over 155.000 employees and annual net sales of 35.000 millions €.

NEC has dedicated over three decades in developing fingerprint identification technology, and today, NEC is the world's leading fingerprint supplier for law enforcement and identity management applications.

NEC biometric solutions have been used by more than 1000 customers in over 30 countries worldwide in law enforcement automated fingerprint authentication systems, national Ids, voter Ids, driver licenses, e-passport, border control and foreigner registration. The main products of the multinational are optical fingerprint scanners with USB interface in order to connect to a PC and fingerprint matching software.

Although NEC is consolidated in the above sectors, as a company that creates scanners and related software systems based on fingerprint access, the reason which makes a direct competitor is that NEC has recently embarked on a new stage to extend its expertise to new markets to offer identification technology of government, civil and commercial users [6].

- **SAFRAN:** SAFRAN is a leading international high-technology French group with three core businesses: aerospace, defence and security. Operating worldwide, the group has 54.900 employees and annual sales exceeding 10,4 billion € [7].

The SAFRAN Group company responsible for electronic and digital fingerprint processing solutions are Sagem Sécurité with 5.600 employees and annual sales of 694 millions € and its American subsidiary, MorphoTrak, formed in April 2009 from the merger of Sagem and Motorola's biometric division, with 450 employees [8].

Sagem Sécurité's products are based on numerous proprietary technologies for designing, modelling and optimizing wide ranges of equipment in biometric identification, chip cards and secure Id documentation and equipment.

In terms of access control systems based on fingerprint, Sagem Sécurité solutions cover all access control applications, from the opening of a simple door to access to buildings, companies, vast infrastructures and government agencies. The main products in this area are optical fingerprint scanners operating in standalone or network mode, or with USB interface, in order to connect to a PC and fingerprint matching software [9].

- **L-1 Identity Solutions:** L-1 Identity Solutions, Inc. is an American company from Connecticut. It was formed on August 2006, from a merger of Viisage Technology, Inc. and Identix Incorporated [10] with around 2264 employees and USD 651 million or 479 million € revenue in 2009.

L-1 Identity Solutions offers hardware, software, services, tools and applications for the identification of individuals through biometrics, enrolment and processing of identity data, and production and authentication of secure identity credentials. In addition to offering products such as those described in previous companies, offer a product called IBIS (Integrated Biometric Identification System), is a modular hand held device that links via Bluetooth to any pre-configured, supported PDA; And these PDA, via cellular communication (EVO or EDGE technology) sending the information to a fingerprint authentication database (see figure 4.1) [11].



**Figure 4.1** L-1 Identity Solutions IBIS Product (extracted from: <http://www.l1id.com/pages/533-ibis-extreme-how-it-works>).



In this case, we are faced with a main competitor, which, while not offering wireless indoor access control fingerprint services, providing this mobile solution that is a substitute to one of the solutions proposed working over cell communication, but as we see, in this case, is necessary a PDA, which is not in the product proposed here due a greater simplicity and cost.

## Main Spanish competitors

In this chapter we will analyse the companies involved in the installation, distribution and / or manufacture of access and time attendance control fingerprint systems solutions operating directly in Spain. For location of these companies we have referred to SICUR (International Security Safety & Fire Exhibition), where are represented the most important companies in various sectors relating to security and access control systems [12].

The companies located and analysed are: Abymatic, Apsys, Accesor, BFI Optilas, By Demes, Circontrol, Databac, Dorlet, Identia, Inzacard, Kimaldi, LSB, Primion Digitek, Rister, Robotics, Saima, Spec, Technomais and Zksoftware. Then briefly describe Spanish competitors main characteristics in the following table (see table 4.1).

**Table 4.1** Spanish competitors' main characteristics

Company	Activities	Products in the sector
Abymatic	Engineering and installer.	Offers installation and engineering services for biometric access control systems [13]. As a provider of fingerprint devices has ADI International [14], which in turn, provides the majority of products of the multinational Sagem Sécurité.
Apsys	Manufacturer, installer and distribution.	<p>APSYS specializes in creating products and developing systems that allow retail companies an access control to their facilities or staff presence. It also produces and coordinates the development of other applications.</p> <p>Offers autonomous and/or wired fingerprint scanners to connect to a PC or the Ethernet network [15].</p>
Accesor	Engineering and distributor.	<p>Sells electronic products and services for safety and persons, vehicles and high value goods identification.</p> <p>Offers autonomous and/or wired fingerprint scanners to connect to a PC or the Ethernet network. It also offers an autonomous low cost biometric reader is only capable of handling a 10 fingerprints record and communicates with the door actuator by radio-frequency [16].</p>
BFI Optilas	Engineering and distributor.	<p>BFI Optilas is a security facilities solutions provider, offers engineering and development, implementation, technical support, warranty and repair.</p> <p>Offers autonomous and/or wired fingerprint scanners to connect to a PC or the Ethernet network [17].</p>

By Demes	Engineering and distributor.	Sells electronic products and services for security. Offers autonomous and/or wired fingerprint scanners to connect to a PC or the Ethernet network [18].
Circontrol	Manufacturer and distributor.	The company manufactures products to meet the needs of any access control, presence and identity system installation.  Offers autonomous and/or wired fingerprint scanners to connect to a PC or the Ethernet network [19].
Databac	Manufacturer, installer and distributor.	Databac is a specialist manufacturer and supplier of cards, ID systems and related products.  Offers autonomous and/or wired fingerprint scanners to connect to a PC or the Ethernet network, fingerprint matching software and servers [20].
Dorlet	Manufacturer and installer	Access control systems development and manufacture.  Offers autonomous and/or wired fingerprint scanners to connect to a PC, to the Ethernet or through an independent bus topology network [21].
Identia	Manufacturer, installer and distributor.	Automatic access control and labour presence systems implementation.  Offers autonomous and/or wired fingerprint scanners to connect to a PC, to the Ethernet network, access via GSM communication or through an independent bus topology network [22].
Inzacad	Manufacturer, installer and distributor.	Operates in control service technologies  Offers autonomous and/or wired fingerprint scanners to connect to a PC or the Ethernet network, fingerprint matching software and servers [23].
Kimaldi	Manufacturer and distributor.	Access and attendance control systems development and distribution.  Offers autonomous and/or wired fingerprint scanners to connect to a PC or the Ethernet network. Optionally give the possibility to access to some fingerprint devices models via Wi-Fi through an external adapter module [24].
LSB	Manufacturer and distributor.	Develops and distributes electronics products related to access control systems.  Offers autonomous and/or wired fingerprint scanners to connect to a PC, to the Ethernet or through an independent bus topology network and fingerprint matching software [25].

Primion Digitek	Manufacturer, installer and distributor.	<p>Designs, produces and sells access control, presence, timing, security and ticketing systems.</p> <p>Offers autonomous and/or wired fingerprint scanners to connect to a PC or the Ethernet network [26].</p>
Rister	Engineering and distributor.	<p>Provides solutions and products for all types of CCTV video surveillance systems, access control and time &amp; attendance systems, intrusion and fire detection.</p> <p>Offers autonomous and/or wired fingerprint scanners to connect to a PC, to the Ethernet or through an independent bus topology network and fingerprint matching software [27].</p>
Robotics	Manufacturer, installer and distributor.	<p>Time management and presence systems development.</p> <p>Offers autonomous and/or wired fingerprint scanners to connect to a PC or the Ethernet network or via Wi-Fi through fingerprint terminals with high impact on client's company premises. Optionally give the possibility to access to some fingerprint devices models via Wi-Fi through an external adapter module too [28].</p>
Saima	Manufacturer and distributor.	<p>Telecommunications solutions development and implementation, which include security and presence services.</p> <p>Offers autonomous and/or wired fingerprint scanners to connect to a PC or the Ethernet network [29].</p>
Spec	Manufacturer, installer and distributor.	<p>Time management, access control and security services development and installation.</p> <p>Offers autonomous and/or wired fingerprint scanners to connect to a PC or the Ethernet network and fingerprint matching software [30].</p>
Technomais	Engineering and installer.	<p>Security, intrusion and fire systems installation and maintenance.</p> <p>Offers autonomous and/or wired fingerprint scanners to connect to a PC or the Ethernet network [31].</p>
Zksoftware	Manufacturer, installer and distributor.	<p>Presence and access control systems solutions development and implementation.</p> <p>Offers autonomous and/or wired fingerprint scanners to connect to a PC or the Ethernet network and fingerprint matching software. Optionally give the possibility to access to some fingerprint devices models via Wi-Fi or GPRS through an external adapter module [32].</p>

## Segmentation and positioning

According to the different solutions offered by companies in the biometric industry, fingerprint market is segmented for the following four main product types:

- Access control
- Door locks
- Safes & Vaults
- Time & Attendance

Currently fingerprint industry includes sectors such airports, borders, transportation, banking & finance, commercial, education, government, utilities and others.

The feature that distinguishes the product/service offered is to provide a low cost fingerprint-based system with low impact on client premises (a quick and easy installation) respect to existing solutions proposed on the market.

The purpose is not to provide a security service to a government for example, but to offer an access and time attendance workers and facilities control system, avoiding the use of passwords or PIN for example, on a more practical and economical procedures through alternative fingerprint-based systems solutions, as we discussed.

The product offered is available to any company in any sector that have the need for access and/or attendance employees control and facilities usage monitoring, offering an attractive alternative to potential clients who intend to use such systems providing a better proposal, as value for money ratio.

One of the main potential clients has been detected for the exposed business idea, would be companies with different offices or retail chains with branches in different places (clothing stores, travel agencies, hotel chains, food and catering chains... etc.).

This will give them a fingerprint system which could take a complete access and time attendance control in all workers' business delegations trough a remote and centralized system.

It would prevent a costly system infrastructure implementation in each of their delegations, to avoid a database that would have to reconfigure every time that workers have movements between the different branches or delegations, in addition to offer the product advantages described in this business plan relative to systems offered in biometric market.

## CHAPTER 5. DEFINITION OF THE BUSINESS MODEL

### Service delivery process

This section will describe the method to provide the service offered. As seen in major competitor's analysis, there are several sectors where the business plan can focus its activity:

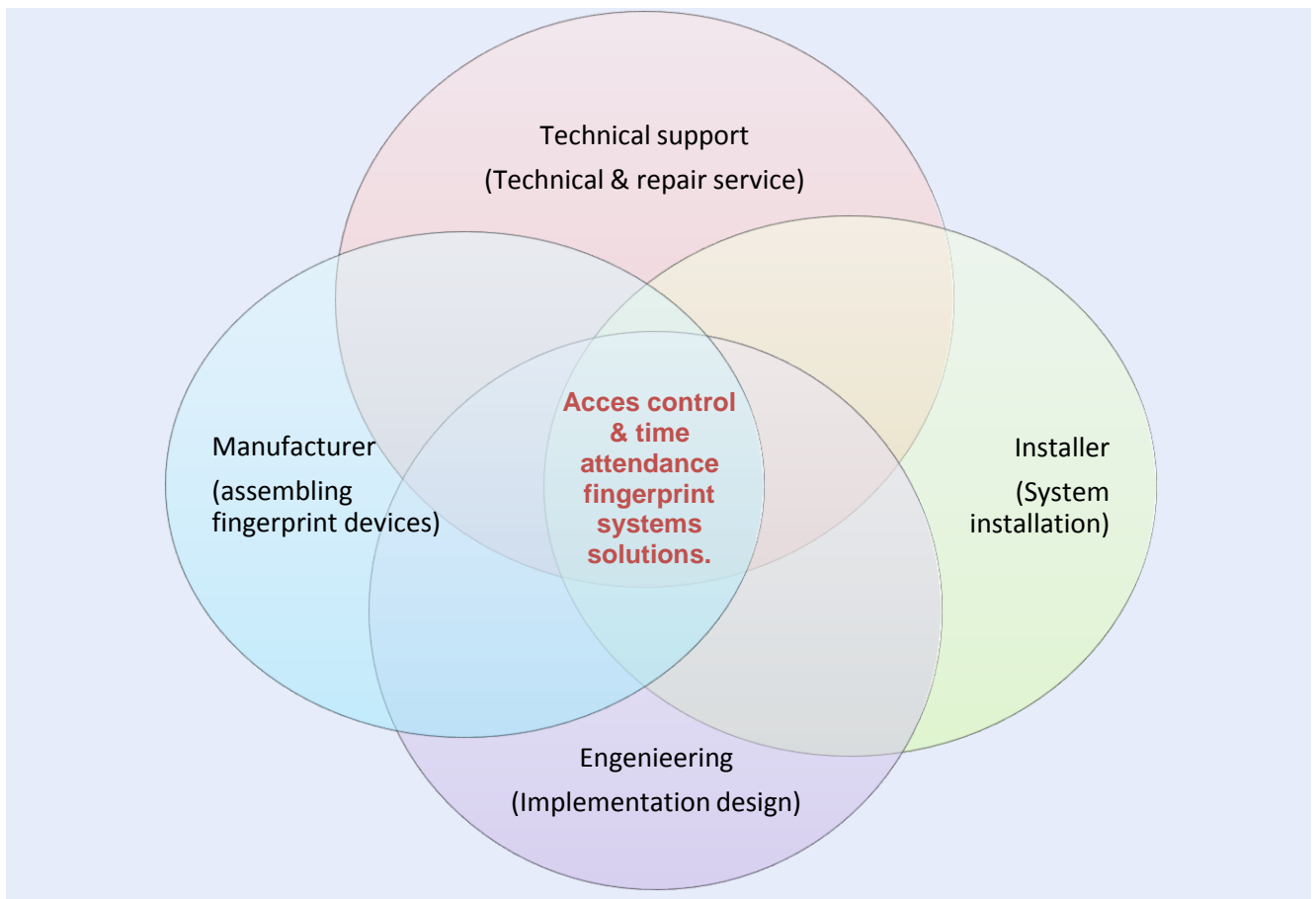
- Engineering: Adapt access and time attendance control fingerprint systems solutions to client needs.
- Installer: Install the systems required.
- Technical support: Perform technical support and repair service.
- Manufacturer: Device manufacturing (fingerprint devices assembling).

The main objective is to provide and adapt the solutions proposed to the client's needs, in addition, to have a unique identity over the rest of companies in biometric industry, its necessary to offer fingerprint devices belonging to the own company through its manufacture (as major competitors already do). For this, would provide an industrial partner as fingerprint sensor provider (having deep knowledge of the sensing technology) and then assemble the final device to offer.

An interesting added value for the client is to offer technical support and repair service, in addition, of the installation service. Thus added value to all products offered and it's an additional source of income.

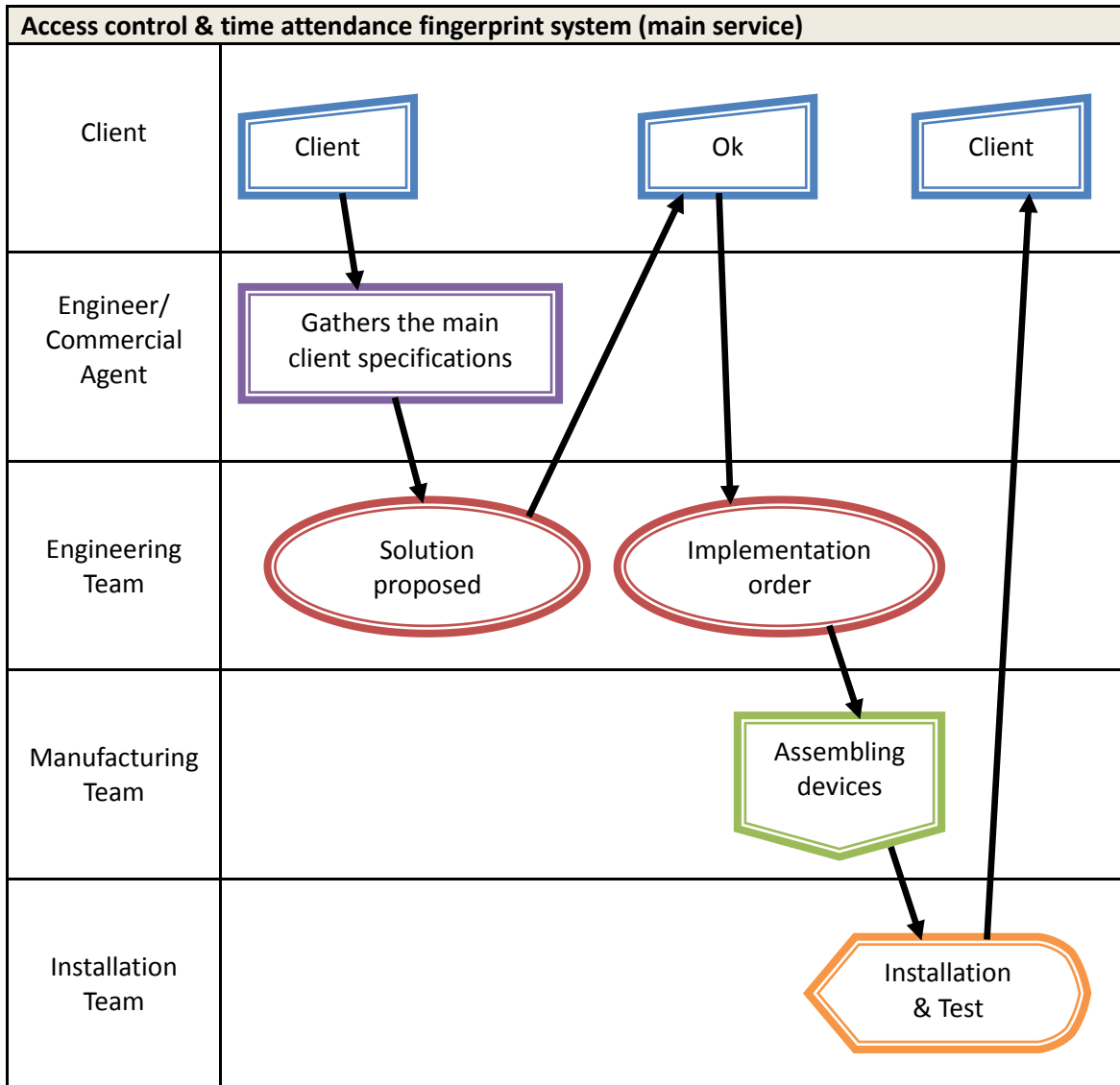
With regard to software development, opt to have a supplier (because it's a highly specialized field).

Taking all these factors into account, at the beginning of the activity, would act as an engineering, manufacturer, installer and technical support (see figure 5.1), dealing directly with the end client, as described below:



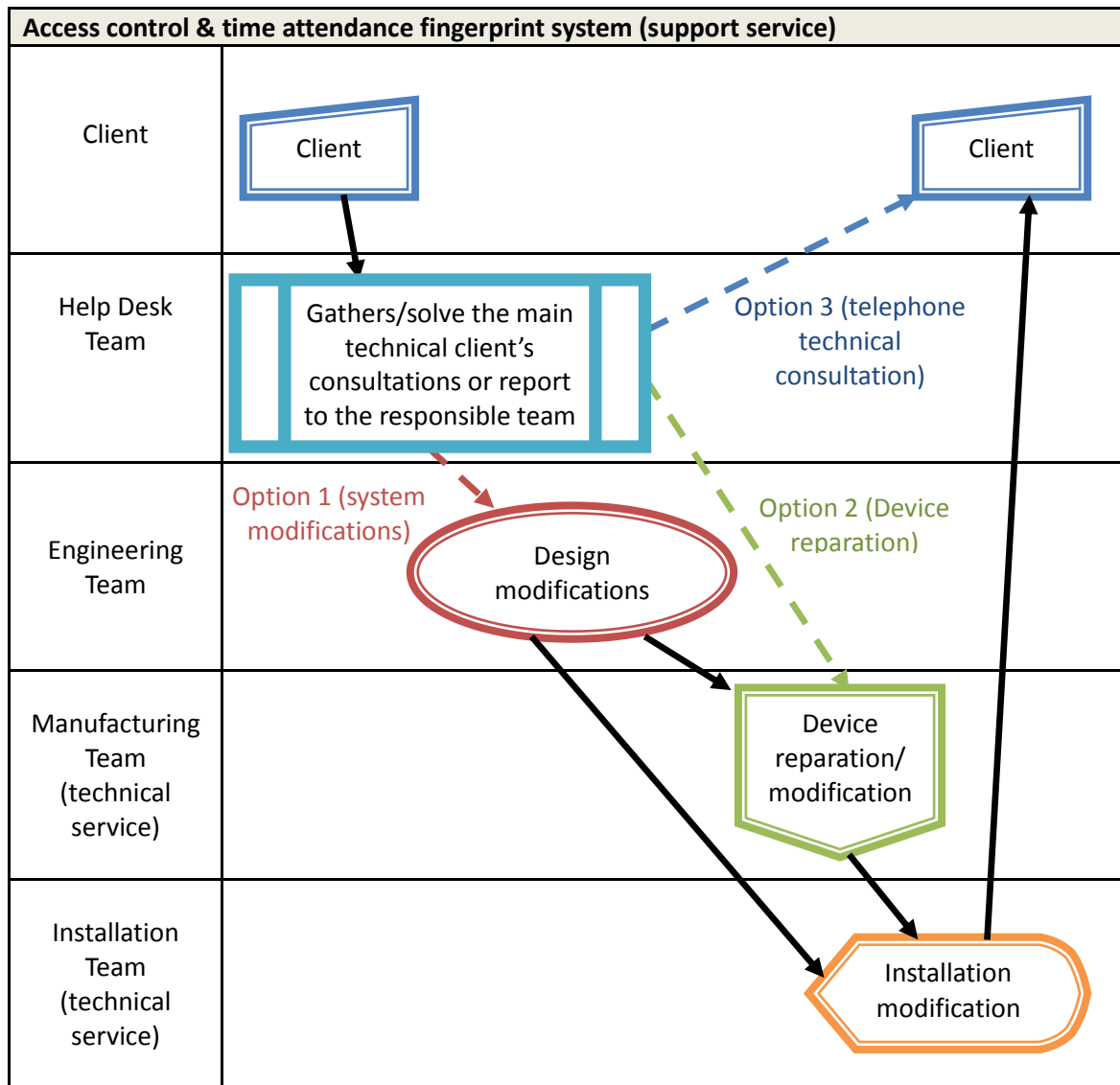
**Figure 5.1** activity sectors.

- A Engineer-commercial agent gathers the main client specifications and the engineering team propose the best solution for client purposes, after the client approval, the manufacturing team assemble the fingerprint devices required and finally the installation team install and test the whole system implementation (see figure 5.2).



**Figure 5.2** service delivery process (main service).

- As for the technical support and repair service, a help desk team would be responsible for collecting and resolve all technical telephone client's consultations and notify to the responsible team for any system reparation or modification (see figure 5.3).



**Figure 5.3** service delivery process (support service).

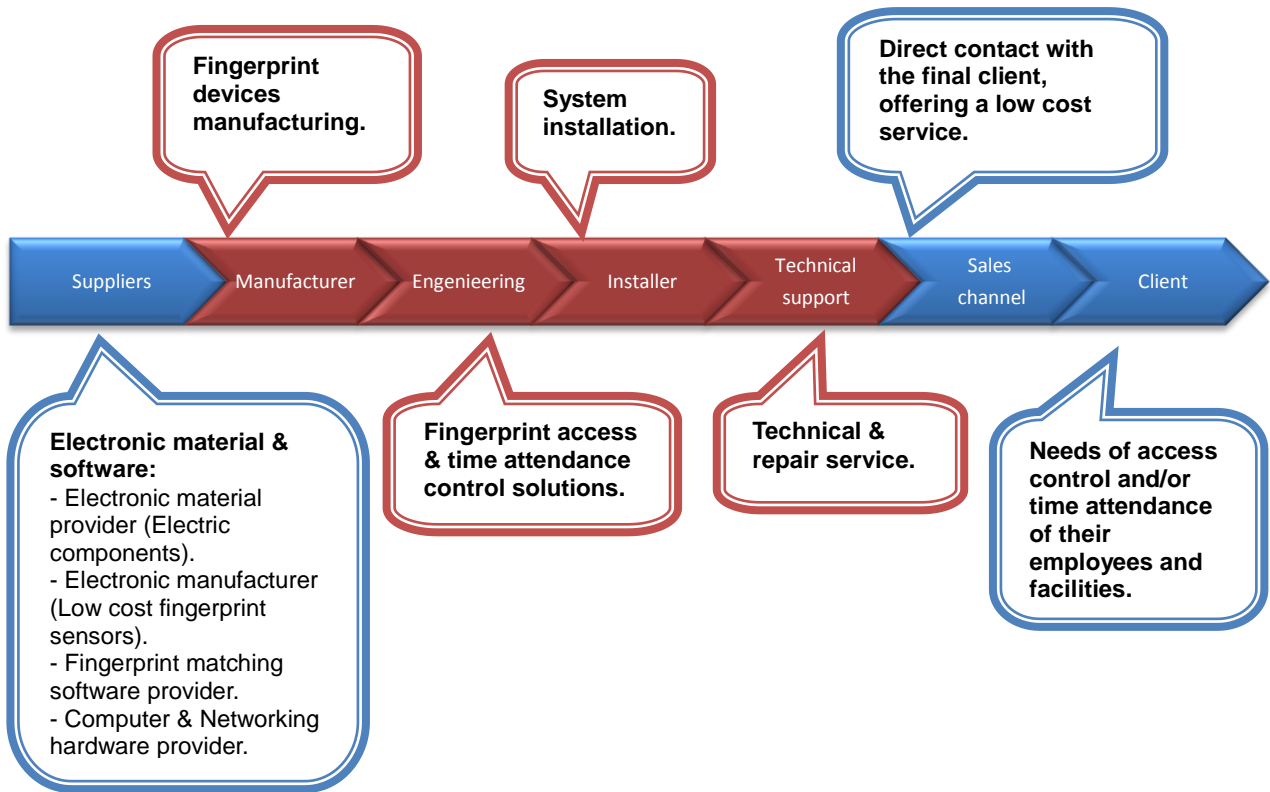
### Value chain

The value chain is a theoretical model to describe the development of a company's activities to reach the final client. Below is shown the position within the value chain that exposed business plan is placed (figure 5.4).

As suppliers to the activity is needed an electronic manufacturer that provides low cost fingerprint sensors, an electronic material provider (electronic components), a software provider to obtain a fingerprint matching software and a computer & networking hardware provider for the telecommunication infrastructure.

Acting as a manufacturer (manufacturing the fingerprint devices offered), engineering (access and/or time attendance control systems solutions), installer (system installation) and technical support (technical and repair services) having direct contact with the end client (sales channel).





**Figure 5.4** value chain.

As seen in the value chain, the end client gets all the necessary services for the design, implementation and support related to these systems giving all the necessary resources through a single company.

## CHAPTER 6. MARKETING PLAN

### Pricing and product policy

Thanks to the ability to integrate a low cost access control and time attendance fingerprint system with a minimum impact on client's facilities through the use of wireless technologies, low cost electronics and remote database servers, focusing on their benefits and advantages regard to present fingerprint systems in the existing market, the aim is to compete in it thanks to the possibility of using biometric technology in other environments where previously were not used.

Taking into account all the factors mentioned, the costs representing the services and products offered (see chapter 9 for details), the expected volume of clients for the third year of activity (see figure 9.1) and the product prices offered in access & time attendance control market (see table 6.2 and 6.3), a profit margin of 35% is appropriate to offer a competitive product on the market and offer a balance to having the benefits described and provide a system with a margin tight enough to attract clients and slow down potential future competitors, offering a fully adaptable products and services, priced depending the number of devices and number of users with an initial quota (a initial price paid only the first year due the initial expenditure associated to each device and user) and an associated annual quota for each user that includes all the support and repair services that client needs (table 6.1).

**Table 6.1** pricing policy.

	Variable cost (21)		Proportional fixed cost regard to variable cost (21) (22)		Total		Price (Profit margin 35 %)	
	initial	annual	initial	annual	initial	annual	initial	annual
<b>Device</b>	8,02 €	- €	34,71 €	- €	42,73 €	- €	<b>57,68 €</b>	- €
<b>User</b>	0,90 €	1,73 €	3,89 €	7,49 €	4,79 €	9,22 €	<b>6,47 €</b>	<b>12,44 €</b>

#### Notes

(21) For details about variable and fixed costs see chapter 9.

(22) Proportional fixed cost regard to variable cost distribution, considering a standard installation of 1 device, 10 users per device, a minimum installation lifetime of 3 years and an annual average of 570 device installations, taking into account clients acquisition forecasting for the third year of activity.

We have chosen this form of payment with the intention of provide all services related to a system of these characteristics (project implementation design, system installation and configuration, technical support and repair service) subject to an annual fee. In this case, the client doesn't have to worry about anything related to system installation and maintenance, without having to plan major changes in their facilities and make a high investment at the beginning, as would happen with the biometric systems focused on providing high security offered by companies that dominate the biometric market.

Referring to USB fingerprint escanners to connect to a PC, the product offered here doesn't have the need to have an associated computer to each scanner in addition of providing all necessary services to manage the database users without any configuration and resources apported by the clients.

We can see in table 6.2 the main product prices offered by the three companies that dominate the biometric market, these prices only include the device price, so that makes us see that to a biometric system implementation for a time attendance workers control of a company for example (where a high security would not be the most important factor) would be a significant cost at the beginning with these types of products, to cover all services offered in the proposed product in this business plan.

**Table 6.2** fingerprint scanners prices.

<b>Manufacturer/Model</b>	<b>Characteristics</b>	<b>Price (for each terminal and access &amp; time attendance control point).</b>
<b>NEC (contact with NEC sales department)</b>		
PU900	Low cost USB fingerprint scanner to connect to a PC.	150 €
<b>Sagem Sécurité [14] [55]</b>		
MA100	Autonomous fingerprint scanner terminal with 500 users capacity.	Between 735 - 880 €
MA500	Autonomous fingerprint scanner terminal with 3000-50.000 users capacity.	Between 1625 - 2490 €
MSO300	USB fingerprint scanner to connect to a PC.	530 €
MSO1300	Low cost USB fingerprint scanner to connect to a PC.	190 €
<b>L1- Identity Solutions [56] [57]</b>		
4G V-Flex	Autonomous fingerprint scanner terminal with 10.000 templates capacity.	Between 530 - 818 €
4G V-Station	Autonomous fingerprint scanner terminal with 500.000 templates capacity.	Between 1045 - 1640 €
IBIS	Modular hand held fingerprint scanner device that links via Bluetooth to any pre-configured, supported PDA.	1230 € (excluding PDA).

In table 6.3 we can see time attendance control devices prices of different technologies (RFID, magnetic cards and PIN codes), as we can see, these prices are slightly lower than biometric devices showed in the table above, with the added disadvantage of having help desk personnel involved in cards and passwords management (lock and forgotten passwords, lost cards...etc.). As discussed above, 40% of calls to a company's help desk are password-related. The cost of maintaining a password in the corporate computing environment has been pegged at \$100 to \$400 per user per year [5].

**Table 6.3** RFID, Bar code, PIN code and magnetic card readers prices.

<b>Manufacturer/Model</b>	<b>Characteristics</b>	<b>Price</b> (for each terminal and access and time attendance control point).
<b>Wasp [73] [74]</b>		
WaspTime RFID Solution – Standard	RFID reader. 50 RFID tags. Database software. Technical support.	651 €
WaspTime Barcode Solution – Standard	Barcode reader. 50 barcode tags. Database software. Technical support.	450 €
<b>Thing Magic [75] [76]</b>		
Thing Magic USB Reader USB-5EC	RFID reader powered by USB connection to PC.	405 €
ThingMagic Mercury5 Reader TM-M5-NA-0-2	High performance RFID reader.	1300 €
<b>Kadtronix [77]</b>		
OP6700	PIN-entry access device to connect to a PC.	236 €
<b>Magtek [78]</b>		
MagTek MiniWedge Stripe Reader	Magnetic card reader to connect to a PC.	65 €

## Sales strategy and advertising

As sales strategy will be emphasized the points raised in the previous section, noting that a service / product with all the advantages of biometric systems but with a better proposal as value for money ratio is offered, in addition can be contemplated the possibility of discounts depending on the quantities demanded by clients, increased cost of the order, greater the discount.

As a main distribution channels, will be very important to have a sales manager with contacts and know-how in biometric industry for a success potential client's detection. Other distribution and advertising channels will be attending to trade fairs and events, both the industry to relating to technology and innovation. Other advertising methods to consider are specialized magazines advertisements and offer an attractive corporate website with the possibility of ordering through a virtual store. All these promotion methods and their annual cost can be seen in the following table (table 6.4).

**Table 6.4** advertising price list.

<b>Concept</b>	<b>Annual cost</b>
Corporate website and virtual shop [65]	52,2 €
Brochures and business cards [66] [67]	500 € (1000 units)
Exhibition stands [68]	4.000 € (5 units)
Specialized magazines advertising [69]	8.000 € (20 ads)
<b>TOTAL</b>	<b>12.552,2 €</b>

## CHAPTER 7. OPERATIONAL MODEL

### Suppliers and partners

The most important suppliers and partners for business activity are fingerprint sensors and matching software providers.

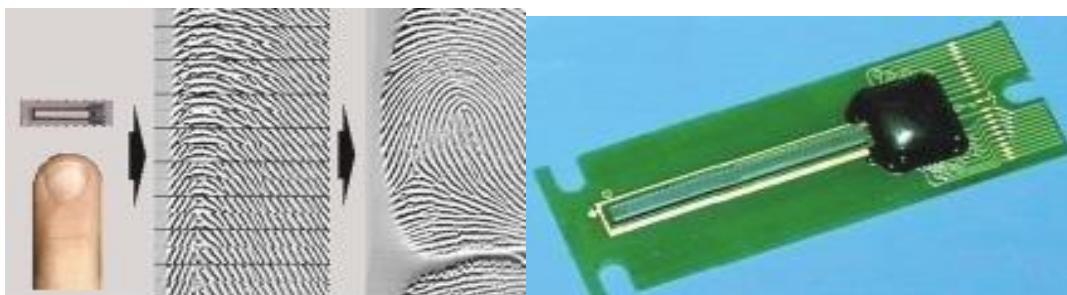
The main fingerprint sensors manufacturers that lead the industry today are as follows [49]:

- **AuthenTec:** AuthenTec is a fingerprint authentication sensors and solutions provider to the high-volume PC, wireless device and access control markets, with more than 45 million sensors in use worldwide. The U.S Company employs approximately 100 people and makes a revenue of \$34 million in 2009, offers low cost and small RF (Radio Frequency) – capacitance silicon sensors, a solution used in millions of today's most popular and innovative biometric cell phones and PDAs. In figure 7.1 we can see sensors offered by AuthenTec [46].



**Figure 7.1** AuthenTec sensors.

- **Atmel:** Atmel is a corporation dedicated to the design and manufacture of microcontrollers and complementary products such as capacitive touch sensing and radio frequency components. As a global company with worldwide revenues coming from Asia, Europe and the Americas, Atmel has a significant number of global development and manufacturing operations. Atmel operates fabrication facilities in Colorado (USA) and in Rousset (France). The company employs approximately 7.000 people worldwide with a annual revenue around \$1,6 billion. The Atmel fingerprint sensor utilizes a thermal-based technology offering low cost and very small fingerprint sensors to be embedded in any device. In figure 7.2 we can see sensors offered by Atmel [47].



**Figure 7.2** Atmel sensors.

- UPEK: UPEK offers integrated end-to-end solutions including comprehensive design & integration biometric services to the world's leading consumer and industrial products companies. UPEK is headquartered in California (USA) with offices in Prague, Singapore, Taipei and Tokyo; employs approximately 150 people with a revenue around \$53,7 million in 2006. UPEK's proven small and medium capacitive silicon fingerprint sensors (figure 7.3) that have been embedded into millions of devices such as laptops, mobile phones, USB flash drives...etc [48].



**Figure 7.3** UPEK sensors.

The main fingerprint matching software developers that lead the industry today are as follows [49]:

- Bio-Key International : Bio-Key International, headquartered in Wall, New Jersey (USA), develops and delivers advanced biometric identification software solutions to commercial and government enterprises, integrators, and custom application developers, employs approximately 50 people with a revenue around \$2,4 million in 2009 [50].
- Argus Global Biometric Technology: Argus Global is a private Australian company with its foundations firmly established in the biometrics industry. The company specialises in providing software applications which utilise biometric technologies to provide personal identity, employs approximately 50 people with a revenue around \$1,6 million in 2009 [51].
- ImageWare Systems: ImageWare Systems Inc., (IWS) is a publicly traded, USA based company focused on highly innovative advanced technology solutions, provider of secure credential, biometric, law enforcement digital identity solutions in the U.S. and across the globe, provides biometric custom software to meet any organization's requirements. The company employs approximately 200 people with a revenue around \$3,7 million in 2008 [52].

In table 7.1 and 7.2 we can see suppliers and other biometric companies' product prices. The components chosen for its value for money ratio for the product offered in this business plan will be AuthenTec sensors and biometric software offered by Argus Global Biometric Technology Company.

**Table 7.1** low cost fingerprint sensors prices.

<b>Manufacturer/Model</b>	<b>Price</b>
<b>Authentec</b> [59] [60] AES2510	5 €
<b>Atmel</b> [61] [62] AT77C104B	5 €
<b>UPEK</b> [64] TCS4 and TCS5 series	7 €

**Table 7.2** fingerprint matching software prices.

<b>Manufacturer/Model</b>	<b>Price</b>
<b>Bio Key International</b> (contact with sales department) Vector Segment Technology (VST) Software (SDK)	Between 60 - 45 € per license (depends on quantity).
<b>Argus Global Biometric Technology</b> (contact with sales department) Time target tool	Between 25 - 15 € per license (depends on quantity).
<b>ImageWare Systems</b> (contact with sales department) IWS Biometric engine	Between 30 - 10 € per license (depends on quantity).
<b>ZK software</b> [58] ZK Finger SDK Standard Version	819 € + 20 € per license
<b>Neurotechnology</b> [63] Verifinger Matcher	Between 25 - 10 € per license (depends on quantity).
<b>NEC</b> (contact with sales department) PID-SDK	Between 65 - 40 € per license (depends on quantity).

## Resources

The following is going to make a study of the necessary resources to carry out the activity of the business plan exposed. For this a process analysis of the business plan activity, both for their main activity and technical support service, will be done to specify the necessary process to establish the connection between suppliers and final product offered.

The definition of each process consists of estimating the time needed to achieve them, define who will do the process, make the calculation of how many workers will be required, the stock necessary and the interconnection between them.

This analysis depends on the number of clients, taking into account the potential market estimation (see chapter 9 for details), is estimated 1 project of 2,6 devices every day.

As for the main activity, 3 main steps are necessary:

- **Implementation design:** Once the client gets in contact, the engineers have to analyze their requirements and the installation environment to make the system design.
- **Device assembly:** Once the manufacturing team has received specifications from engineering team, is preparing to assemble the device designed and standardized previously (unless client requires some extra functionality that is not in the models offered). The team will oversee the automated assembly through printed circuit board machinery and then test the final device.
- **Installation & test:** Once the devices are ready, the installation team is ready to go to client premises to install the devices, configure and test the whole system.

As for the stock are two steps necessary to expedite the activity, one side will need a electronic and digital fingerprint sensors stock in order to start the main service functions (to manufacturing team have materials to assembly devices), and on the other band, have assembled devices stock (to installer team have equipment available).

To an optimum stock flow movement is necessary to maintain a balance, so if it's not enough, the service would be impaired; and if it's too much, useful space will forego for other productive assets.

We choose the necessary material stock to cover 2 working days (2 projects), to renew the material continuously (normally the material of this type usually takes between 24 and 48 hours to be served by suppliers).

As for the workers needed for each process, after estimating the time needed to do these processes (*Production time*), daily production (*Production* = 2,6 devices per day) and the total workday time (*workday time* = 8 hours), use the formula 7.1 for estimating this quantity, obtaining a total of 1 engineer and 1 worker/installer in device manufacturing and installation & test labours respectively working at part-time.

$$workers\ needed = \frac{Production\ time\ x\ Production}{workday\ time} \quad (7.1)$$



All these parameters discussed and the bond between the different processes and sub-processes through a discipline FIFO (First Input First Output) can be seen in figure 7.4.

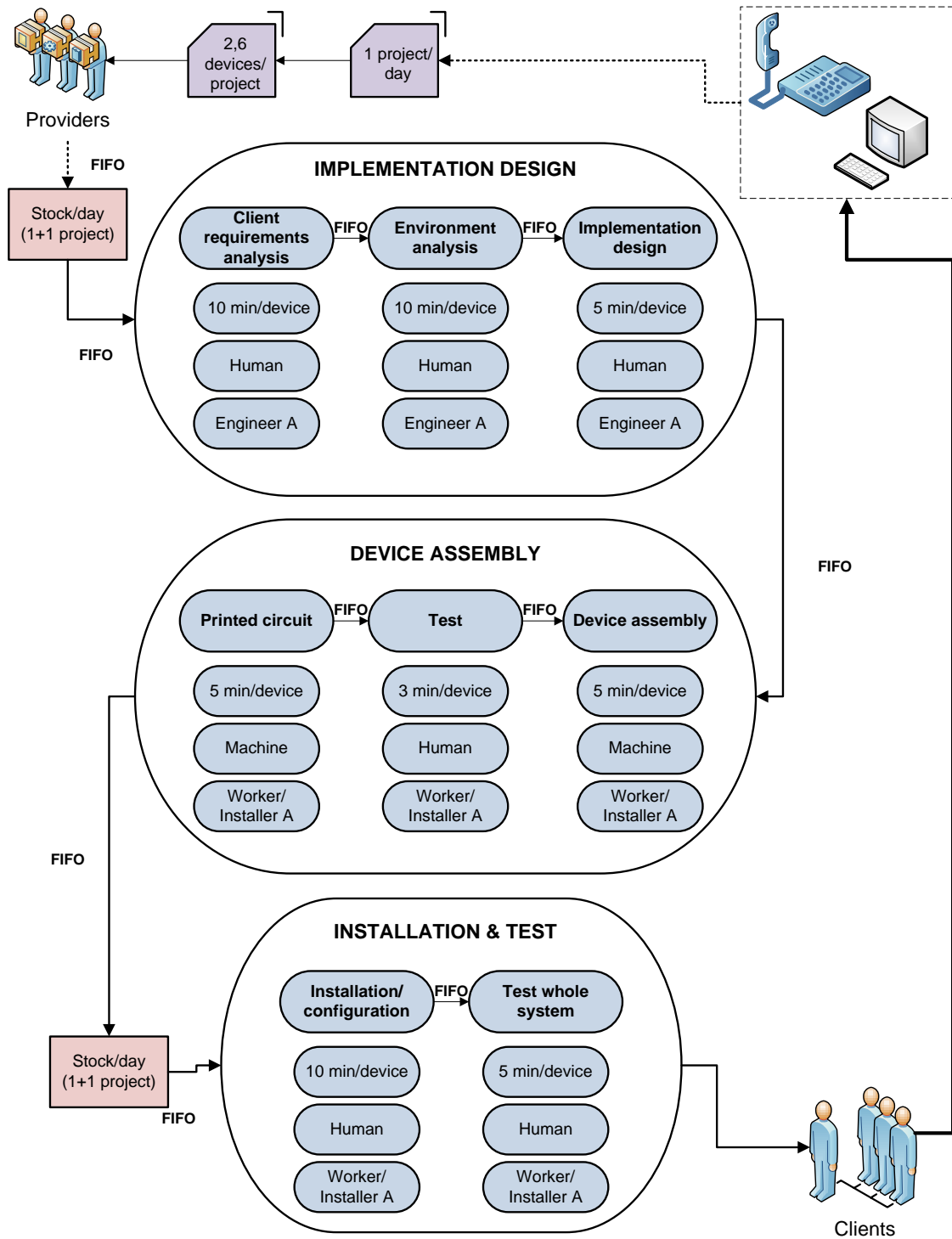


Figure 7.4 process analysis (main service).

In support service analysis exist 3 main options: telephone technical consultation, device reparation and system modification.

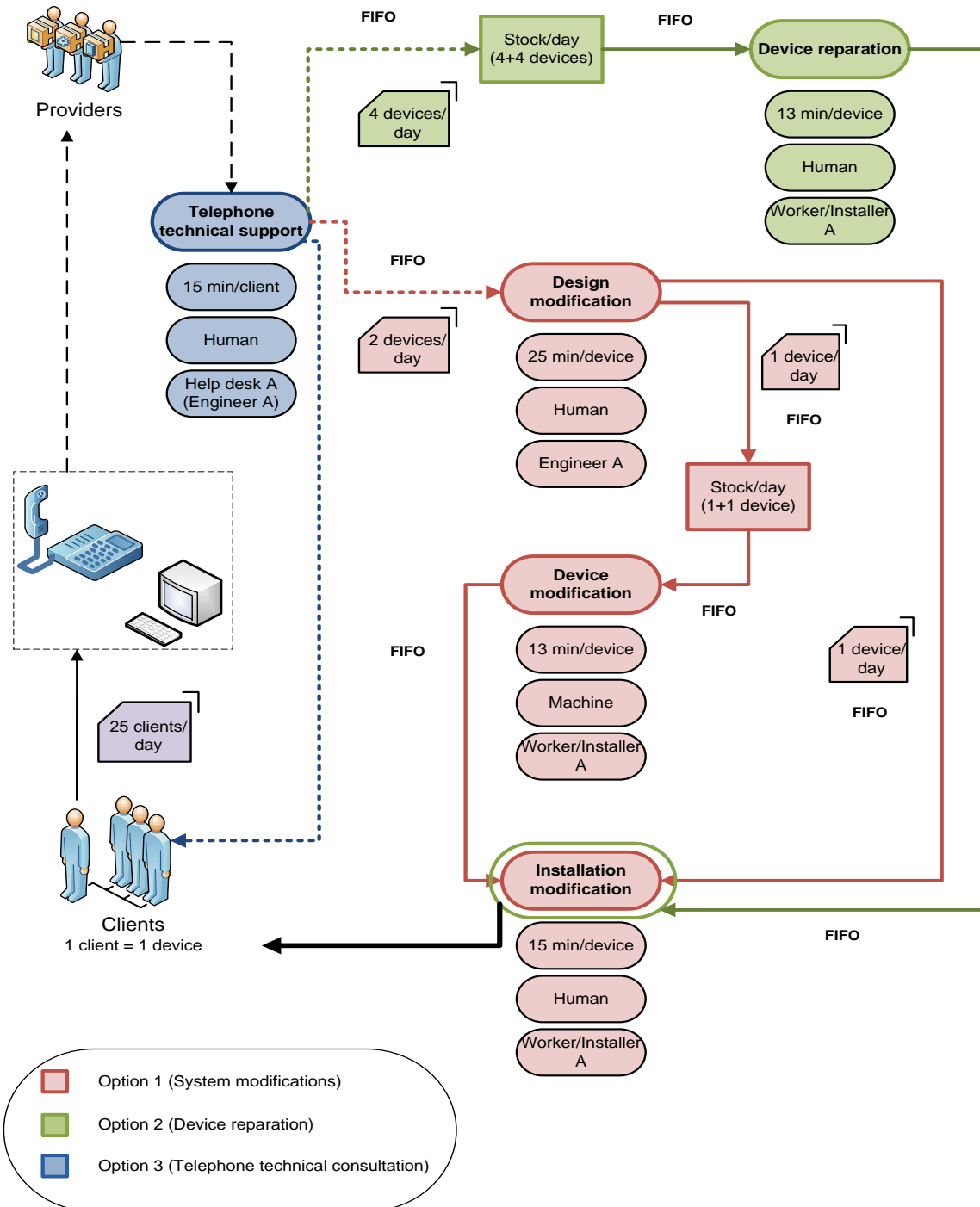
All calls will go through help desk team that will be responsible for solving any problem that can be done with remote procedures (telephone, virtual connection to a PC...etc.) without other department's intervention, if it's not possible, would be responsible for transferring the incident to the required department.

Taking into account the potential market estimations (see chapter 9 for details), we have contemplated the possibility of receiving about 25 technical consultations per day (where each query corresponds to 1 device).

- Telephone technical consultation: Taking into account that in the main service the major part of cases will have been designed properly, of these 25 clients per day, most telephone inquiries will not require an actuation from other departments; and then, help desk team will be responsible for resolve these client doubts and small configuration problems.
- Device reparation: Anyway, it's possible that device reparation would be necessary, in this case, the 25 clients per day, it's estimated that 4 of these 25 will require a repair service of 1 device per client (4 devices in total). In this case the manufacturing team repair the device and the installer team install it.
- System modifications: About the possibility that a client requires any system changes or some extra device functionality that is not covered in the initial design, a demand of 2 devices per day is estimated. The engineering team will study the changes and depending if any device installation or modification is required, send the order to the manufacturing team (with an estimation of 1 device per day) or to the installer team (receiving 2 devices per day).

As for the stock and the workers needed, has followed the same procedure and considerations in the analysis above, having an electronic material stock of 2 working days and 1 help desk for carry out support service, in this case, in the initial activity of the company the engineer would be the responsible to solve these functions .

All these parameters discussed and the interconnection between the different processes can be seen in figure 7.5.



**Figure 7.5** process analysis (support service).

Taking into account the workers needed and the estimated production, would need a local about  $175 \text{ m}^2$ :

- A office to commercial/manager agent could serve clients ( $20 \text{ m}^2$ ).
- A meeting room for the engineering team could do their studies ( $25 \text{ m}^2$ ).
- A laboratory for manufacturing and installation team ( $30 \text{ m}^2$ ).

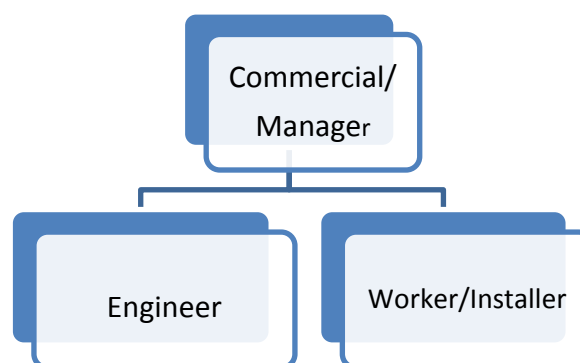
- A room where the servers are located to offer remote services ( $85\text{ m}^2$ ) (it depends of the number of accumulated clients, with  $85\text{ m}^2$  is estimated at up to 500 servers with the ability to authenticate 50.000 users with a 3 fingers registration per user, around 150.000 fingerprints, see annex A for details).
- A small warehouse to store fingerprint sensors, electronic material and final products to serve (fingerprint scanners and hardware) ( $15\text{ m}^2$ ).

The materials required are office furniture, electronic materials for laboratories (printed circuit board machinery, welders, electronic components, oscilloscopes, power generators and testers), materials for installers (screwdrivers, stripping-wires and computer & network equipment) and all computer & network equipment for the remainder of activities (offices, laboratories and servers).

## Organization chart

The organization chart consists of a hierarchical structure, efficient for a small number of workers (see figure 7.6). The structure presented is intended to provide a main service with a potential of 2,6 devices each day, and technical support service of 25 technical consultations per day. So therefore for higher production would have to increase the company human capital. Here we describe the workers profiles that make up the chart:

- Commercial/manager: is responsible for client's direct relationships, general management and financial operations, he will be in charge of client contacting to set the projects specifications and monitor their satisfaction and potentials service improvements that can be introduced, looks for new clients and establishes the marketing policies required. It requires someone with negotiation, leadership, business & marketing skills, with contacts and know-how in biometric industry and with an enough technological knowledge to collect client's requirements and translate it to engineering team.
- Engineer: Will be responsible for systems design and solve technical consultations, will be needed engineers with knowledge in biometric industry and in the electrical engineering field for devices design / modification.
- Worker/installer: Responsible for device assembling, repair and modification and carrying out the necessary installations and configurations. Specialized technicians will be required for such functions.



**Figure 7.6** organization chart.

## CHAPTER 8. GROWTH STRATEGY AND BUSINESS ANALYSIS

### Growth strategy

On the growth strategy several possibilities are evaluated as promote R & D for continuous improvement and development in all system elements, in order to have intellectual property on some technologies and procedures that increased the company's value.

It would also be interesting to offer new products with greater mobility, comfort and low cost, such as the possibility of developing a system based on user's mobile phones or PDAs as fingerprint scanners belonging to system infrastructure.

### SWOT and Porter five forces analysis

SWOT analysis is a strategic planning method used to evaluate the Strengths, Weaknesses, Opportunities, and Threats involved in a project or in a business venture (table 8.1). It involves specifying the objective of the business venture or project and identifying the internal and external factors that are favourable and unfavourable to achieve that objective [53].

**Table 8.1** SWOT analysis.

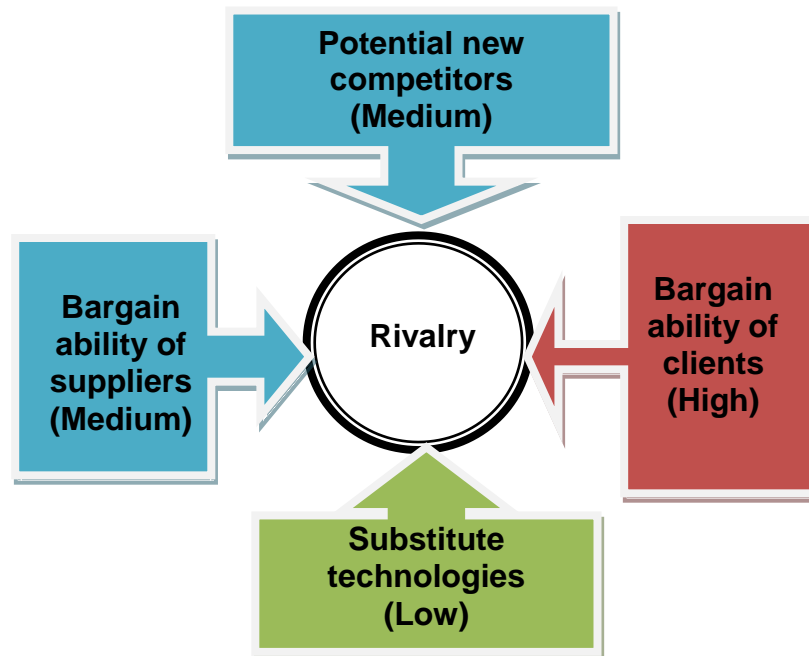
	<b>Strengths</b>	<b>Weaknesses</b>
I N T E R N A L	<ul style="list-style-type: none"> <li>• Knowledge of present biometric market.</li> </ul>	<ul style="list-style-type: none"> <li>• High client bargain power.</li> </ul>
	<b>Opportunities</b>	<b>Threats</b>
E X T E R N A L	<ul style="list-style-type: none"> <li>• A market gap to cover.</li> <li>• Growth industry.</li> </ul>	<ul style="list-style-type: none"> <li>• New market competitors (possibility for competitors to offer similar products).</li> </ul>

As we can see in the table, from an internal point of view, the main strength is a full knowledge and awareness about the products offered in biometric market. As for the main weaknesses identified, a high client bargain power due to competition in biometric industry is detected; it causes a reduced profit margin due to the importance of establishing business relationships with clients.

From an external point of view, the main opportunities identified are the possibility to address to a new client type that previously doesn't contemplate the use of these systems due to its cost and high impact installation to apply this technology in environments where a high security level is not needed, and then, the opportunity to cover this market gap in a growth industry.

As major threats identified, the most important is the emergence of new competitors with similar products or services to the exposed business idea, although it's considering that a reduced profit margin could slow down that risk. Nevertheless, as discussed, as a growth strategy would be interesting an R & D activity to give patentable system parts and procedures to increase the company value.

Porter's five forces is a framework for the industry analysis and business strategy development to derive five forces that determine the competitive intensity and therefore attractiveness of a market (figure 8.1) [54].



**Figure 8.1** Porter five forces analysis.

Following five forces analysis we see substitute technologies have low impact on the business plan exposed because fingerprint technology is the most widely biometric feature used in these systems (see chapter 3 for details).

As for the suppliers bargaining power is considered medium, because product components price doesn't have a strong impact on the final product (see chapter 9 for details) and a high client bargain power and a medium potential competitor's power is estimated as commented in SWOT analysis.

In conclusion, taking into account all factors analysis, we can say, in general terms, that it's an attractive market that offers new opportunities to invest.

## CHAPTER 9. ECONOMIC AND FINANCIAL PLAN

### Initial capital

As the initial capital required was taken into account the financial forecast for the first five years, where the company would have total losses in its first three years of activity about 80.000 €, if we also consider a margin of 10%, we obtain about 90.000 €, of these 90.000 €, 35.000 € will come from a 5-year bank loan, and the remaining 55.000 €, by the initial capital contributed by the entrepreneurial team.

### Sales forecasting

To make the sales forecasting, we will identify a potential market, that trough the marketing plan specified in the business plan, a feasible annual clients would be considered, also related to the sales achieved by the commercial department dedicated to the search and interview potential clients, taking into account that at the beginning of the activity the company will have much lower sales, requiring a pilot test to gain confidence and popularity to future clients acquisition, and bearing in mind also that this is a small business , with few workers and a low initial investment. The detail of all these aspects and the related justifications can be seen in the following paragraphs:

- Potential market: Taking into account that the product offered is available to any company in any sector that have the need for access and/or attendance employees control and facilities usage monitoring, offering an attractive alternative to potential clients who intend to use such systems (offering a low cost and low installation impact system). One of the main potential clients has been detected for the exposed business idea, would be companies with different offices or retail chains with branches in different places (clothing stores, travel agencies, hotel chains, food and catering chains... etc.).

This will give them a fingerprint system which could take a complete access and time attendance control in all workers' business delegations trough a remote and centralized system. It would prevent a costly system infrastructure implementation in each of their delegations, to avoid a database that would have to reconfigure every time that workers have movements between the different branches or delegations, in addition to offer the product advantages described in this business plan relative to systems offered in biometric market.

To enter in the market would choose a pilot test in a small retail chain with few branches. After explaining the system advantages, the service for free would be offered. This will have a success implementation case as advertising to future clients' attraction.

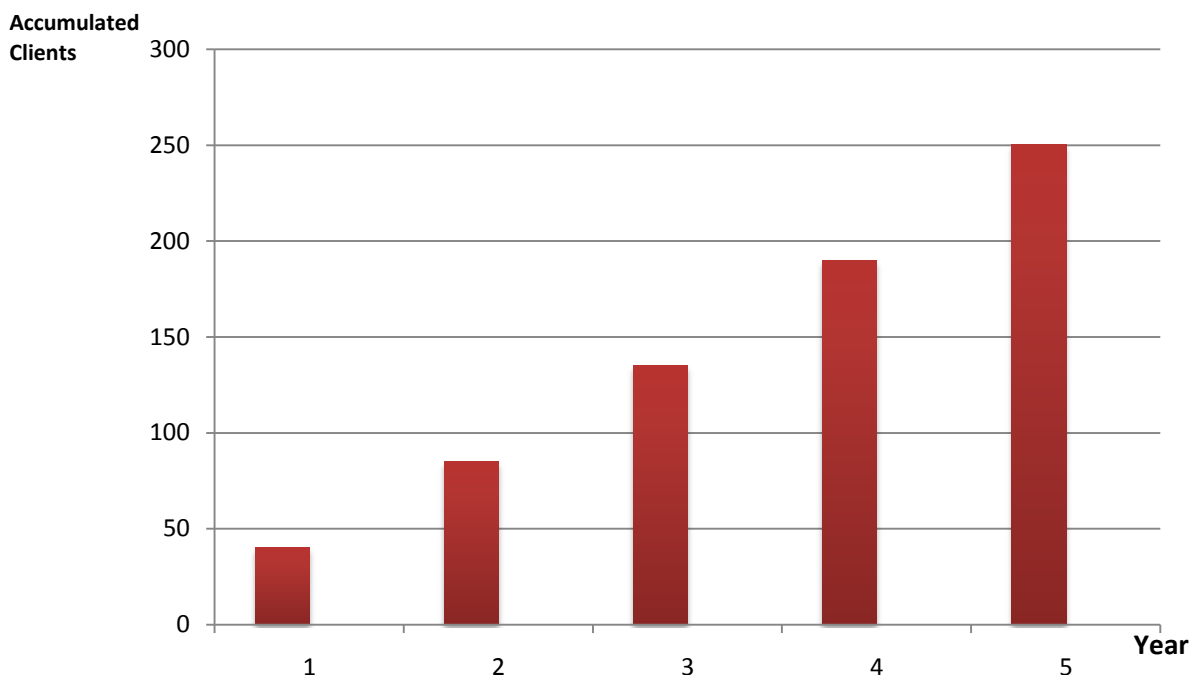
As a starting point, the exposed business idea would be directed to the Spanish market, the idea would be with a reduced investment and numbers of workers obtain significant benefits with only a small potential market percentage.

According to the Spanish National Statistics Institute (INE) data, a total of 164.173 business chains, with an average of 9,5 delegations each one, operate in Spain in 2008, following the distribution described in the following table (table 9.1) [72]:

**Table 9.1** business chains with more than 5 delegations in 2008 in Spain (source: Spanish National Statistics Institute (INE)).

Delegations	Between 5 and 19	Between 20 and 99	More than 99
Business chains	136.451	23.456	4.276

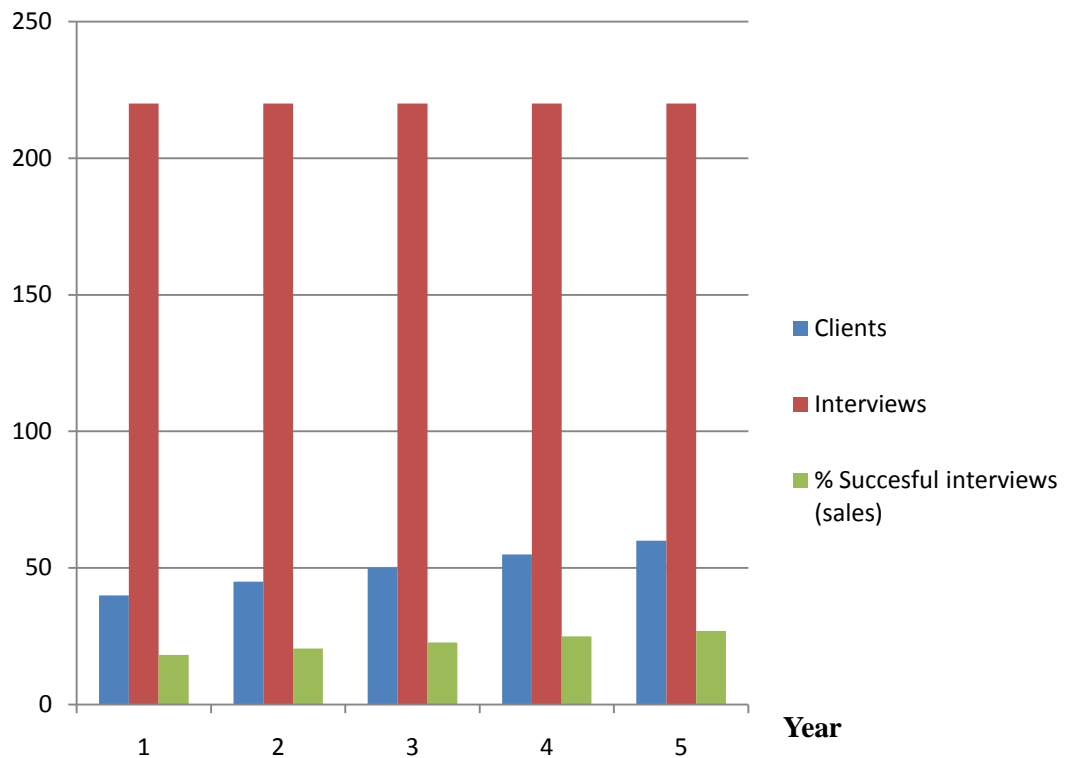
- Clients and sales: If we establish a feasible accumulated annual clients described in figure 9.1, with only a 0,15 % of the business chains described in table 9.1 and considering 1,2 fingerprint devices located in each delegation, 10 users for each device and the pricing policy described in the marketing plan (see chapter 6 for details), it would obtain an average annual revenue of 235.295 € in the first 5 years.



**Figure 9.1** clients acquisition forecast evolution for the next five years.

- Commercial department: Taking into account the search for clients by one commercial agent, capable of meeting with one business chain every working day and considering the clients acquisition forecast evolution described before, we obtain the results described in figure 9.2:

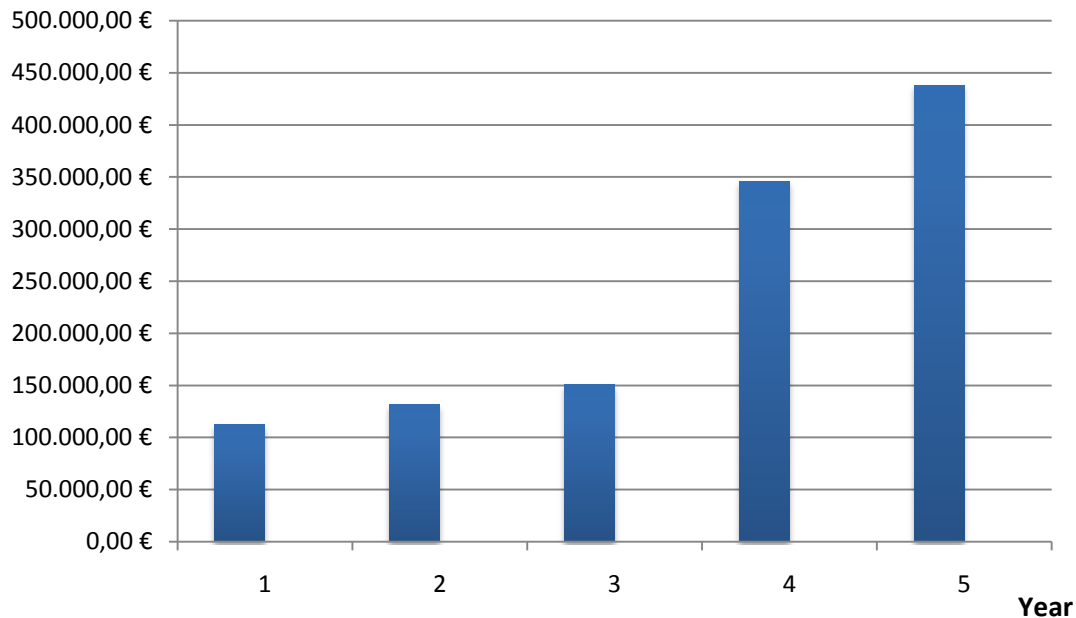




**Figure 9.2** clients acquisition by commercial department.

As we see in figure 9.2, only with 22,7 % of successful interviews would achieve the figures described (5-year average), where the blue column corresponds to the annual clients acquired, the red column to the annual interviews realized and the green column to the needed percentage of successful interviews to achieve the desired sales.

- Revenues evolution: Given that first-year revenues will be less than the following and this will increase annually, if we have a successful marketing policies and strategies, we assume incremental sales evolution, taking into account that biometric technologies advantages and the possibility to apply this technology in a more cheaply and efficiently manner causes a market growth forecast for the coming years. In figure 9.3 we can see the sales forecast evolution for the next five years, considering the potential market detected, the clients forecast acquisition evolution and the pricing policy established in the marketing plan.



**Figure 9.3** sales forecast evolution for the next five years.

## Expenditure forecasting and break even point

In this section we detail the projected costs to the business plan activity.

As for the initial costs will have a total of 23.346.25 €, these costs corresponds to the expected start-up expenditure needed to start the business activity (office furniture, electronic and laboratory material, initial local rent costs...etc).

The highest percentage corresponds to printed circuit board machinery investment (32% of total costs), machinery to produce the electronic printed circuits to assemble fingerprint devices, followed by expenses related to office furniture (24 % of total costs), in table 9.2 and figure 9.4 we can see the details of those costs.

**Table 9.2** initial costs.

Concept	Cost
Office furniture (1)	5.000,00 €
Electronic and laboratory material (2)	4.910,00 €
<b>Printed circuit board machinery (3)</b>	<b>8.000,00 €</b>
Computer and network equipment renting (4)	56,25 €
Tools (5)	80,00 €
Initial local rent costs (6)	4.200,00 €
Telecommunications (7)	150,00 €
Pilot test (8)	950 €
<b>TOTAL</b>	<b>23.346,25 €</b>

**Notes**

(1) 1 meeting room + 1 office + 1 laboratory

(2) 2 Welders (25 €/unit), 2 oscilloscopes (300 €/unit), 2 power generators (80 €/unit), 2 testers (50€/unit) and laboratory furniture.

(3) 1 x PCB board router engraver drilling and milling machine [70] + 1 x 30L large tank PCB ultrasonic cleaning machine [71]

(4) 3 work stations (300 €/unit) = 900 € / 48 months (4 year renting service) (3 months initial deposit).

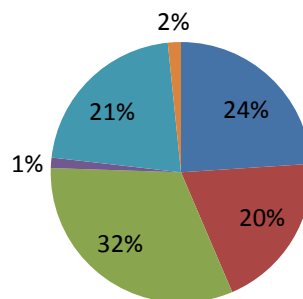
(5) Screwdrivers and stripping-wires.

(6) 175 m<sup>2</sup> local (1400 €/month) (3 months initial deposit).

(7) Initial telecommunication service quota.

(8) To enter in the market would choose a pilot test in a small retail chain with few branches (consider 1 business chain with 4 delegations, with 5 devices and 50 users).

## Initial costs: 23.346,25 €



**Figure 9.4** initial costs.

Referring to fixed costs, we have an annual expenditure of 134.906,92 €, the highest percentage correspond to employees salaries (62% of total costs) followed by expenses related to the local renting (11% of total costs), in table 9.3 and figure 9.5 can see the details of those costs.

**Table 9.3** fixed costs.

Concept	Monthly cost	Annual cost
<b>Salary (9)</b>	<b>6.875,00 €</b>	<b>82.500,00 €</b>
Local renting (10)	1.400,00 €	16.800,00 €
Telecommunications (11)	88,33 €	1.060,00 €
Water	25,00 €	300,00 €
Electricity	308,33 €	3.700,00 €
Cleaning service	300,00 €	3.600,00 €
Advertising	1.046,02 €	12.552,20 €
Bank loan interest (12)	349,35 €	4.192,22 €
Computer and network equipment renting (13)	18,75 €	225,00 €

<b>Insurances</b>		
<i>Financial insurance (14)</i>	150,00 €	1.800,00 €
<i>Other insurances (15)</i>	100,00 €	1.200,00 €
<i>Liability insurance</i>	100,00 €	1.200,00 €
<i>Legal services (16)</i>	208,33 €	2.500,00 €
<b>Fixed assets depreciation</b>		
<i>Printed circuit board machinery (10%)</i>	66,67 €	800,00 €
<i>Forniture and tools (25 %)</i>	104,17 €	1.250,00 €
<i>Electronic and laboratory material (25%)</i>	102,29 €	1.227,50 €
<b>TOTAL</b>	<b>11.242,24 €</b>	<b>134.906,92 €</b>

### Notes

(9) Worker/installer: 12500 (part-time), Engineer: 30000, Commercial /manager: 40000 (annual gross salary in €).

(10) 175 m<sup>2</sup> local (1400 €/month).

(11) Telephone and Internet service.

(12) 25,000 €, 5 years loan, 19 % annual interest

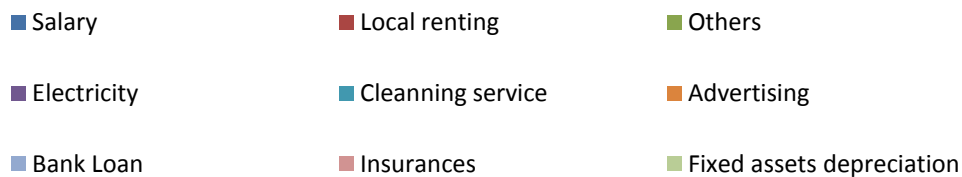
(13) 3 work stations (300 €/unit) = 900 € / 48 months (4 year renting service).

(14) Protection against late payments and lack of liquidity.

(15) Fire, theft and weather events insurance.

(16) Financial and labour legal services.

### Annual fixed costs: 134.906,92 €



**Figure 9.5** annual fixed costs.

The variable costs associated can be seen in the next table (table 9.4) where the initial variable costs are the expenditure related due to the device components cost (cost/device) and the expenditure related to a matching fingerprint software license to manage the fingerprint checks against the database (fingerprint matching software license per user), and the annual variable costs are related to the remote service offered, taking into account that each user is related to an infrastructure investment due to servers where are located their fingerprints (remote service per user) and the electricity consumption associated to each server and user.

**Table 9.4** variable costs

<b>Initial variable costs</b>		
<b>Concept</b>	<b>cost/device</b>	<b>cost/user</b>
Logistic (17)	0,02 €	
Fingerprint sensor	5,00 €	
Fingerprint matching software license per user (18)		0,90 €
Electronic components	3,00 €	
<b>TOTAL</b>	<b>8,02 €</b>	<b>0,90 €</b>
<b>Annual variable costs</b>		
	<b>cost/device</b>	<b>cost/user</b>
Remote service (19)	- €	1,00 €
Electricity (20)	- €	0,73 €
<b>TOTAL</b>	<b>- €</b>	<b>1,73 €</b>

### **Notes**

(17) Fingerprint sensors in boat trip (1 €/Kg).

(18) 18 €/ server, 1 server = 1 license = 100 users.

(19) 1 server=300 €=100 users, consider renting service of 3 years.

(20) 1 server= 70 W; 0,12 €/KWh, 1 server=100 users.

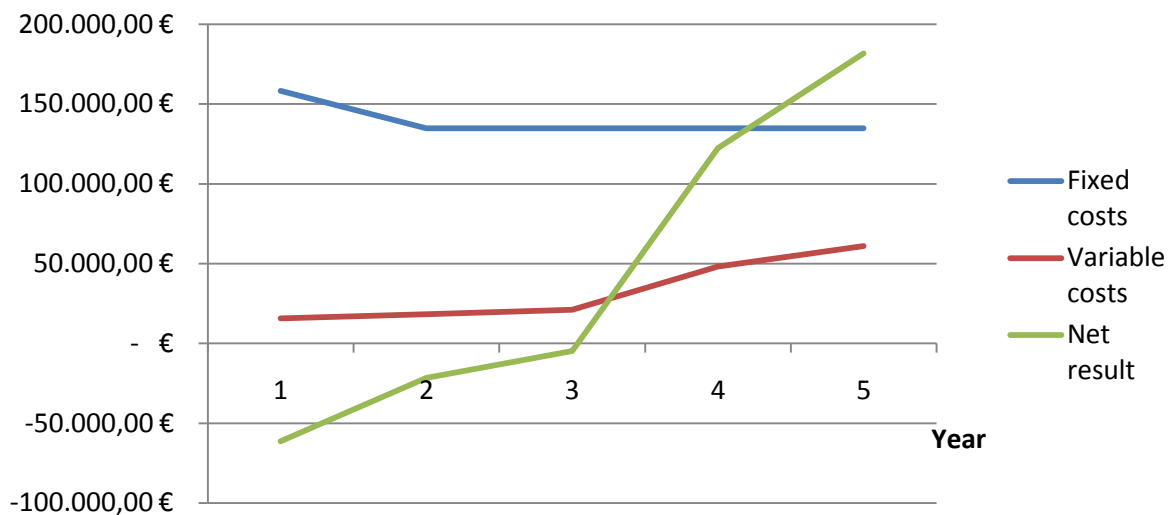
In table 9.5 the expected results for the first 5 years of activity are showed, earning a net profit of 122.349,30 € the fourth year of exercise, resulting in a NPV (Net Present Value) of 226.671,04 € and an IRR (Internal Rate of Return) 45%, with 55.000 € as initial investment (considering a company residual value of 10 years with the net result obtained in the fifth year of exercise as reference) (see table 9.6). In figure 9.6 we can see this evolution graphically, where the break even point occurs at the fourth year.

**Table 9.5** first 5 years financial results (for details see annex B).

Year	1	2	3	4	5
Fixed costs	158.253,17 €	134.906,92 €	134.906,92 €	134.906,92 €	134.906,92 €
Variable costs	15.649,92 €	18.298,16 €	21.032,90 €	48.143,34 €	60.946,68 €
Revenue	112.531,68 €	131.574,14 €	151.238,60 €	346.182,66 €	438.247,92 €
Result	- 61.371,41 €	- 21.630,94 €	- 4.701,22 €	163.132,40 €	242.394,32 €
<b>Net result</b>	<b>- 61.371,41 €</b>	<b>- 21.630,94 €</b>	<b>- 4.701,22 €</b>	<b>122.349,30 €</b>	<b>181.795,74 €</b>

**Table 9.6** financial parameters.

NPV	Interest	Investment
226.671,04 €	20%	55.000,00 €
IRR		
45%		

**Figure 9.6** break even point graphic.

We can see in figure 9.6 that fixed costs are the most influence in the proposed business plan, specifically the cost due to workers salaries, because variable costs related have a low impact in the final price product. From the fourth year, thanks to the increase of annual clients and the annual fees collected from clients acquired in previous years, the benefits described are achieved.

Finally, given a feasible annual sales within the proposed potential market, after analyzing all the financial parameters, we can say that this is a profitable business idea.

## Cash flow and balance sheet

We present the annual cash flow forecast for the first five years of activity, as seen in table 9.7, the business idea would always liquidity since its inception despite the losses (thanks to 55.000 € as initial capital contributed and a 5-year bank loan of 35.000 €) with an upward trend in the last 2 years due to the increased revenues due to expected sales.

**Table 9.7** Cash flow forecasting.

Year	5	4	3	2	1
Expenses (fixed + variable costs)	195.853,60 €	183.050,26 €	155.939,82 €	153.205,08 €	173.903,09 €
Income (revenue)	438.247,92 €	346.182,66 €	151.238,60 €	131.574,14 €	112.531,68 €
Result	242.394,32 €	163.132,40 €	- 4.701,22 €	- 21.630,94 €	- 61.371,41 €
<b>Net result</b>	<b>181.795,74 €</b>	<b>122.349,30 €</b>	<b>- 4.701,22 €</b>	<b>- 21.630,94 €</b>	<b>- 61.371,41 €</b>
<b>Initial capital+ 5 year bank loan + net result accumulated</b>	<b>124.645,73 €</b>	<b>2.296,43 €</b>	<b>6.997,65 €</b>	<b>28.628,59 €</b>	<b>90.000,00 €</b>
<b>Cash</b>	<b>306.441,47 €</b>	<b>124.645,73 €</b>	<b>2.296,43 €</b>	<b>6.997,65 €</b>	<b>28.628,59 €</b>

Following we present a balance sheet summary for the firsts financial five years of activity, as we see in table 9.8, we would have assets and liabilities between 84.589,69 € and 317.633,69 € in the first and fifth year respectively.

**Table 9.8** balance sheet summary (for details see annex C).

Year	5	4	3	2	1
<b>Assets &amp; liabilities</b>	<b>317.633,69 €</b>	<b>147.030,17 €</b>	<b>35.873,09 €</b>	<b>51.766,53 €</b>	<b>84.589,69 €</b>

## CHAPTER 10. FINAL CONCLUSIONS

The main objective of this master thesis has been to make a business plan, which is researching a business opportunity, analyze the existing technologies to provide a suitable solution and develop a product from its root to the constitution of a possible company, taking into account all intermediate steps to get there.

After a market opportunity detection in a growing market such as fingerprint recognition systems, the possibility of applying this technology in a more cheaply and efficiently manner in different business environments has been feasible, thanks to the ability to integrate a low cost access control and time attendance fingerprint system with a minimum impact on client's facilities through the use of wireless technologies, low cost electronics and remote database servers.

If we highlight the main features of the business plan submitted:

- The aim is to provide a product to attract clients requiring these services in environments where previously this wasn't considered, for their high cost and installation impact, where a high security is not a relevant factor to realize shifts control and other complementary functions as authentication for a photocopier usage, meeting rooms access...etc.
- The purpose is not to provide a security service to a government for example, but to offer an access and time attendance workers and facilities control system, avoiding the use of passwords or PIN for example, on a more practical and economical procedures through alternative fingerprint-based systems solutions.
- One of the main potential clients has been detected for the exposed business idea, would be companies with different offices or retail chains with branches in different places (clothing stores, travel agencies, hotel chains, food and catering chains.. etc.). This will give them a fingerprint system which could take a complete access and time attendance control in all workers' business delegations through a remote and centralized system. It would prevent a costly system infrastructure implementation in each of their delegations, to avoid a database that would have to reconfigure every time that workers have movements between the different branches or delegations, in addition to offer the product advantages described in this business plan relative to systems offered in biometric market.
- Although a high client bargain power is estimated due competition in biometric industry and the possibility that potential new competitors with similar products or services emergence, a reduced profit margin in the product offered is a key parameter to slow down that risk.
- In the economic forecasting realized, earning a net profit of 122.349,30 € the fourth year of exercise, resulting in a NPV (Net Present Value) of 226.671,04 € and an IRR (Internal Rate of Return) 45%, with 55.000 € as initial investment (considering a company residual value of 10 years with the net result obtained in the fifth year of exercise as reference).

Finally, given a feasible annual sales within the proposed potential market, after analyzing all the parameters of a business plan evaluation, we can say that it's a profitable business.



## **CHAPTER 11. ENVIRONMENTAL STUDY**

One of the main requirements for the development and progress of society in an information and communication technologies world is the enterprises development adopting new ways to perform their activities in a more efficient and cheaper manner.

These important objectives not make us forget another key aspect to a technological society progress, environmental awareness, thanks to a model that combines technological development without harming our environment.

Years ago has brought the economic interest over any aspect, so in these lines is to make clear that the business idea outlined here is made in consideration of a recycling plan in its products and a zero impact in its development without altering our natural environment.

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## ANNEX A. TECHNOLOGIES INVOLVED

Will make a short description of the technologies used in the different solutions proposed in the business plan, to know their characteristics and justify why have been chosen (for a detailed and deep expansion of each technology refers to the references). Below we will make a brief summary of the main factors of biometric and fingerprint technology [33].

### Biometric and fingerprint technology

A biometric system is essentially a pattern recognition system that recognizes a person by determining the authenticity of a specific physiological and/or behavioural characteristic possessed by that person.

Fingerprint recognition is a rapidly evolving technology that has been widely used in forensics such as criminal recognition and prison security, and has a very strong potential to be widely adopted in a broad range of civilian applications.

- **Fingerprint sensing:** The most important part of a fingerprint scanner is the sensor (or sensing element), which is the component where the fingerprint image is formed. Nowadays, most civil and criminal AFIS (Automatic Fingerprint Identification System) accept live-scan digital images acquired by directly sensing the finger surface with an electronic fingerprint scanner. No ink is required in this method, and all that a subject has to do is press his finger against the flat surface of a live-scan scanner.

Almost all the existing sensors belong to one of the three families: optical, solid-state, and ultrasound. The sensing technologies used in low cost and small-medium size applications are optical (some technologies) and solid-state (actually one of the most low cost, power consumption and compact are silicon-based capacitive fingerprint sensors).

- **Fingerprint images:** To maximize compatibility between digital fingerprint images and ensure good quality of the acquired fingerprint impressions, the US Criminal Justice Information Services released a set of specifications that regulate the quality and format. The main parameters characterizing a digital fingerprint image are as follows:
  - **Resolution:** This indicates the number of dots or pixels per inch (dpi). 500 dpi is the minimum resolution for FBI-compliant scanners and is met by many commercial devices; 250 to 300 dpi is probably the minimum resolution that allows the extraction algorithms to locate the minutiae in fingerprint patterns.
  - **Area:** The size of the rectangular area sensed by a fingerprint scanner is a fundamental parameter. An area greater than or equal to 1 × 1 square inches (as required by FBI specifications) permits a full plain fingerprint impression to be acquired. However in most of the recent fingerprint low cost scanners the area is sacrificed to reduce cost and to have a smaller device size.
  - **Number of pixels:** The number of pixels in a fingerprint image can be simply derived by the resolution and the fingerprint area.

In the next table we can see the main characteristics of some commercial sensors (table A.1):

**Table A.1** some commercial fingerprint sensors (extracted from [33]).

	Technology	Company	Model	Dpi	Area (h×w)	Pixels
Optical	FTIR	Biometrika www.biometrika.it/eng/	FX2000	569	0.98"×0.52"	560×296 (165,760)
	FTIR	Digital Persona www.digitalpersona.com	UareU2000	440	0.67"×0.47"	316×228 (72,048)
	FTIR (sweep)	Kinetic Sciences www.kinetic.bc.ca	K-1000	up to 1000	0.002"×0.6"	2×900 (H×900)
	FTIR	Secugen www.secugen.com	Hamster	500	0.64"×0.54"	320×268 (85,760)
	Sheet prism	Identix www.identix.com	DFR 200	380	0.67"×0.67"	256×256 (65,535)
	Fiber optic	Delsy www.delsy.com	CMOS module	508	0.71"×0.47"	360×240 (86,400)
	Electro-optical	Ethentica www.ethentica.com	TactilSense T-FPM	403	0.76"×0.56"	306×226 (69,156)
Solid-state	Capacitive (sweep)	Fujitsu www.fme.fujitsu.com	MBF300	500	0.06"×0.51"	32×256 (H×256)
	Capacitive	Infineon www.infineon.com	FingerTip	513	0.56"×0.44"	288×224 (64,512)
	Capacitive	ST-Microelectronics us.st.com	TouchChip TCS1AD	508	0.71"×0.50"	360×256 (92,160)
	Capacitive	Veridicom www.veridicom.com	FPS110	500	0.60"×0.60"	300×300 (90,000)
	Thermal (sweep)	Atmel www.atmel.com	FingerChip AT77C101B	500	0.02"×0.55"	8×280 (H×280)
	Electric field	Authentec www.authentec.com	AES4000	250	0.38"×0.38"	96×96 (9,216)
	Piezoelectric	BMF www.bm-f.com	BLP-100	406	0.92"×0.63"	384×256 (98,304)

And then the size of each image to process, belonging to the fingerprint, would be between 9 Kbytes and 90 Kbytes, depending on the sensor characteristics.

- Fingerprint matching: The fingerprint image is encoded into a suitable form for comparison with the records held in the database. The encoded record consists of information describing the positions of the fingerprint's key attributes, called minutiae, and their spatial relationships.

Fingerprint matching refers to finding the similarity between two given fingerprint images. The choice of the matching algorithm depends on which fingerprint representation is being used. Typically, a matching algorithm first attempts to recover the translation, rotation, and deformation parameters between the given image pair and then determines the similarity between the two images. Matching is then performed by comparing the encoded record against those held in the database.



The number of templates per individual is an important design parameter of the verification system. On the one hand, the larger the number of templates, the better the expected accuracy of the verification system. On the other hand, the larger the number of templates stored for each individual, more resources (computational and memory) are required [34].

To get an idea of the power processing needed for a server we see the recommendations of some providers:

Artificial intelligence Company and Axeze company recommends a minimum server requirements of a 2,4 Ghz CPU and 512 MB RAM to control up to a maximum of 99 users with a 3 fingers registration per user (around 300 fingerprints) [35] [36].

Bioenable Company recommends a minimum server requirements of 2 CPU's of 3 Ghz and 4 GB RAM to authenticate 20.000 operations per minute [37].

## Bluetooth

Then we will make a brief summary of Bluetooth characteristics that makes us choose this technology [38].

As discussed in the project, fingerprint scanners communication is performed through an ad-hoc network (two of the most common link protocols in these networks would be IEEE 802.11 or Wi-Fi and Bluetooth) [2], with hundreds of nodes, where each one would be able to cover distances up to 100 meters with a Bluetooth interface (depending on the device class).

As mentioned, the size of the data used (fingerprint images) is between 9 Kbytes and 90 Kbytes, an adequate size to be transmitted by Bluetooth technology that can achieve a data rate of 1 to 3 Mbit/s. Bluetooth wireless technology is a short-range communications technology intended to replace the cables connecting portable and/or fixed devices while maintaining high levels of security. The key features of Bluetooth technology are robustness, low power, and low cost (Bluetooth technology costs a third of Wi-Fi to implement), ideal characteristics for the purpose of the business exposed.

- Bluetooth Security: Developers that use Bluetooth wireless technology in their products have several options for implementing security. And there are three modes of security for Bluetooth access between two devices.

Security Mode 1: non-secure.

Security Mode 2: service level enforced security.

Security Mode 3: link level enforced security.

The manufacturer of each product determines these security modes. Devices and services have different security levels. For devices, there are two levels: "trusted device" and "untrusted device." A trusted device has already been paired with one of your other devices, and has unrestricted access to all services. Services have three security levels:

- Services that require authorization and authentication.
- Services that require authentication only.
- Services that are open to all devices.

## UMTS

The Universal Mobile Telecommunications System (UMTS) is one of the new third generation (3G) mobile cellular communication systems being developed within the framework defined by the ITU known as IMT-20001. UMTS builds on the capability of today's mobile technologies by providing increased capacity, data capability and a greater range of services. One of the aspects of GSM that has played a significant part in its global appeal is its set of security features, where UMTS security builds on the success of GSM, by providing new and enhanced features in this area [39].

The main reasons why we have chosen this technology are its data transmission rate (up to 2 Mbp/s [40]) with respect to GSM or GPRS, and the wide diffusion of this technology in mobile devices for data transmission, which makes it suitable to offer mobile phones or PDA's that can also act as fingerprint scanners (business future lines).

## VPN

Virtual private network is a way to simulate a private network over a public network (such as Internet) through a virtual connection (temporary connections that have no real physical presence, only logical) created between two machines, a machine and a network, or two networks. There are several technologies that VPN's use to protect data travelling across Internet as firewalls, authentication, encryption and tunnelling. For more detail about VPN see reference [41].

- Mobile VPN: Mobile virtual private networks (MVPNs) can provide remote users with easy, secure high-speed access to their enterprise network resources. There is a tremendous market opportunity for operators who can meet the needs of these users. Third-generation (3G) systems and IEEE 802.11b wireless local area network (WLAN) systems have complementary strengths [42].

## ANNEX B. PROFIT AND LOSS STATEMENT

**Table B.1** profit and loss statement.

Year	5	4	3	2	1
1. Revenues	438.247,92 €	346.182,66 €	151.238,60 €	131.574,14 €	112.531,68 €
2. Supplying	- 60.946,68 €	- 48.143,34 €	- 21.032,90 €	- 18.298,16 €	- 15.649,92 €
3. Personnel expenses.	- 82.500,00 €	- 82.500,00 €	- 82.500,00 €	- 82.500,00 €	- 82.500,00 €
4. Other operating expenses	- 44.937,20 €	- 44.937,20 €	- 44.937,20 €	- 44.937,20 €	- 68.283,45 €
5. Depreciation expense of assets.	- 3.277,50 €	- 3.277,50 €	- 3.277,50 €	- 3.277,50 €	- 3.277,50 €
<b>A) OPERATING PROFIT (1+2+3+4+5)</b>	<b>246.586,54 €</b>	<b>167.324,62 €</b>	<b>- 509,00 €</b>	<b>- 17.438,72 €</b>	<b>- 57.179,19 €</b>
6. Financial expenses (Bank loan)	- 4.192,22 €	- 4.192,22 €	- 4.192,22 €	- 4.192,22 €	- 4.192,22 €
<b>B) FINANCIAL RESULT (6)</b>	<b>- 4.192,22 €</b>	<b>- 4.192,22 €</b>	<b>- 4.192,22 €</b>	<b>- 4.192,22 €</b>	<b>- 4.192,22 €</b>
<b>C) RESULT BEFORE TAXES (A+B)</b>	<b>242.394,32 €</b>	<b>163.132,40 €</b>	<b>- 4.701,22 €</b>	<b>- 21.630,94 €</b>	<b>- 61.371,41 €</b>
7. Taxes on benefits.	- 60.598,58 €	- 40.783,10 €	- €	- €	- €
<b>D) RESULT OF THE EXERCISE (C+7)</b>	<b>181.795,74 €</b>	<b>122.349,30 €</b>	<b>- 4.701,22 €</b>	<b>- 21.630,94 €</b>	<b>- 61.371,41 €</b>

## ANNEX C. BALANCE SHEET

Table C.1 balance sheet.

Year	5	4	3	2	1
<b>ASSETS</b>					
<b>A) FIXED ASSETS</b>					
I. Property, Plant, and Equipment.	1.522,50 €	4.800,00 €	8.077,50 €	11.355,00 €	14.632,50 €
<b>B) CURRENT ASSETS</b>					
II. Inventories.	9.669,72 €	17.584,44 €	25.499,16 €	33.413,88 €	41.328,60 €
II. Cash and cash equivalents.	306.441,47 €	124.645,73 €	2.296,43 €	6.997,65 €	28.628,59 €
<b>TOTAL ASSETS (A+B)</b>	<b>317.633,69 €</b>	<b>147.030,17 €</b>	<b>35.873,09 €</b>	<b>51.766,53 €</b>	<b>84.589,69 €</b>
<b>LIABILITIES AND OWNER'S EQUITY</b>					
<b>A) OWNER'S EQUITY</b>					
<b>A-1) Equity financing.</b>	<b>306.441,47 €</b>	<b>124.645,73 €</b>	<b>2.296,43 €</b>	<b>6.997,65 €</b>	<b>28.628,59 €</b>
I. Capital stock.	90.000,00 €	90.000,00 €	90.000,00 €	90.000,00 €	90.000,00 €
1. Stated Capital.	90.000,00 €	90.000,00 €	90.000,00 €	90.000,00 €	90.000,00 €
II. Results of previous exercises	34.645,73 €	- 87.703,57 €	- 83.002,35 €	-61.371,41 €	- €
IV. Results (Income or loss) for the period.	181.795,74 €	122.349,30 €	- 4.701,22 €	-21.630,94 €	- 61.371,4 €
<b>B) NON-CURRENT LIABILITIES</b>					
I. Long-Term Debts.	11.192,22 €	22.384,44 €	33.576,66 €	44.768,88 €	55.961,10 €
1. Bank loans.	11.192,22 €	22.384,44 €	33.576,66 €	44.768,88 €	55.961,10 €
<b>TOTAL LIABILITIES AND OWNER'S EQUITY (A+B)</b>	<b>317.633,69 €</b>	<b>147.030,17 €</b>	<b>35.873,09 €</b>	<b>51.766,53 €</b>	<b>84.589,69 €</b>