

POLITECNICO DI TORINO

Master's degree in Engineering and Management



Master's Degree Thesis

Analysis and Development of an IoT Platform in a Software Company

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Academic Year 2023/2024

*Alla vita e ai sogni
che ci spronano a diventare migliori
A questo traguardo
che è un punto di partenza verso nuovi orizzonti*

Abstract

In today's industrial landscape, increasingly more oriented towards energetic sustainability and operative efficiency, data management is a crucial element for the companies, especially because often energy efficiency and consumption have become strategic priorities.

Data that is accurately collected and analyzed allow the companies to identify waste areas, optimization of resources usage, significant reduction in consumption causing a reduction in operating costs and environmental impact. The ability to monitor and manage data in real time allows the companies to be more competitive and resilient over time.

The objective of this thesis is to describe the steps of a real project concerning energy management by data collection from industrial machines with possible applications to the field of agriculture as well.

The project was carried out by a software development company, and the system was entirely created and implemented by them.

The company in question is Softbotica srl, based in Busca (CN), and the project was carried out during an internship period, so all the steps of project development were fully experienced in close contact with company dynamics.

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INTRODUCTION

Nowadays it is harder and harder for companies to maintain their competitiveness in the market. The technological and economic environment is constantly changing. For this reason, they must adapt quickly, and they have to follow the new trends that come out in order not to fall behind competitors. Here, it is no longer an option to remain static; updating processes and systems must be ongoing to match trends taking place in the market.

Companies have to keep up with the times if they want to expand. Businesses are today evolving with new technology that helps them operate and interact with customers. Significantly, Industry 4.0 is a revolution that converges such technologies to result in an intelligent and highly automated manufacturing environment. The new industrial paradigm is well-placed not only to improve efficiency and productivity but also to confer a potential competitive advantage over time.

The project described in this thesis will have a fundamental function in ensuring a smooth transition towards Industry 4.0 within companies, given that it trains them to get all the means to modernize their operations to be increasingly suitable for the digital age, with an advanced energy and data management system. The advanced energy management system optimizes the collection and analysis of data, integrating parts of the advanced monitoring technologies and allowing real-time resource management.

It helps organizations find inefficiencies, predict trends, and make decisions based on real factual data by accurately and timely collecting and analyzing data. Besides, data visualization through a dedicated platform provides an immediate and intuitive view of business performance to support proactive and strategic management.

Moreover, Industry 4.0 is not only a technological innovation; it also secures long-term sustainability and competitiveness. Those companies which will invest in such advanced technologies and automation processes will get the relevant competitive advantage: high operation efficiency, low costs, and fast response to the changeable market needs. Besides, resource management will be raised to a better-informed and strategic

decision-making level through data and analytics-based practices, thus contributing to environmental sustainability with ecological footprint reduction in business.

The project thus gives an opportunity for key enterprise modernization according to Industry 4.0 requirements. Integration of advanced technologies would be necessary together with innovative management systems, so a firm could be competitive in the fast-changing world. It is a project intended to smoothen the way for such industries into the next phase of more efficient and sustainable processes that give strategic advantages to companies desirous of staying competitive and relevant in the global market today.

The objective of this thesis is therefore to describe the feasibility study process for the energy management project and data analysis. In detail, the thesis is divided into six chapters.

The first chapter introduces the company and the project, providing context on the organization's background and the specific project focus.

The second chapter explores the market, specifically the Energy Management Sector. It covers an introduction to the sector, current innovations and trends, competitive analysis, SWOT analysis, and differentiation strategies to position the project effectively within the market.

The third chapter delves into product planning, where I analyze customer needs and define the product's positioning to ensure it meets market demands and stands out among competitors.

The fourth chapter discusses product design, with a focus on technology and system architecture, particularly in the case of Rosatello. It includes the technical components of the system, an overview of the dashboard, and an analysis of the make-or-buy decisions for technology components.

The fifth chapter outlines the marketing strategies and go-to-market plan. It describes strategies based on demand interception, database utilization, and direct campaigns, concluding with a comparison between these strategies.

The sixth and final chapter provides a conclusion, summarizing the key insights from the research and recommendations for future work.

To conclude this introduction, through a critical examination of the issues addressed and the solutions adopted, this paper aims to make a significant contribution to both theory

and practice in the field of energy management. In particular, the thesis explores the main technical, economic and strategic obstacles that arise in the context of energy innovation and analyzes the most effective design and market responses to overcome them.

1. THE COMPANY AND THE PROJECT

1.1 The Company

Softbotica is a software company located in Busca (CN) that was born from the initiative of a group of programmers who, initially, worked together for another company. When the company they worked for closed for personal reasons of one of the founders, the team had to reorganize from scratch. Initially there was no clear division of roles; everyone was in charge of a little bit of everything. The lack of clear organization led to inefficiencies and slowdowns as there was a lack of a clear working method and everyone's skills were dispersed in various unrelated tasks.

Realizing these difficulties, the team of programmers decided to find a new software company with the goal of creating a more organized and productive work environment. The idea was to assign more specific roles to each person and figure out what tasks each person preferred to perform. This division of labor allowed each person to specialize in some specific tasks, and this greatly benefited the team by increasing productivity and work efficiency. In this new context, each person can devote himself or herself entirely to his or her role, knowing that he or she can count on the support of colleagues for specific needs.

Having said that, from nearly two decades of experience in the automation field of its founding partners, Softbotica was established in 2022. The team consists of well-prepared, competent, and professional technicians who can boast years of prior internal collaboration.

Today, Softbotica is a software company that specializes in the design and creation of PLC, Robot, Scada, and PC software, addressing the current needs of clients. This includes integrations with databases (SQL, MySQL) for data collection, product traceability within and outside the production cycle, and the integration of machines into plant automation systems.

1.2 The Project

1.2.1 Project Context and Background

The decision to undertake the development of this project and study its feasibility was triggered by the fact that many companies struggle to monitor their consumption accurately. Since Softbotica works with many companies in the industrial sector and lives with these kinds of problems on a daily basis, it has been decided to look for a solution.

Many companies would like to have more accurate control of the data but fail to manage their energy usage effectively due to outdated systems, a lack of real-time data, and insufficient analytics capabilities.

Another problem that has been identified by Softbotica relates to the world of agriculture. Many agricultural producers need to monitor temperatures, humidity and consumption of their greenhouses, fields or factories on a daily basis.

Combining these two issues, the company has initiated the development of an Energy and Data Monitoring System aimed at providing companies and small business owners with a comprehensive, user-friendly tool to track and easily visualize data related to their activities.

The main idea behind the product was to create a product that could be adapted to any industry where there is data to be monitored.

The system will be equipped with software and hardware so as to provide the customer with a system that can be complete. The hardware consists of the sensors needed for field data collection while the software relates to a data visualization and comparison dashboard that the customer can interact with.

Essentially, the project involves the installation of measurement sensors at the customer's plant, which can be either industrial or agricultural, to measure real-time data. The type of data that will be collected will depend on the sensor installed and the customer's needs based on what their goals are and what they want to optimize, control, or monitor. For example, sensors can measure parameters such as temperature, humidity, energy consumption, or liquid levels.

The data is sent to a platform that has a dashboard to visualize the data. Because the data is saved with date and time of detection, on the dashboard the data will be displayed through graphs and other advanced features. This will make it easy from the platform to compare and analyze the information over time, helping the customer to make decisions and be in control of their data. This section offers an overview of the system. A detailed analysis and a comprehensive description, breaking down each component, will be presented in the following chapter.

1.2.2 Project Objectives

Project goals are the basis on which the project will be built. It is important to always keep in mind and aim to meet these goals. For this project the main goals are:

- Develop a data monitoring system that can be sustainable and can be useful to do analysis and help companies grow and decrease waste and costs
- Create a user-friendly platform that can be easily understood and used by any type of profile
- Create a data monitoring system that can be scalable. The goal is to have a system that can be applied to multiple realities with different facets and different needs.
- Being able to get a consistent market share with the new product.

1.2.3 Project Scope

The scope of this project includes the design, development, and commercialization of an advanced energy and data monitoring system to meet the needs of diverse industrial, commercial and agricultural clients.

In the project will be included:

- Hardware components (like sensors and smart meters) that will be installed in various industrial and agricultural environments with the purpose of data monitoring.
- The creation of a dashboard for data visualization that each customer will be able to customize in order to visualize their data how they like.
- The integration of analytics features such as graphs and alerts. In this way the clients can easily understand where and when their production is not efficient.
- A marketing plan to introduce the product on the market that includes market analysis, data analysis and sales predictions to introduce the product into the market.
- Custom on-site installation for each individual client

1.2.4 Methodology and Approach

The development of the project will follow the agile methodology because it provides flexibility and responsiveness to change. It is essential to be ready for possible changes in the project because the project is part of a fast-paced business environment, and it could happen that some modifications occur.

Agile allows the team to increase the value generated using development cycles, enabling them to adapt quickly to new market conditions or requirements.

For this project, the Agile methodology is applied to a single team. The team works in short development cycles (sprints) and in order to keep each team member informed about the latest updates several team meetings are conducted regularly.

During these meetings several activities are conducted like the discussion of progress and obstacles, definition of goals, planning of the tasks that each member will have to complete before the next sprint and discussion of what went well and what went wrong.

1.2.5 Risks and Challenges

There are several risks and challenges that have been identified that could impact on the results of the project. In order to overcome these obstacles, it is crucial to focus on each challenge individually so that a strategy can be developed to address a specific solution for the specific needs of each issue.

Tackling each challenge individually encourages innovative thinking to find a solution and it reduces the risk of overlooking critical details and it also leads to a more structured and efficient path to achieving project success.

The risks and challenges that have been identified are:

- **Larger and established competitors:** The presence of competitors who are already well placed in the market is perhaps the biggest challenge that needs to be overcome. Competitors that are already active in this field are either large companies that have very significant capital and thus can diversify among many projects among which there may be energy management and data collection, or they are smaller companies that are specialized in Data collection.

To overcome this challenge Softbotica decided to focus on offering a very efficient system that can be adapted to any type of customer. Each customer will have different needs and objectives, and the goal of the project is to have a system that is capable of meeting all needs coming from clients, even in different industries.

Being able to adapt to any business system and satisfy all types of customers by providing them with the data they most need may be the way to overcome this challenge and gain a good market share.

- **Creating a User-Friendly and Intuitive Platform:** Designing a platform that is easy to use and that meets the customer expectation is fundamental for the success of the project.

The platform on which the customer visualizes the data detected from the sensors is extremely important because it is the main element that will affect the user experience since it is the element that the customer will interface with on a daily basis.

The risk is that a poorly designed platform interface could lead to poor user experience, making it difficult to understand the data and frustrating to utilize the system's features.

The plan to avoid the risk of developing a mediocre platform that does not provide good user experience is to develop a platform that has a simple interface that is easy to use and understand, eliminating all superficial elements so that only those strictly necessary for the user are retained.

Another way to make the platform more intuitive for the customer is to create guides and video tutorials that can be sent to the customer so that they can learn how to use all the features of the platform and can refer to the tutorial whenever they need assistance.

The platform is available on different devices with different operating systems both from desktop and mobile, this detail is expected to enhance the customer experience even more.

- **Perfect System Functionality:** Making sure the system runs smoothly at all times is crucial, as any disruption could result in the loss of critical data, compromising trust and the reliability of the service provided. To prevent the risk of a software failure, system crash, loss of connection with the servers or data synchronization issues it is very important to implement a strong infrastructure, frequent backups and an active monitoring system that detects any anomalies. The positive aspect is that the system does not require a highly complex or resource-intensive setup; instead, it relies on a straightforward configuration with essential components that work efficiently together to ensure smooth and reliable operation.
- **Preventive Maintenance:** Preventive maintenance is a key element that cannot be underestimated because it is essential to ensure continuity of operations and avoid disruptions that could negatively affect the user experience. The main risk is neglecting or underestimating the importance of making regular checks to sensors that could deteriorate over time and either stop working or lead to inaccurate or incomplete data collection.

To deal with this problem, it is necessary to create a detailed maintenance plan and also train maintenance personnel by providing them with clear guidelines for interventions to keep the system in optimal conditions, ensuring consistent and reliable functionality and extending its operational life.

2. THE MARKET

2.1 Energy Management Sector

The market analysis conducted by the candidate of data collection systems in the business environment shows a growing importance in the adoption of advanced technologies for monitoring and managing business processes. These systems, often referred to as 'Industrial IoT', will play a crucial role in optimizing resources and achieving operational efficiency in the industrial environment.

The market for data sensing systems is fragmented into various sectors and each of these sectors has specific needs related to the monitoring of operational parameters. The main users of this technology are manufacturing, logistics, energy, healthcare and smart cities. These systems used in these sectors include advanced sensors for real-time data sensing from machinery, which are processed by software platforms so that they can be analyzed in depth and are

The market for data collection and energy management systems in industrial and agricultural environments is growing rapidly, driven by the increasing need for companies to reduce energy costs and become more environmentally efficient. As environmental regulations become more stringent, industries are increasingly adopting digital solutions to monitor and optimize energy consumption. These systems use technologies such as the Internet of Things (IoT), artificial intelligence (AI) and cloud platforms to collect, analyze and manage energy data, enabling more informed and efficient decisions to be made in real time.

According to a recent study by Schneider Electric, the potential energy savings from implementing these systems are significant, with the potential to reduce overall energy consumption by up to 20% in some industries. According to this study, the market is expected to continue to grow in the coming years due to increased demand for sustainable solutions, with a compound annual growth rate (CAGR) of more than 10 per cent until 2027 and the global market value of energy management and data collection systems is expected to exceed 10 billion USD by 2027. This growth is also driven by the

need to reduce the carbon footprint, improve sustainability and increase competitiveness in international markets.

2.1.1 Innovation and trends

The data collection market is strongly influenced by several technological innovations that are changing its development and future applications. One of the most significant trends is the use of artificial intelligence (AI) and machine learning (ML) that are being applied to improve data analysis. With the integration of artificial intelligence, systems can collect large amounts of data and process them to provide real-time insights, allowing companies to make decisions quickly and efficiently. AI-based predictive analytics, for example, can predict when a machine might fail, allowing preventive maintenance interventions, resulting in reduced downtime costs and improved operational efficiency. A second trend that must be considered is the expansion of 5G networks that offer greater bandwidth and reduced latency. This allows for faster and more reliable data transmission between IoT devices, making real-time monitoring possible even on a larger scale. Companies will be able to implement a denser network of sensors that provide detailed data on every aspect of production, from machine conditions to energy consumption.

2.1.2 Challenges

The market for industrial data collection and energy management systems certainly offers various opportunities but also has some significant challenges to face.

The first challenge is related to the high initial cost linked to the implementation of the technologies. An initial investment is necessary in sensors, IoT networks and above all for the development and implementation of software platforms for data management and data visualization platforms, as well as the costs relating to the infrastructure guaranteeing connections and data security. These costs could represent an obstacle for any small business or with a limited budget.

The second challenge is related to the difficulty in managing data. As the number of sensors increases in an application, the volume of data that must be managed also increases and can become a substantial amount. Often this is unstructured data which must therefore be processed in order to be managed efficiently and to ensure that it can be used to reach meaningful conclusions.

This requires investment in high-capacity storage units, cloud solutions and specific skills for data analysis. The main risk is to extract a large volume of data without then being able to extract real value from them, which is the main objective of this type of application.

The last challenge that is often encountered in this type of project is linked to IT security, in particular the security of data extracted from industrial machines. Often the data is private and therefore it is very important for companies that this data remains within the company and does not end up in the wrong hands. The increase in connectivity between devices makes corporate infrastructures more vulnerable to cyber-attacks. Data detection systems can be a target for hackers aiming to access private and sensitive information. Therefore, it is essential to adopt advanced security measures to avoid inconveniences. These security systems may involve additional costs and complexity but are essential because companies would not agree to install a data detection system on their machines without being sure that it is 100% safe.

2.1.3 Future prospects

As mentioned before, despite the challenges, the data collection market is very promising. Thanks to IoT technologies, artificial intelligence and big data analytics, companies investing in systems for monitoring business processes are significantly increasing.

Real-time data analytics and predictive maintenance are expected to become standard practices in many industries. This will drastically reduce costs and production interruptions and also by having all the data interconnected from various devices it will be possible to have integrated and optimized management on a large scale.

This change is also accelerated by regulations regarding sustainability which will increasingly be at the center of corporate decisions in the field of energy consumption.

The transition to industry 4.0 and 5.0 is also facilitated by tenders and funding from the state with the aim of reducing corporate emissions and making companies smart.

2.2 Competitors

The market for energy management systems is highly competitive because of the many players offering innovative and cutting-edge solutions. The market for energy efficiency management systems and data sensing is growing rapidly because of the technological evolution offered by numerous players who are already in the market and as many who are still entering. Competition in this sector is brought by the presence of numerous multinational companies such as Siemens, Schneider Electric, ABB, Honeywell and Johnson Controls, which dominate the sector with advanced solutions based on IoT and artificial intelligence.

In addition to the large multinationals, the opportunities in this sector have also led to the emergence and expansion of various innovative startups and small companies that usually offer niche or customized solutions for customers, increasing the competitiveness of the sector even more. Smaller companies focus mainly on niche areas and often collaborate with other companies to offer a complete service to the end customer. Some examples of these companies or startups may be Enertiv, Senseye, and GridPoint, which are increasing their market share due to their agility in introducing innovations that match market needs.

Despite the very high competition in the sector there is still room for new solutions, especially thanks to the new emerging trends and the very large number of possible customers for this type of application.

The strategies of large multinationals are based on three factors: Integration, Automation and Sustainability.

Integration consists in the creation of end-to-end platforms that integrate all data into a single system so that they can all be managed and analyzed simultaneously in order to offer a complete solution to the end customer.

Sustainability consists of the implementation of green technologies and solutions with the aim of reducing the business impact of companies. This type of solution is certainly very attractive for all those companies that have very strict environmental policies and therefore need a system that can control their emissions and consumption. Automation is the third factor on which many strategies of the large players in the sector are based is based on solutions based on artificial intelligence (AI) and these are systems capable of analyzing data and providing concrete results to customers using automated decisions without the need for manual intervention on the system.

As is easy to understand, in this competitive scenario the players must constantly evolve, innovate and propose innovative solutions to maintain their position in the market while new companies must specialize in more specialized solutions in order to be able to expand their market.

2.2.1 Products and solutions

Below is the detailed analysis that was carried out regarding the main competitors in the sector, their products and the solutions they offer.

1. Schneider Electric

Schneider Electric SE is a French multinational corporation that specializes in digital automation and energy management.

Schneider electric is a global leader in energy management and industrial automation with a strong commitment to sustainability and innovation. Schneider electric offers numerous services in numerous technological fields.

The main application in the field of data collection and energy sensing in the industrial sub-region is their platform called **EcoStruxure Power** (figure XX)

EcoStruxure Power digitizes and simplifies power distribution systems. The IoT-enabled, open, and interoperable architecture integrates connected products, edge control, apps, analytics, and services for more efficient, reliable, and sustainable

energy management. It provides actionable data to help protect people, safeguard assets, and maximize continuity.

The platform enables integrated connectivity and intelligence, using standard communication protocols, and the ability for smart devices to perform analytics on native data for control decisions.

EcoStruxure Power is particularly appreciated for its ability to integrate energy and environmental management systems allowing real-time visibility and corrective actions based on predictive analytics. A strength of this platform is that it can be applied in different sectors such as data centers, manufacturing, healthcare and critical infrastructure. EcoStruxure has the potential to be used for both large establishments and small to medium enterprises and this makes it a versatile solution.



Figure 2.1- EcoStruxure Logo from Schneider Electric

2. Siemens AG

Siemens AG is a German multinational technology conglomerate. It is focused on industrial automation, distributed energy resources, rail transport and health technology. Siemens is the largest industrial manufacturing company in Europe and holds the position of global market leader in industrial automation and industrial software.

Siemens is another very important player in automation and energy management, particularly with its **Insight Hub** platform, which is an IoT operating system that uses the cloud to manage and store data.

Insight Hub is particularly used in the industrial sector since significant energy savings can be achieved in this area. The system allows industrial machines, sensors and other devices to be connected to collect and analyze data in real time to improve operational efficiency and energy management.



Figure 2.2- Insight Hub Logo from Siemens AG

3. Honeywell

Honeywell International Inc. is an American publicly traded, multinational conglomerate corporation headquartered in Charlotte, North Carolina. It primarily operates in four areas of business: aerospace; building automation; performance materials and technologies and safety and productivity solutions.

Honeywell offers a wide range of energy management solutions, all delivered through the **Honeywell Forge platform**. Their solution uses artificial intelligence and machine learning to make energy use more efficient and optimize energy use in industrial

plants where energy use is very high.

Honeywell's solutions have the ability to analyze and predict energy spikes so that they can be dealt with in advance.

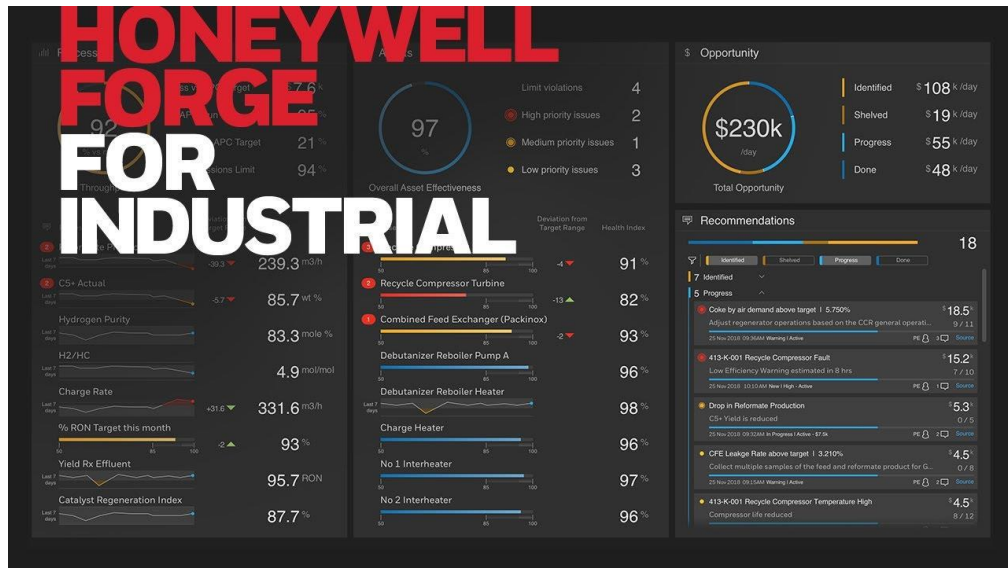


Figure 2.3- Honeywell Forge Platform

4. ABB

ABB is a technology leader in electrification and automation, helping to build a more sustainable and resource-efficient future.

ABB has created the **ABB Ability platform**, one of the most advanced in the field of energy management. The platform enables real-time monitoring of energy consumption and optimizes operational efficiency. Again, the platform is used in industrial environments where energy efficiency management is critical and reducing consumption means significantly reducing costs.



Figure 2.4- ABB Ability Logo

5. Johnson Controls

Johnson Controls International plc is an American, Irish domiciled multinational conglomerate headquartered in Cork, Ireland, that produces fire, HVAC, and security equipment for buildings.

Because Johnson Control is primarily a building management solutions provider, they have developed a system called **Metasys** that enables centralized monitoring and management of building infrastructure. Again, the goal of the platform is to reduce costs and consumption while improving environmental sustainability.



Figure 2.5- Metasys Logo from Johnson Control

6. Enertiv

Enertiv is a US-based startup that specializes in IoT solutions for analyzing and monitoring energy consumption by storing data in real time. The company is currently focused on the commercial real estate market and is not present in the industrial machinery sector.

The platform also provides predictive analytics tools to prevent outages and predict energy spikes.



Figure 2.6- Enertiv Logo

7. Senseye

Senseye is a technology company that uses artificial intelligence to perform predictive maintenance. Senseye was acquired by Siemens in June 2022. Siemens has integrated Senseye into the Siemens Digital Industries Division, enriching the Insight Hub solution offering.

Senseye enables industrial companies to monitor machine health and predict failures to reduce unplanned downtime.



Figure 2.7- Senseye Logo

8. GridPoint

GridPoint is a company that offers scalable energy management solutions for businesses with multiple locations. GridPoint combines IoT hardware with a cloud-based system, enabling companies to monitor and optimize energy consumption in real time and reduce operating costs.

GridPoint's solutions are designed to improve energy efficiency and contribute to sustainability goals. The company offers easily scalable systems that can be used by both small and large organizations. Their system helps reduce peak energy demand and better manage demand response, improving the overall sustainability of operations.



Figure 2.8- GridPoint Logo

2.3 SWOT Analysis

To complete the analysis of the field of data collection in business and energy management, the candidate conducted a SWOT analysis. The SWOT analysis is critical to understanding market dynamics and identifying how the company should work based on its strengths and weaknesses. In addition, it is also important to consider what are the opportunities for growth in the industry and what are the possible threats that the industry hides. The benefits of SWOT analysis are many and can contribute significantly to strategic project management. It provides a clear and comprehensive view of the market and all the factors that may affect the project and allows a direct focus on objectives.

To carry out the analysis, the candidate started with a 2x2 matrix in which the four items (strengths, weaknesses, opportunities and weaknesses) were entered. Before starting to try to identify the content to be included in the four dedicated areas, questions were written for each section whose answers would help in identifying what would be useful for the analysis.

Three questions were generated for each section:

- Strengths
 - What do you do well?
 - What unique resources can you draw on?
 - What do others see as your strengths?
- Weaknesses
 - What could you improve?
 - Where do you have fewer resources than others?
 - What are others likely to see as weaknesses?
- Opportunities
 - What opportunities are open to you?
 - What trends could you take advantage of?
 - How can you turn your strengths into opportunities?
- Threats
 - What threats could harm you?
 - What is your competition doing?
 - What threats do your weaknesses expose to you?

With the help of the answers to these questions, the contents for each item of the analysis were found. All the items have been listed in each dedicated section of the matrix. In the figure 2.8 are represented the key factor of the analysis and then are explained below.

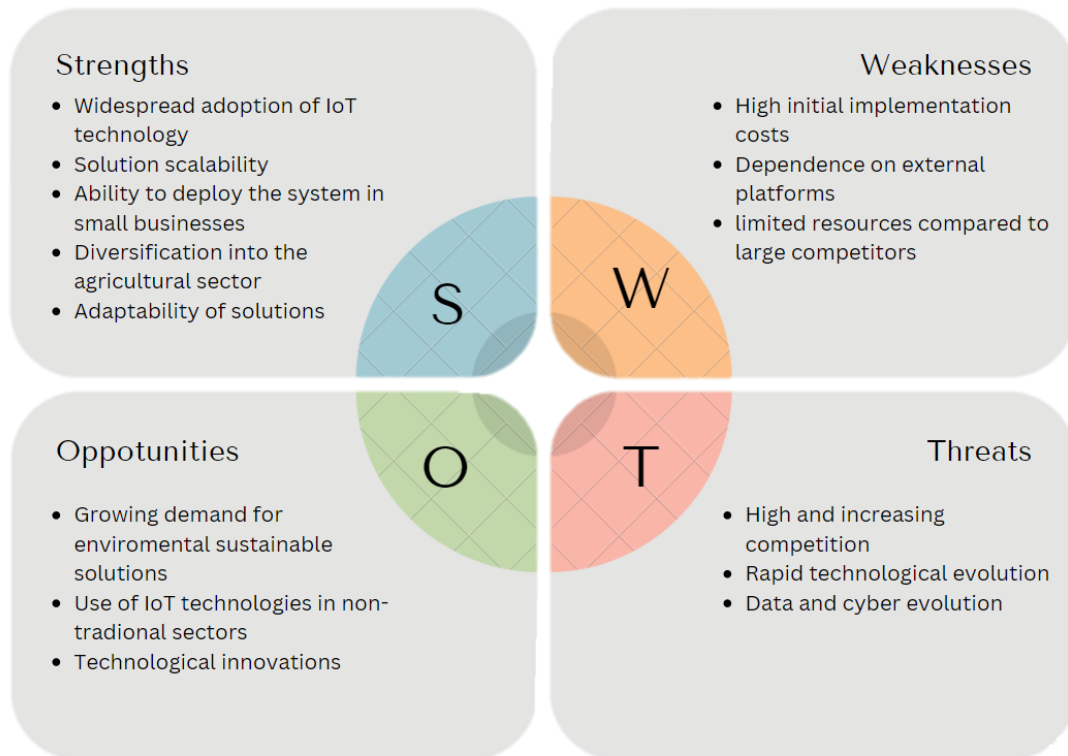


Figure 2.9- Representation of the key factors of the SWOT analysis

Strengths

- **Widespread adoption of IoT technology:** The Internet of Things is revolutionizing the industry because it allows data to be captured in real time and uploaded to the cloud. Having a system that can leverage these technologies is definitely a strength for the company.
- **Solution scalability:** Due to the cloud-based architecture of the system, the solution is highly scalable and can be easily adapted to both large and small or medium enterprises.
- **Ability to deploy the system in small businesses:** Unlike large multinational companies, Softbotica offers a service that can be targeted to small and medium enterprises. This factor reduces the barrier to entry and allows companies without large budgets to enter the market and offer their services to niche customers.

- **Diversification into the agricultural sector:** The ability to apply the solution to the agricultural sector is an advantage because of the flexibility it offers compared to companies that offer solutions with a single application.
- **Adaptability of solutions:** Softbotica offers a solution that can be adapted according to the customer's needs and the type of data they want to visualize.

Weaknesses

- **High initial implementation costs:** Initial implementation costs can be high for the solution as initial investment is needed for the IoT and cloud system
- **Dependence on external platforms:** A weakness of the system can be the dependence on external cloud platforms and internet connectivity for the systems to function.
- **Limited resources compared to large competitors:** The fact that there are many multinational rival companies is a weakness for Softbotica as the resources for system development and implementation are limited compared to those of larger companies.

Opportunities

- **Growing demand for environmentally sustainable solutions:** There is no doubt that the focus on sustainability has increased recently, and this is reflected in the solutions that companies are choosing. Businesses are increasingly looking for solutions that can improve energy efficiency.
- **Use of IoT technologies in non-traditional sectors:** In recent years, even sectors with traditionally less technological industries, such as agriculture, have begun to adopt more technological solutions. This certainly opens up new markets and opportunities for Softbotica.
- **Technological innovations:** It is now possible to integrate new emerging technologies such as artificial intelligence (AI) and machine learning into systems. This is a huge opportunity because by combining all these technologies, the potential for growth in technology and solutions offered is very high.

Threats

- **High and increasing competition:** The industry is highly competitive, and most competitors are well-structured multinational corporations with large amounts of capital to invest in the project. They are able to offer highly technological and innovative solutions.
- **Rapid technological evolution:** Technological innovation is advancing very rapidly, which could make current technologies obsolete in the short term. This could be a problem for the company if it cannot keep up with technological innovation.
- **Data and cyber security:** As the amount of data in the cloud increases, so does the risk of cyberattacks by hackers interested in obtaining corporate data. It is therefore necessary to invest in systems that are secure and that customers can trust.

2.4 Differentiation Strategies

After the SWOT and market analysis, it is clear that it is not an easy market to enter. Therefore, it is crucial to develop specific differentiation strategies in order to stand out from the big players present in the industry.

The first factor to consider is the choice of the market segment to target.

Softbotica, not being able to compete directly with the big players in the industry, has decided to target small and medium-sized companies. In fact, it often happens that small and medium-sized companies cannot afford to buy the complete, but also complex and expensive systems offered by large multinational companies. There is a part of the market that is not yet saturated because there are only a few players selling to this type of customer. Therefore, the main challenge is to provide an affordable, scalable and flexible system for small and medium enterprises that want to implement an IoT system for data collection and energy control, but without incurring excessive costs.

The second key strategy is to diversify the services offered to the agricultural sector as well. Most of the companies in the sector focus mainly on the industrial sector by offering services for data reservation directly extrapolated from industrial machines. Technology applied to agriculture is facing strong growth and with this is also growing the application of IoT systems for monitoring environmental conditions, irrigation management, temperature management in greenhouses or cold storage. Offering solutions in agriculture would allow Softbotica to position itself as an innovative and versatile option compared to competitors.

One of the weaknesses of many competing platforms is that they offer a very complex platform that, while very comprehensive, may not be compelling to the end user because they are unable to take advantage of all the features. Softbotica's goal is to provide simplified user experience and ongoing customer education. Softbotica's data visualization platform will have only those features that are absolutely necessary to simplify the user experience, and by offering the service to small and medium sized companies in the region, Softbotica will be in direct contact with these companies, providing them with comprehensive initial training on how to use the platform, and then ongoing training on new features and updates. In this way, the platform can be fully utilized by those who may not have much experience with technology.

In conclusion, by focusing on small and medium-sized enterprises and the agricultural sector, while leveraging the simplicity of its user interface, platform flexibility, and continuous customer training, Softbotica is well-positioned to gain significant market advantages. This strategy will allow the company to stand out from more structured competitors by offering accessible, scalable solutions that cater to the specific needs of underserved segments. At the same time, Softbotica ensures an optimized user experience and consistent support, enabling customers to fully realize the value of the technology being adopted. In the following chapter about product positioning these aspects of the strategy will be more deeply discussed.

3. PRODUCT PLANNING

3.1 Customers' needs

One of the most important steps in product planning and subsequent development is customer need analysis. This step is based on the identification of customer needs. Needs can be latent or expressed; obviously latent ones are more difficult to identify.

Companies, by fully understanding the needs of their customers, have the ability to target the most appropriate market segment and develop a product or service with features and functionality suited to the type of customers that have been identified so that the benefits are perfectly aligned with the expectations of their users.

In the data monitoring and energy management sector, customer needs can vary greatly based on the size of the companies and their future objectives. Large companies will require very powerful solutions integrated with the current technologies present in the company and will therefore need highly customized solutions in order to optimize the collective corporate experience. Small and medium-sized businesses, on the other hand, may be looking for simpler solutions that can possibly be expanded later as the company grows over time.

In the case of Softbotica, after careful research and analysis to identify the main needs of the company's customers, some key factors driving the demand for its service have been identified. The analysis was done considering small and medium enterprises as the target user, it is obvious that there is a large number of different companies with different objectives and needs but many share the three customer needs that have been identified. Softbotica's solution is based on these three customers' needs so that it can satisfy the main needs of its customers.

The first customer needs common to most of the companies of the market segment considered is ease of use. Small and medium-sized businesses, especially in the agricultural and manufacturing sectors, often lack specialized technical and IT expertise, and therefore need a platform that is simple to use and intuitive. Unlike many solutions on the market, Softbotica offers a solution designed to be simple and direct so that a technically qualified person in the field is not required for its operation. This responds to

the essential need to optimize operations by collecting data and monitoring energy without having to invest heavily in training staff to use the system.

The second customer need that has been identified for Softbotica customers is for the solution to be scalable. Small and medium-sized businesses, especially at the beginning, will opt to install limited solutions but overtime and as the company grows they need solutions that can grow together with their operations' volume. Softbotica responds to this need with a platform capable of adapting to different production scales and changing business needs. In fact, in the Softbotica system, once the network has been installed and the system is connected to the cloud, it is possible to add a large number of sensors without the need to compromise the functioning of the system and without interrupting data collection.

This flexibility is particularly appreciated in small and medium-sized businesses for the reason just mentioned and in the agricultural world for having the possibility of applying the solution to different crops or agricultural activities.

Finally, sustainability is definitely a growing priority for Softbotica customers. Today's companies require solutions that allow you to save on energy consumption and monitor it. Also, very important to them are the growing limitations in the field of sustainability which have been increasing in recent years and will continue to increase. The service offered by companies operating in the field of data monitoring and energy management is certainly optimal for companies with an eye on sustainability.

3.2 Product Positioning

Product positioning is the process of deciding and communicating how the product or service should be and how the market should think and feel about your product. It is an advanced process that helps companies define their products, understand how they are different from the competition, and how they are perceived by the target market.

Effectively positioning a product in the marketplace is essential to bring out its distinctive values and ensure that they are appreciated and recognized by the desired

target. This process involves not only the technical and functional characteristics of the product, but also the customer's perception of the overall product.

Comparative analysis is one of the most important techniques for positioning a product in the market. Benchmarking involves a careful analysis of competitors in the market and identifying areas where one's product offers unique advantages or better performance. A very important factor in product positioning is the ability to clearly communicate the value of the product so that the target customer understands that it is the right product for them and that it is a product that is appropriate for their market segment.

Another reason why it is essential to position your product correctly is the fact that not all market segments are equal. Each segment will have different ways of perceiving the value offered by the product or service, and as a result, the competitive advantage for the company will be closely tied to its ability to differentiate itself on the basis of these key characteristics and the exploitation of strengths that are not replicable or easily attainable by competitors.

The positioning of Softbotica, as already mentioned in the previous chapter, clearly stands out from most of its competitors and focuses on the market segment least served by other companies that offer this type of service. Softbotica's positioning is focused on small-medium enterprises and the agricultural sector while most of its competitors offer very complex, expensive and structured solutions. The platform proposed by Softbotica is a more accessible, adaptable, flexible solution and capable of responding to the needs of companies with limited resources or even companies that do not need to have a very complex system but just need a system for data collection and energy management that performs basic functions.

The decision of what Softbotica's positioning would be was made based on three key factors:

- **Affordability:** Unlike competitor platforms, Softbotica offers an affordable solution that can be implemented incrementally by any type of company, making the system

attractive to companies that want to have cutting-edge technology without having to purchase and install a system with a very complex infrastructure.

- Optimized user experience: Softbotica has focused heavily on the simplicity and intuitiveness of its user interface, allowing a greater number of people to use the platform without the support of IT consultants. Many small companies do not have IT teams that can be trained to be able to use very complex systems.

Customers can easily interact with their machines thanks to the intuitive interface and can view and analyze their data without the need for specific training.

- Adaptability to multiple sectors and measurements: The last distinctive aspect of Softbotica is the ability to differentiate both in multiple sectors such as small and medium-sized businesses and the agricultural sector, and on the type of measurements. Softbotica does not only offer a system for data collection for energy optimization but also offers the possibility to measure other types of data such as temperatures, humidity and power.

In addition to these aspects, Softbotica also offers continuous support and training to its customers by being close to them where and when it is needed.

This approach aimed at small and medium-sized businesses and the agricultural sector focused on the simplicity and accessibility of the product differentiates Softbotica in a competitive market by conquering a well-defined niche of customers.

4. PRODUCT DESIGN: TECHNOLOGY AND SYSTEM ARCHITECTURE– ROSATELLO’S CASE

4.1 Architecture of the system

4.1.1 Technical components of the system

As has been shown in previous chapters, the system is designed to collect data from various devices and sensors, transmit it to a cloud server, and display it on a dashboard. A detailed description of all components and their function within the system will be made in this chapter.

A representation of the system components and how they communicate to exchange data during system operation is shown in Figure 4.1.

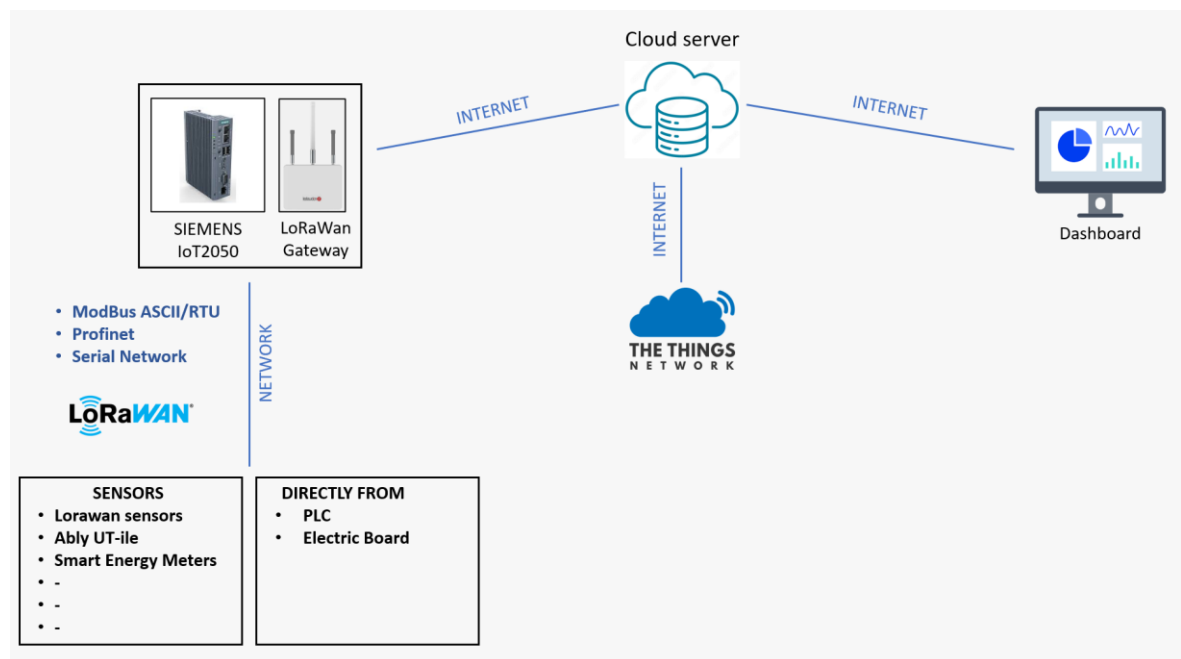


Figure 4.1- Representation of the system components

The system offered to clients is not always the same, some components may change based on the needs and will of the client.

The components that may be different between applications of the same system are the way the data are measured from the external environment, the gateway which will

elaborate and broadcast data to the cloud and the network on which the data will travel from the sensors to the cloud.

The operation of the product can be briefly explained as a system that collects data from sensors applied in the field or directly from industrial machines. The data is then transmitted from the sensing point to gateways that process and transmit the data to the cloud. The data can be transmitted within the system using different networks that depend on the type of sensors used to detect the data.

This overview provides a basic understanding of the product's operations. Each component will be explained in detail to give a comprehensive view of the system.

Sensors and Measurement Devices

Sensors and measurement devices are of course fundamental components in any data monitoring system.

They are used to capture data from the environment or are used to monitor specific parameters. These sensors are the connection between the system and the external environment, in fact, they transform physical phenomena into digital signals that will then be transmitted and processed to reach a final conclusion. Since they are so important and are the first step from which all analysis starts, it is essential that they are accurate and reliable because their quality can directly impact the final outcome of the entire project.

In this project, the data can be detected in two ways, directly from the industrial machines or using sensors that are interfaced with the external environment.

In the situation in which data are detected without using sensors the system is directly connected to a Programmable Logic Controller (PLC) or to an electric board, the system will detect data directly from these components thus not requiring external sensors.

On the other hand, when the data has to be detected from the external environment sensors on the field are needed. Several sensors are suitable for the system as long as they can communicate to one of the data transmission networks that work with the system. The networks that are supported by the system are Modbus, LoRaWAN and Profinet and Serial Network.

The most common sensors used in the system are LoRaWAN sensors, Aply UT-ile and in general Smart Energy Meters but like it has been said many other are suitable for the system.

Here is a more in-depth explanation of those most commonly used:

LoRaWan sensors

LoRaWAN (Long Range Wide Area Network) is a wireless network protocol that is designed to provide secure, reliable, and low-cost communications for IoT applications. LoRaWAN is based on the LoRa physical layer technology which provides long-distance communication between smart devices, gateways, and end-user and the coverage range can be up to 15 km which is much larger compared to Wi-Fi.

LoRaWAN is more economical to deploy compared to cellular IOT technologies (in remote areas) and the LoRaWAN protocol follows Internet of Things (IoT) requirements such as bi-directional communication, end-to-end security, mobility, and also enables localization services.

LoRaWAN sensors are devices that use the LoRaWAN protocol to exchange data with a gateway and its network server. They are used in the IoT for applications such as asset tracking, monitoring environmental conditions, and collecting other types of data from remote locations. The sensors are low power consuming and long-range. These sensors support adaptive data rate control allowing their operation to be flexibly configured to support transmission over both long and short distances efficiently.

Smart Energy Meter

Smart energy meter is an electronic device that measures the most accurate amount of electricity consumed by a residence, business or any electrically powered device. A smart meter is a reliable source for most accurate information of consumed energy that reduces the chance of error in the existing billing system to minimal, voltage levels, current, and power factor. Smart meters communicate the information to the consumer for greater clarity of consumption behavior, and electricity suppliers for system monitoring and customer billing. Smart meters typically record energy near real time, and report regularly, short intervals throughout the day. A smart meter appears to be

very similar to a traditional electricity, gas, or water meter located in a residence or business.

The difference between the two types is that smart meter's record consumption in intervals of an hour or less.

Communication Networks

Once the data are detected from the sensors, PLC or Electric Board they have to be transmitted to the system gateway before being sent to the cloud.

There are four networks that can be used to send data to the gateway, these networks are Modbus, Profinet, LoRaWAN and serial network. The sensors have to support at least one of these networks otherwise it would not be possible to have efficient communication between sensors and gateways.

In each application, only one of these networks is used depending on the sensor or detecting method used to bring the data into the system.

Communication networks provide the infrastructure that enables the transfer of data between different components of the system.

To enable the transfer of data these networks include various communication protocols and other elements that facilitate the flow of data throughout the system and these networks ensure that data and information are transmitted efficiently despite physical distance. There are various elements that must be chosen when using a communication network that depend on the specific requirements of the application.

The following descriptions will provide a more detailed analysis of the networks that can be used in application of the system.

Modbus

Modbus is a data communication protocol that is based on a request-response model. It is used for transmitting information between devices that are connected to buses or networks over serial lines or Ethernet and, increasingly, using wireless.

Modbus is popular because it is open source (available for public use and modification), simple to use, and used everywhere, making it a reliable solution for transferring discrete or analog I/O and register data between control devices.

The communication speed is moderate, and its limited data rate and relatively short communication range make it less suitable for complex tasks.

Profinet

Profinet is a protocol that enables real-time communication between industrial devices such as programmable logic controllers (PLCs) and sensors. It offers a high-speed and reliable connection, making it ideal for industrial automation applications.

Profinet is based on Ethernet technology, making use of standard Ethernet infrastructure for communication.

Profinet uses a cascading real-time concept. The concept of cascading real-time refers to the ability of devices or network components to pass real-time data through a series of interconnected nodes or devices while maintaining strict timing requirements.

The key strength of Profinet is its ability to foster rapid and reliable exchange of data, which is why it is primarily used in industrial automation use cases.

LoRaWAN network

As explained before, LoRaWAN network is a wide-area network designed specifically for wireless communications, and it is particularly suitable for transmitting small size payloads (like sensors data) over long distances.

LoRa modulation provides a significantly greater communication range with low bandwidths than other competing wireless data transmission technologies. The following figure 4.2 shows some access technologies that can be used for wireless data transmission and their expected transmission ranges vs. bandwidth.

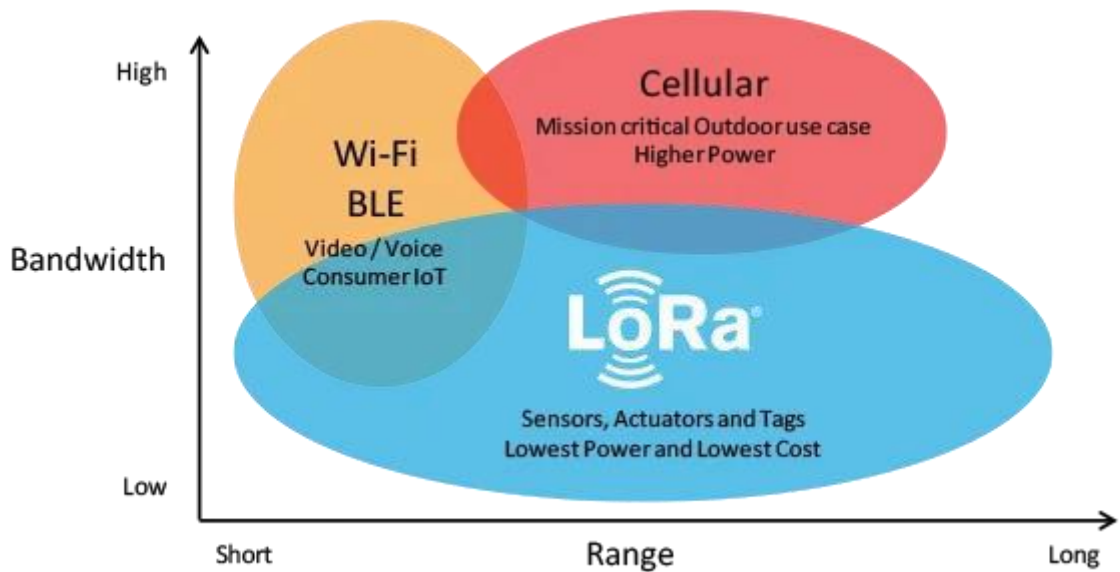


Figure 4.2-Representation of the characteristics of the LoRaWAN network

Serial Network

Serial communication is one of the simplest and most established methods for data transfer used in industrial settings. It is the process of sending data one bit at a time, sequentially, over a communication channel or computer bus. This is in contrast to parallel communication, where bits are sent as a whole, on a link with several parallel channels.

There are several serial communication standards, but the two most widely recognized are RS-422 and RS-485, which can transmit data using point-to-point or multi-point architecture for distances up to 15 meters and 1.2 kilometers, respectively.

Serial communication offers simplicity and reliability, but it operates at lower speed compared to the other communication networks.

Data Acquisition Devices

Data acquisition devices serve as an intermediary between the sensors in the field and the central data processing system. These devices perform an aggregation function between data collected from different sensors.

Sometimes, if necessary, they also perform pre-processing and initial filtering of the sensed data and convert the data to be compatible with the downstream components.

They are equipped with interfaces and protocols that facilitate the collection of data and prepare it for transmission to a higher-level system such as the cloud server.

Thus, their main task is to make sure the data collected is accurate and act as a bridge between the sensors in the field and the central data management system.

Even in this section of the system, there are several alternative components that can be used depending on the desired characteristics, the sensors that have been used and the network coverage availability.

The first possibility is to use a SIEMENS SIMATIC IoT2050 to recover data. This option is available when there is a Modbus, Profinet or serial communication, with these connections the IoT2050 is able to send data to the cloud.

When the LoRaWAN sensors are installed on the field, and they are used to detect data on the field the system could work also without the IoT2050 because it could be substituted by an Edge PC.

In the situation in which there is not a LoRaWAN network connection available, it needs to be installed a LoRaWAN gateway to communicate between the LoRaWAN sensors and the cloud. On the other hand, when the LoRaWAN network is available, since it is a free network, any gateway will be fine for the functionality of the system, even the ones installed by third parties.

SIEMENS SIMATIC IoT2050

The Siemens SIMATIC IoT2050 is a versatile IoT gateway designed for industrial applications. It facilitates the acquisition, processing, and transfer of data directly within production environments.

The smart IoT gateway is easy to acquire, process, harmonize, and save data from multiple sources and then pass it on to a local or cloud-based system.

LoRaWAN Gateway

The LoRaWAN Gateway is a device used to provide LoRaWAN coverage, similar to a cellular network, that allows LoRaWAN devices to communicate with the server and their owner's application. Simply speaking, it acts as the bridge between the physical world and the virtual world. The gateway receives the data from the LoRaWAN devices

and then forwards it to the network server, which stores it and distributes it to the applications as needed.

Another important component of the system is The Things Network (TTN) that is used only when the LoRaWan network and sensors are used.

The sensors send data using LoRaWAN technology to an antenna with its gateway. The gateway, via connection, forwards it to TTN.

The Things Network is a server that collects data coming from the LoRaWAN gateway and sends them to the cloud where the database for the data collection is.

Thanks to the existing infrastructure TTN allows us to avoid the costs and the complexity due to the installation and maintenance of private gateway.

The forwarding of data to the cloud is made using the API interface and it allows also the integration with other applications.

Storage Infrastructure

Cloud Server

The cloud is an essential component for the system because it allows us to handle, store and analyze the data that has been collected from the sensors from the field.

On clouds, data are centralized and filed in a secure way and the most important thing is that they can be easily accessible anytime.

In addition, the cloud offers the ability to scale because of its huge data management capabilities, allowing the system to grow and adapt to future data volumes without having to invest in local infrastructure or hardware.

Usually, all the data of the customers are stored in the cloud but if, for any reason, a customer wants his data saved in a local system it is possible to do so. To save the data in a local system it is necessary to have some additional instrumentation and a computer where to image the data and on which to have the acquisition services.

4.1.2 The Dashboard

The data visualization dashboard is the most important element for the end user since it is the part of the system on which data are displayed, and control and optimization analyses are done.

The dashboard has been fully internally developed by Softbotica and the idea behind it was to have a user-friendly and easy to use platform to allow all the customers to use it without the intervention of a software expert.

The website has been developed using **Angular** framework and will be hosted on the same server as the data.

The goal of the dashboard is to have different graphs and representations to visualize the data detected from the field.

Personal Profile

Each client has his or her own login with a username and password so that he or she can access the platform and view only his or her own data.

Figure 4.3 shows the platform login page.



Figure 4.3- Platform login page of Softbotica's system

Once a login is made, one enters the data visualization screen. Figure X shows the platform interface for the data visualization. The platform is fully

customizable so that each customer can adapt the graphs in the way he or she prefers. The customization allows the customer to have an organized dashboard focused on the data they are most interested in. Once the graphs have been placed as the user likes them, it is possible to click on the “Save Dashboard” button. In this way the interface will become the default and every time the user uses the platform, they will have their charts in the foreground.

The configuration will be saved in a table of DB related to active account, ready for future logins.

The disposition and dimension of the graphs can be modified any time with an easy drag and drop system and they can be easily eliminated by dragging them on the bin icon.

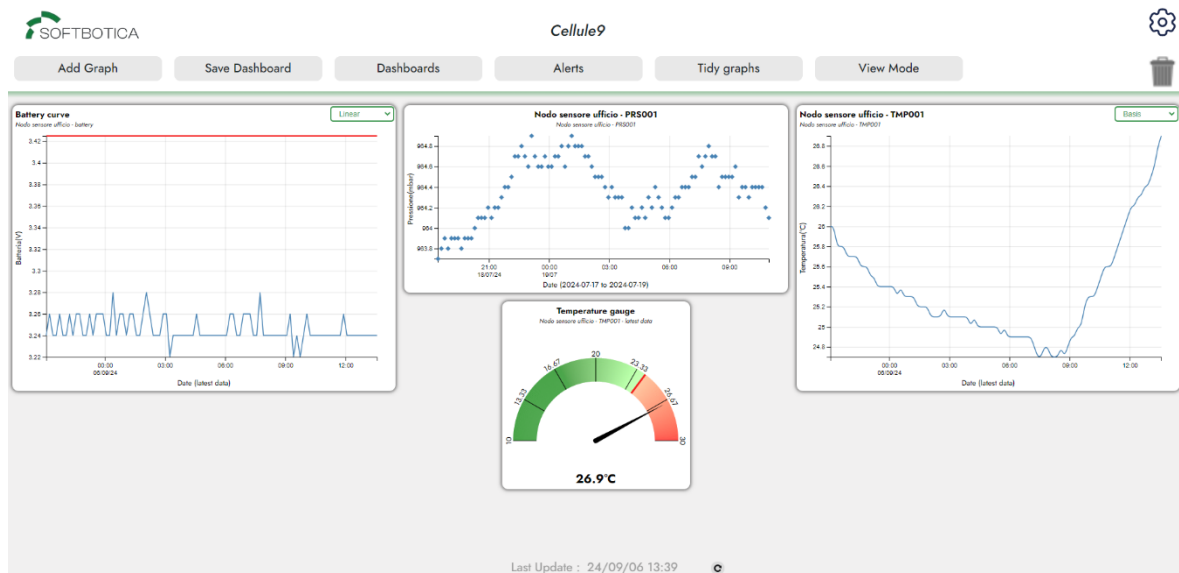


Figure 4.4- Page dedicated to the graph visualization

In the case of a user with more than one machine or device connected to the system it is possible to have more than one different customized dashboard. By clicking on “Dashboard” a side menu will open where there will be a list of all the different dashboards for the different machines connected to the system as shown in figure X. Like before, all the dashboards can be different and fully customizable.

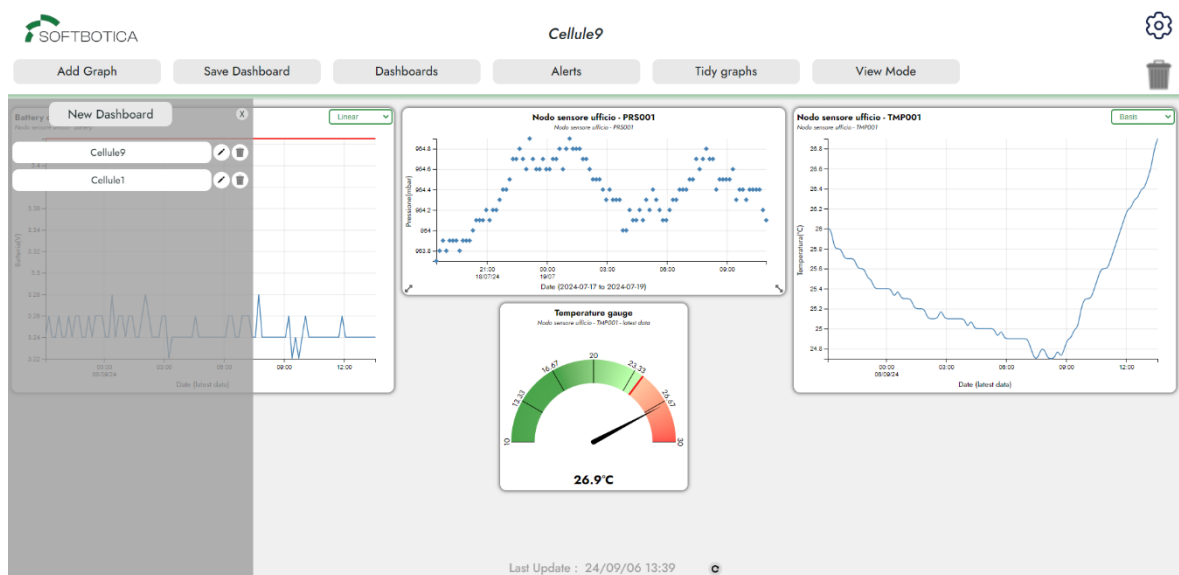


Figure 4.5- Dashboard Customization options

Alarms

One of the most useful features for system users is the alarm functionality. This feature allows users to set both upper and lower limits for measurements. Whenever the sensor reading exceeds these limits, the user is notified. Users can choose to be alerted immediately if urgent intervention is required or receive a less immediate notification if the situation is not critical. In any case, users can observe on the graphs when and at what times of the day the values have exceeded the alerts, enabling them to adapt and act if necessary.

Alarms are extremely valuable because they eliminate the need for users to manually check critical values multiple times a day to ensure they are within normal ranges. Instead, they can simply monitor the dashboard, significantly streamlining the monitoring process.

By clicking on the “alert” button, another side menu will open on which all the alerts are displayed and the ones that have surpassed the limit set by the user will be highlighted as shown in figure 4.6. In the figure the upper limit of the pressure has been surpassed and by clicking on it, it is possible to see when, for how long and by how much.

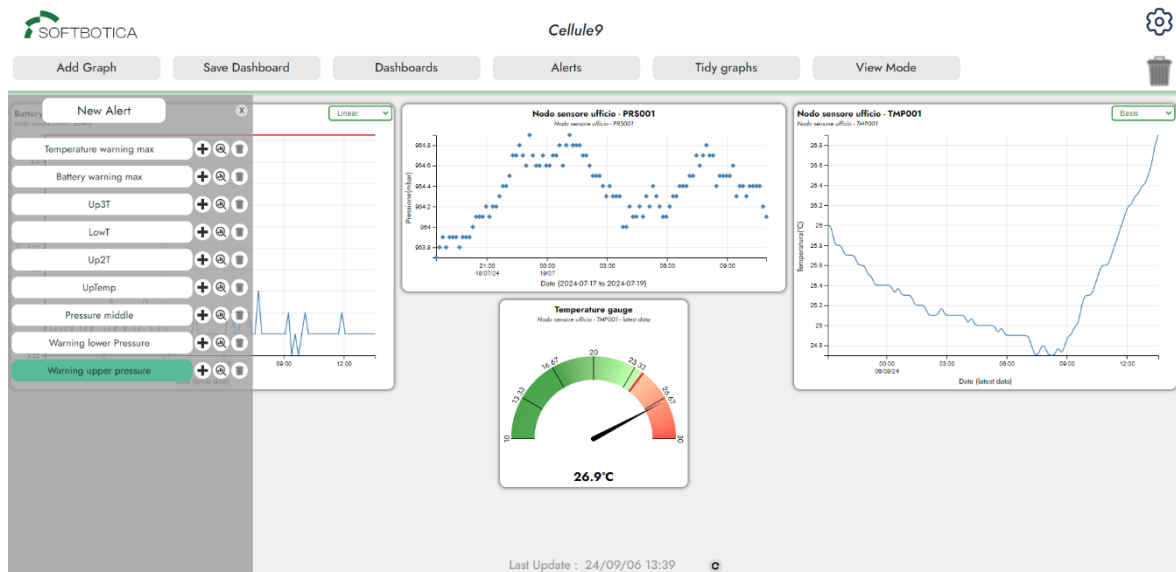


Figure 4.6- Options to set alerts on the graphs

4.2 Make or Buy Decision

The decision to develop the dashboard internally was not the Softbotica initial approach; it was first performed a make or buy analysis to evaluate all the possible options.

A make-or-buy analysis results in a decision of whether particular work can best be accomplished by the project team or needs to be purchased from outside sources. If the decision is to make the item, then the procurement plan may define processes and agreements internal to the organization. A buy decision drives a similar process of reaching agreement with a supplier for the product or services.

Softbotica, during the process of developing the system has been in contact with a company that was offering a ready to use dashboard integrated with AI for data analysis and real time data visualization. There was the possibility of integrating the dashboard provided by the company into the system for data detection.

The company offered a complete package including the dashboard, three months of coaching of one full-time person equivalent to explaining the functionality of the platform and after sale assistance.

The factors that have been analyzed in a make or buy decision are:

- Costs
- Quality of the product
- Time to Market
- Flexibility and Customization
- Scalability
- Long-term Strategic Impact

Costs

Cost is the most significant factor in the make-or-buy decision, certainly not the only one that matters but the one that carries the most weight. Since Softbotica is a small-medium business, cost management is very important, and this is why cost is one of the main factors in this decision.

In-house development of the platform results in significantly less cost than purchasing the platform developed by the external company.

However, the cost savings must be considered along with other factors such as the quality of the product and the possible use of functionality in order to satisfy the end customer.

The cost of having the external solution implemented can be divided into different categories: the cost of the IoT system, the cost of the initial coaching to learn how to use the platform and the cost for additional licenses to use the platform.

Here is a list of the detailed costs for the system and the coaching:

- Demo of the platform: €250
- IoT and AI Assessment Workshop: €3.300
- Initial project IoT and AI platform assistance for three months: 58.800
- Mandatory license for the use of the system: €4.500
- Two optional licenses for the complete use of the system: €25.000 and €30.000

The total cost of outsourcing the system to the external company without buying the optional licenses is around €66.850.

The internal development of the platform is expected to require about 750 working hours, resulting in an approximate cost of €21.000, which also include the sensors used for the testing in the first application case.

Quality of the product

In terms of product quality, the internally developed platform is significantly inferior to what the company offers. The internally developed platform does not have the same advanced features found in the one that one might buy, and artificial intelligence is not integrated.

However, for a less demanding target market with a lower propensity to spend, the inferior quality may not be an obstacle, if balanced with a competitive price.

Time to Market

Another crucial factor is the time to market.

Since the idea of the platform to be developed internally is already well understood by the developers and there are already developed development bases that can be used, the internally developed platform can be launched to market earlier than the external one. Because of the complexity of the external platform, the development company requires a 3-month shadowing by a platform expert, and this goes to delay the start of the project and market entry.

Flexibility and Customization

Both the options offer a good possibility of personalization of the platform. The platform that can be bought is a white label platform. A white label platform is a product developed by one company that is rebranded and sold by another company as if it were their own. The platform is built to be easily customizable, allowing the purchasing company to add their own branding, logos, and sometimes specific features, while the underlying technology remains the same.

The platform developed internally, of course, it is totally customizable, and any change can be made.

Scalability

In-house development allows Softbotica to scale in a gradual and controlled manner, adapting to future needs as they arise, ensuring that the platform can grow along with the evolution of the project. The external platform, even if scalable, could incur additional costs for each new user or extra functionality required, which could significantly increase the total cost in the long run.

Long-term Strategic Impact

The last factor that needs to be analyzed is the long-term strategic impact. Developing the platform in-house offers the huge advantage of intellectual property because the platform would be wholly owned by Softbotica and can always be leveraged by the company.

In contrast, the platform developed by a third party would make Softbotica dependent on vendors for future updates, changes, and functionality, and this could be very influential on Softbotica future strategies.

4.2.1 The Decision

After evaluating the considerations above, weights were assigned to each category and grades were given to each make or buy options within the different categories to determine the final decision.

The weights for the categories were given on a scale from 0 to 100%. The sum of all the weights makes 100% so the highest is the weight of a category, the highest will be the percentage assigned to that category.

The weights that have been assigned are:

Costs-35%: As has been said before, cost is the most significant factor because of the limited monetary resources available. It is important to consider that other than the cost, there will be more costs that may arise, this is why the weights have this value.

Quality of the product-20%: Quality is always a very important factor because it is crucial for the customer to have a well-functioning product equipped with all the functions that

he or she needs. For this project there is the option to adapt the target of the customer based on the level of features provided.

Time to Market-15%: Time to Market is a factor that is not as significant as cost and quality, but it is surely to be considered when taking the final decision for the product.

Flexibility and Customization-10%: Both options allow a good level of customization of the platform, so it is an important factor but it also less differentiating.

Scalability-10%: Also in this category, both options provide a good level of scalability, the difference between them is that in the external solution costs could rise more compared to the internal one.

Long-term Strategic Impact-10%: Owning the platform without doubt has a long-term strategic benefit for the company but in the immediate future costs and quality are more significant categories.

After the weights have been assigned to each category, the scores have been given. While weights represent how important each category is for the final decision, the scores represent how well internal and external development satisfy each category. The grade scale used is 1 to 10, where 10 represents the best possible score given and 1 the worst.

Option 1: Internal Development of the platform

Costs-8: Internal development is cheaper than the external solution, but it still requires many hours of work that translates into a higher cost.

Quality of the product-6: The internally developed solution doesn't have many features and lacks AI integration with the platform. The quality is still enough for the market segment chosen for this product.

Time to market-9: The development of the internal solution was already advanced so the time to market for the solution developed by Softbotica should be short.

Flexibility and Customization-8: The platform is highly customizable, and any change or modification can be made without any limitation.

Scalability-7: The platform developed internally allows scalability. The most difficult thing to manage will be technical aspects of it.

Long-term Strategic Impact-8: Owning the code of the platform is a great advantage looking under a strategic point of view.

Option 2: External Development of the platform

Costs-4: The cost of buying the platform from the external company is very expensive and it would affect the budget of Softbotica a lot.

Quality of the product-10: The external platform is very well developed; it has many great features including AI integration. Additionally, it provides excellent support for any doubts or problems while using the platform. These characteristics make it a very valid option for the project.

Time to market-5: The time to market for the project choosing the external solution will be a little longer because of the time required to start using the platform. It will take time for the contractual agreement and after that there will be three months of support to understand the features of the platform.

Flexibility and Customization-7: The external platform can be customized as liked by Softbotica. The grade is a little lower than the internally developed one because there might be some options that cannot be modified.

Scalability-7: The platform developed externally is scalable but long-term cost could rise significantly as more features and users are added.

Long-term Strategic Impact-4: Buying a platform from a third-party would surely limit the strategic flexibility that Softbotica would have in the future.

After weights and scores have been decided, the weighted scores have been calculated and summed up together to find which is the best solution to adopt.

Category	Weight	Score "Make"	Score "Buy"	Weighted Score "Make"	Weighted score "Buy"
Cost	35%	8	4	2,80	1,40
Quality	20%	6	10	1,20	2,00
Time to Market	15%	8	6	1,20	0,90
Flexibility and Customization	10%	8	7	0,80	0,70
Scalability	10%	7	7	0,70	0,70
Long-term Strategic Impact	10%	8	4	0,80	0,40
TOTAL				7,50	6,10

Table 1-Weights and grades assigned to each factor for the Make or Buy decision

Table 1 shows the comparison between the weighted scores of the internal and external. It is possible to obtain the values in the final row by summing all the weighted scores. The values obtained are 7,50 for internal development and 6,10 for external development.

Based on the scores, internal development seems to be the more advantageous option for the development of the platform of the project.

4.3 First Application-Rosatello's Case

The first application of the project coincides with the testing phase. It will be initiated at a local fruit company. The company in question is Rosatello Good Fruit, which is a post-harvest fruit preservation company.

In this application, an existing system of twelve refrigerators cells controlled by twelve manual electronic controls will be transformed into an IoT system. The infrastructure for data acquisition will be implemented and the data will be saved on the cloud and will be made available and accessible to the customer through the online dashboard.

4.3.1 The Problem

Rosatello GoodFruit is a company that specializes in the storage of large quantities of fruit, often on behalf of third-party clients who rent cold storage rooms to safeguard their own produce. These cold rooms are used to store various types of fruit, each requiring specific temperature conditions to ensure freshness and prevent spoilage. If the temperature inside these storage units is not carefully regulated, certain types of fruit could be damaged, resulting in significant financial losses.

To mitigate the risks associated with potential damage, Rosatello has always relied on insurance policies to cover the value of the fruit stored on-site. This approach helps protect the company from having to reimburse clients in case of temperature-related damage. However, managing the temperature in the cold storage rooms is not an easy task. Rosatello has to personally visit the facility regularly to verify that the temperature inside all 12 storage cells remains within the required temperature range for the different types of fruit. This manual process is both time-consuming and increasingly problematic.

Insurance companies, in particular, have raised concerns about the manual nature of these temperature checks. They worry that, despite Rosatello's efforts, the lack of real-time monitoring increases the likelihood of an oversight, leading to fruit spoilage that they would be liable to cover. As a result, many insurers have started to reconsider or refuse to underwrite Rosatello's policies, viewing the process as too risky due to the lack of continuous and automated monitoring.

In addition to these storage concerns, Rosatello also faces challenges in managing his orchards, particularly during the winter months. When temperatures drop below freezing, it is critical to take immediate action to protect the orchards from frost damage. Similar to the cold storage rooms, Rosatello personally monitors the situation, often having to visit the orchards at inconvenient times, such as during the night or early morning, to confirm if temperatures have fallen below zero. These late-night trips can be disruptive and inefficient, especially since they often involve traveling distances that are not very short just to verify a drop in temperature.

4.3.2 The Solution

Both of the challenges Rosatello currently faces can be efficiently addressed through advanced Energy Management and data collection system. At present, the temperature within each cold storage cell is monitored by Ably UT-ile sensors. These sensors provide critical data, but Rosatello must manually check them in person every day, a process that is both time-consuming and prone to human error. The Ably UT-ile sensors do more than simply measure the temperature; they also track the operational status of the storage cells, indicating whether a cell is actively cooling, in a defrost cycle, or in standby mode. This added functionality helps ensure that Rosatello can maintain optimal conditions for the fruit.

Since the Ably UT-ile devices support the Modbus ASCII/RTU network, it can be used to transmit the data from the sensors to the system. This network efficiently transmits data from the field sensors to a central gateway, and then to the cloud, ensuring that real-time temperature and operational data are always available without the need for on-site checks. Specifically, the Ably UT-ile sensors will be connected via Modbus to a Siemens IOT2050 gateway, which acts as the intermediary, uploading all the collected data to the cloud. From there, Rosatello can access and monitor this data from any location through the platform for data visualization, eliminating the need for frequent in-person visits to the cold storage facility.

In addition to temperature monitoring, we will also install a smart energy meter, which will be an amperometric transformer specifically designed to measure the energy

consumption of each individual storage cell. Initially it will only be installed on one of the twelve cooling cells and then it will be eventually installed on the rest of them. This additional feature was introduced to make the system more comprehensive, enabling Rosatello not only to track temperature data but also to conduct detailed consumption analyses. This will allow him to monitor the energy usage associated with each type of fruit and to optimize energy efficiency across the entire cold storage facility.

In figure 4.7 the full system is shown with the components and network used.

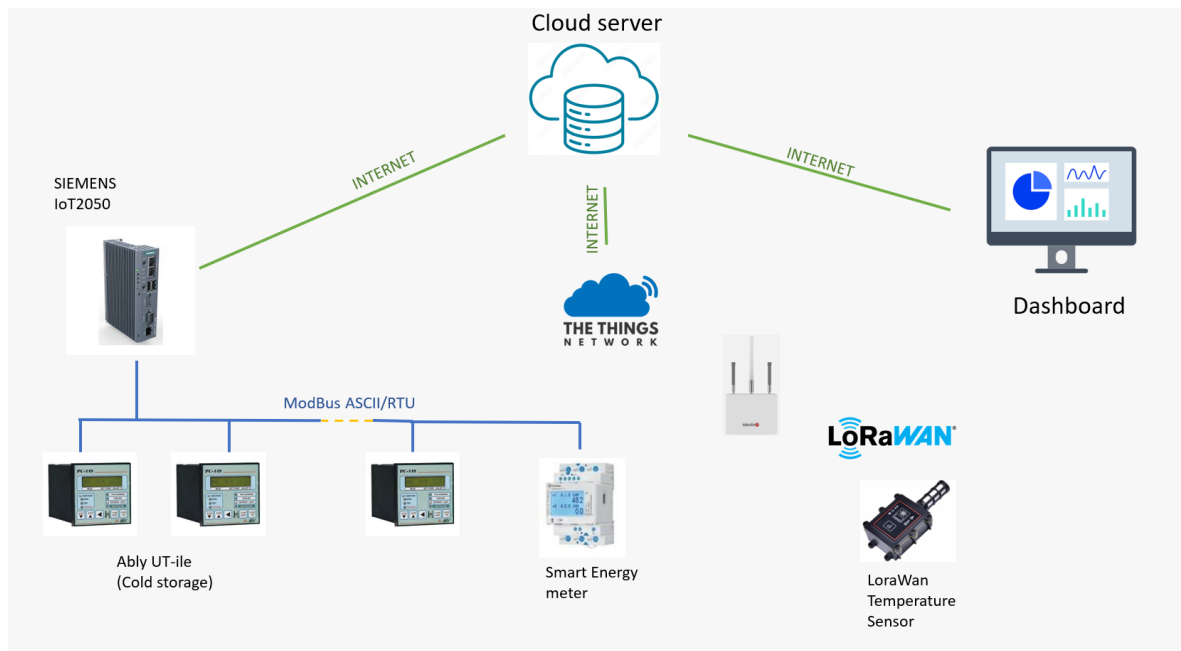


Figure 4.7- Structure of the system used for Rosatello's application

With this integrated solution, Rosatello will gain full control over the storage environment, benefiting from both automated temperature regulation and valuable insights into energy consumption, which will ultimately reduce operational risks and improve efficiency. This complete system addresses both the immediate need for accurate, remote temperature monitoring and the longer-term goal of energy optimization, providing Rosatello with the tools to manage his business more effectively and reliably.

The second issue, related to temperature monitoring in the orchard, will be resolved by using a LoRaWAN sensor that measures both temperature and humidity.

As outlined in the previous chapter, the LoRaWAN sensor can be directly placed in the field, where it communicates with a LoRaWAN gateway to transmit data via the LoRaWAN network. This enables the sensor to send real-time data from the orchard, which is then uploaded to the cloud and visualized on the dashboard.

Beyond simply addressing the immediate need for temperature tracking, this solution offers additional benefits. With the data stored in the cloud, Rosatello will be able to perform in-depth analyses, such as tracking average temperatures over the course of a year or analyzing how many times the temperature has dropped below freezing. This not only ensures timely action when critical thresholds are met but also provides valuable insights for long-term orchard management and decision-making.

Conclusion of the case

This initial application is highly beneficial for the project, as it provides a practical opportunity to test both data and energy monitoring via the Modbus network, as well as temperature monitoring through the LoRaWAN network. This dual implementation allows for a comprehensive evaluation of the system's capabilities, ensuring reliable detection and transmission across both networks.

5. MARKETING STRATEGIES AND GO-TO MARKET

Marketing is the fundamental function for all types of companies, representing the bridge between the products and the customers. Marketing can be defined as the sum of all the activities and strategies used by a company to promote, sell and distribute a product or a service to its target clients. Marketing includes advertising and allows businesses to sell products and services to consumers, other businesses, and organizations. Professionals who work in a corporation's marketing and promotion departments seek to get the attention of key potential audiences through advertising. Promotions are targeted to certain audiences and may involve celebrity endorsements, catchy phrases or slogans, memorable packaging or graphic designs, and overall media exposure. Over the years, the concept of marketing has changed from a sales-focused approach to one that is oriented towards building relationships and long-term customer satisfaction.

5.1 Marketing Plan

The implementation of an effective energy management and data analysis system, like all products and services, requires a well-defined marketing strategy in order to be able to promote the benefits and most distinctive features of the solution and make the solution known to as many companies as possible in the target audience. It is essential to approach potential customers in an appropriate way to avoid burning potential contact with them; to do this effective market strategies are needed that can contribute to educating the market and building trust. The ability to convey the added values of the system and the platform, being able to differentiate yourself and make yourself known to customers are essential factors in acquiring new customers and making yourself known to the market. The marketing strategy must therefore be aligned with the company objectives in order to bring the results in the desired direction.

In the case of Softbotica, the product is aimed at a market in strong growth and evolution. Although there are many competitors on the market, this type of product is not yet very well-known and widespread or in any case similar products are widespread and not complete with all the functions that an energy management and data analysis

system offer. These observations are certainly to be taken into consideration for the formulation of a marketing plan that allows the company to achieve the desired results in the pre-established times.

For the Softbotica project, since it is still in the strategic definition phase, two main options for the platform's marketing plan have emerged based on different but complementary approaches. The two approaches differ mainly in the initial phase of the strategy, that is, the customer base to target. Both strategies are structured in various steps so as to start with a wide range of people all the way down to those directly interested in becoming Softbotica customers. Below they are both illustrated in detail:

5.1.1 Strategy based on demand interception

The first strategy is focused on creating a digital presence using social media campaigns as a communication tool. This approach is based on targeting a market segment that is already somewhat interested in the world of energy and data but without fully knowing whether Softbotica's system would serve them directly and are really possible future Softbotica customers. The goal is to introduce the system to a large number of people and among all of them to be able to convert some of them.

The strategy is based on the following points:

1) Lead generation through digital channels

The idea of this strategy, as mentioned earlier, is to create interaction through social communication channels. The main channels that you are going to use in this strategy are google ads, LinkedIn, Facebook ads and other similar channels. Ads and sponsorships will be created on these platforms targeting companies and individuals who show interest in topics such as energy efficiency, data collection, and energy in general. Using a strategy like this one needs to have a fairly targeted segmentation but, in any case, the number of people reached will be a very large number compared to the people who will actually be interested in the service.

2) Landing page and video presentation

The next step in the marketing campaign is to create a landing page dedicated to the product so that people reached by social ads and interested in the service can find more information about the service and the company. On the landing page, leads interested in the project will find a video presentation of the service that has the task of explaining in a clear and engaging way why relying on Softbotica is the right solution for their company and how it could be useful for optimizing their energy efficiency. The idea is for the video to be something simple and effective because it will have the first real impact with the client, because for all the in-depth information there will be dedicated moments later. In addition to the video, some data about the company or about the private are asked by the people visiting the landing so that Softbotica will have more information about them.

3) Customer Relationship Management (CRM)

The third phase of the strategy is an internal phase that consists of analyzing potential Softbotica customers. The collected leads are inserted into a CRM (customer relationship management) system that allows all information about possible customers to be displayed. Only leads that are on target will move on to the next phase, which consists of the proposal of an initial negotiation.

4) Marketing content creation and call-to-action

After determining among the contacts who have interacted with the Softbotica site those likely to become full-fledged customers, mini-magazines will be sent containing the services and solutions offered by Softbotica. These marketing materials will also include calls to action so that interested customers can contact Softbotica directly to set up an appointment to design the final solution.

5) Sales visits and appointments

In any case, all customers who receive a magazine and marketing material will be contacted and appointments will be made with some of them in which it will be possible to explore the actual situation of the company and propose suitable customized solutions.

5.1.2 Strategy based on databases and direct campaigns

The second possible marketing strategy takes a more proactive and targeted approach. The main difference with the first strategy is the way in which potential customers interested in the project are contacted. In this strategy, advertising and marketing campaigns aim to target a smaller number of people but who are almost certainly interested in the world of energy efficiency and who are in some way in a position with decision-making power within a company. Here are the steps of the campaign in detail:

1) Business List

The first step of the second strategy is to buy contact lists of potential target customers. The idea is to buy a list of about 500 companies belonging to the industrial sector. There are databases that sell this type of list based on the desired criteria, thus receiving a list of target customers. The first way to contact potential clients is to call the people on these lists.

2) Direct Response Campaigns

The second strategy that Softbotica uses to attract the attention of potential customers is the creation of targeted advertising campaigns on local television and radio. On many television platforms, it is possible to air personalized advertisements based on the occupation, interests and geographic region of the person watching the television program.

Obviously, all these campaigns must be carefully planned to reach the right audience and convey clear and effective messages.

Creating advertisements to be broadcast on television is important to create an idea of Softbotica and make it known to as many people as possible so that when people are contacted, they have already heard of the company, and it is not the first time for them.

3) Website & Conversion

As with the previous strategy, Softbotica's goal after contacting potential customers is to have target customers view material on the services offered by Softbotica. After the calls, marketing material will then be sent to potential customers so that they can understand in depth the services offered by the

company. In this case too, communication must be targeted and adapted to the language and priorities of the reference sector.

4) Energy Efficiency & Testimonials

Customers will be offered an energy-efficiency consultancy which consists of an assessment of the company's client systems and consumption in order to quantify the possible savings. For the first customers, these consultations will be done free of charge by Softbotica due to the need to have testimonials from customers. A business that starts from scratch without testimonials will not be seen positively by potential future customers. Once some customers have received the free testimonial and Softbotica has their testimonial, it will also start charging for energy assessment consultancies.

5) Appointment & Sale

The final phase of the strategy will be to set up appointments to define the details of the system and to sell the final service.

5.1.3 Comparison between the strategies

Both strategies analyzed have distinct advantages and challenges. The first strategy that consists in intercepting demand on large numbers offers greater scalability since it offers a very high and extensive potential coverage thanks to the use of online ads that have almost no limits on the number of people reached. The main risk of this strategy is that there is no certainty that the leads that are going to be generated are real target customers. It may happen that many people see the Softbotica ad but that few of them are really interested in this type of service. To increase the number of contacts interested in the service it may be necessary to greatly increase the number of people reached and to do this on platforms such as LinkedIn and Google Ads the cost could increase a lot without guaranteeing a high return.

The second strategy offers a more direct and targeted approach and is the most suitable strategy for a company of the size of Softbotica. The contacts are based on a finite list of local companies and therefore easier for Softbotica to manage. This solution cannot be scaled because once it is finished there will be no more companies to contact without changing the customer target. The second benefit of this strategy is to be able to increase

the reputation of Softbotica through the testimonials of local entrepreneurs who have used the service offered by Softbotica, creating an image of reliability and competence and in the future, it will be possible to increase the customer base.

Net of these considerations, the strategy adopted will be the second one, that is, the one that exploits the list of local customers for the advantages listed above.

6. CONCLUSION

The aim of the thesis was to fully analyze the feasibility of an Energy management and data collection project for a small Software company and identify the possible obstacles that could have appeared during this process.

The candidate's work began with the identification of the risks and challenges of the project and then followed by a study of the market and competitors. The market study was done starting from the energy management sector in order to identify the characteristics and opportunities of the sector and then identify the innovations and trends of the sector that were useful to the candidate to understand in which direction the reference sector was moving. The analysis of the competitors was to have a clear idea of who the players were in the sector and what solutions they brought to the market. A SWOT analysis was also carried out useful for understanding the current positioning, potential growth areas, and the various factors impacting the market's future prospects. Finally, what should have become the differentiation strategies of Softbotica to enter the market in a competitive way were thought.

The second phase of the project study was the product planning phase. This phase has been instrumental in gaining a deeper understanding of customer needs and product positioning, both of which are crucial for developing targeted marketing strategies and defining a value proposition that not only meets but exceeds customer expectations. These insights enable the identification of market opportunities, the optimization of offerings, and the enhancement of the overall customer experience, thereby ensuring a sustainable competitive advantage in the long run.

The work on the project at Softbotica continued with the Product design phase where the system was developed following the strategies and criteria previously decided to ensure that the service could be competitive on the market. The candidate's work in this phase was crucial in the make or buy decision of the platform used for the project. The comparison was very important to limit the development costs of the system.

The system will initially be implemented at a company specializing in post-harvest fruit preservation. This first application will give Softbotica the opportunity to identify and

correct any errors or imperfections in the system, thus allowing continuous improvement and optimization of the service for subsequent customers.

At the end of the internship period, the team dedicated an important phase to the marketing analysis of the project. During this process, two alternative marketing strategies were developed that could be used to disseminate the service. These strategies were carefully compared to identify which one was more effective in reaching the target audience. The analysis highlighted that the preferable strategy seems to be the one that focuses on the creation of lists of local entrepreneurs, rather than the one that aims to expand the service to a wider market. This choice is motivated by the possibility of establishing stronger and more direct relationships with potential customers, favoring an immediate understanding of their specific needs and improving penetration in the local market.

In conclusion, the internship path represented an important opportunity for learning and professional growth. Each phase brought a different cognitive contribution to the candidate. The complexity and relevance of the energy management and data collection project not only allowed the candidate to apply theoretical knowledge in a practical context, but also highlighted the importance of a systematic and strategic approach in project management. Each phase brought a different cognitive contribution to the candidate:

Through the in-depth analysis of the market and competition, it was possible not only to identify the challenges to be faced, but also the opportunities to be seized to ensure effective positioning in the sector.

The product design phase demonstrated how crucial it is to fully understand customer needs, as well as the importance of strategic product design to ensure competitiveness in the market.

Finally, the marketing analysis highlighted the importance of establishing strong and direct relationships with local customers, underlining how this approach can facilitate an immediate understanding of their needs and improve market penetration.

In summary, the project has demonstrated how careful planning, and strategic analysis can lead to significant results, not only for Softbotica, but also for the energy management industry as a whole.

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Ringraziamenti

I ringraziamenti sono dedicati a tutte le persone che mi hanno accompagnato in questo percorso e mi hanno permesso di raggiungere questo traguardo che conclude un capitolo della mia vita.

Il primo ringraziamento va alla Softbotica e in particolare a Massimo Giordana per avermi affiancato durante il mio periodo di tirocinio e per aver condiviso un periodo di applicazione pratica delle conoscenze imparate durante il mio percorso di studi.

Un ringraziamento al mio relatore, Marco Cantamessa, per avermi supportato durante la stesura della tesi.

Ringrazio i miei genitori e mia sorella per avermi sempre supportato durante il periodo universitario e per avermi appoggiato in tutte le scelte permettendomi di fare tutto ciò che ho sempre voluto.

Un ringraziamento speciale va a Virginia per avermi accompagnato in questo percorso. Mi ha permesso di avere qualcuno su cui contare sempre e mi ha sempre offerto la possibilità di confrontarmi e condividere momenti belli e brutti nonostante la distanza.

Grazie a tutti coloro che mi hanno permesso di passare anni bellissimi della mia vita fino ad oggi. I Coinquilini, Pinerolesi, Torinesi e vari altri sono stati sicuramente essenziali per me in questo percorso e vi ringrazio con tutto il cuore per i momenti indimenticabili passati insieme.

