NOVA SCHOOL OF SCIENCE & TECHNOLOGY

DEPARTAMENT OF
ELECTRICAL AND COMPUTER ENGINEERING

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BSc in Electrical and Computer Engineering

PORTAL FOR SUBMITTING TRAVEL EXPENSE REPORTS

DIGITAL TRANSFORMATION, ON SMALL AND MEDIUM ENTERPRISES

MASTER IN ELECTRICAL AND COMPUTER ENGINEERING

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Portal For Submitting Travel Expense Reports

À minha esposa, aos meus pais, familiares e amigos.

AGRADECIMENTOS

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“You cannot teach a man anything; you can only help him discover it in himself.” (Galileo).

ABSTRACT

Small and medium enterprises (SMEs) have great difficulties in making the digital leap. This leads to many enterprises doing unnecessary manual work that could be easily automated for example, when an employee goes on a business trip and must keep the receipts of the expenses he or she made for future reimbursement. This is a hassle for both because the employee must be very careful not to lose any invoices and will have to go in person to deliver them to Human Resources (HR) who will be left with many receipts easy to lose.

All large enterprises have a digital platform capable of simplifying this process. Some have created their own, others rent the service. Although there is already a solution for these SMEs on the market, it is not appropriable for most of them because it is not economically feasible.

This thesis proposes a simple and open source solution to help the digital transition of these enterprises. People with lack of digital skills or people resistant to them will find it easy to adapt, given the friendly interface and its simplicity. It is also clear that training will be needed for those enterprises that decide to join this new platform.

In the future, small and medium-sized enterprises will be able to automate parts of their work to be more efficient and productive.

Keywords: Expenses Management, Digital Transition, Digital Transformation

RESUMO

Nas pequenas e médias empresas é muito difícil fazer o salto digital. Nos dias de hoje existem inúmeras empresas que fazem trabalho desnecessário à mão que poderia ser facilmente automatizado, como por exemplo, quando um empregado vai em viagem de trabalho e tem de guardar os recibos das despesas que fez para futuramente ser reembolsado. Isto traz desvantagens para ambos: o empregado tem de ter muito cuidado para não perder nenhuma fatura tendo que as ir presencialmente entregar aos recursos humanos e estes irão ficar com muitos recibos fáceis de perder.

Todas as grandes empresas têm uma plataforma digital capaz de simplificar este processo. Umas criaram o seu próprio, outras alugam esse serviço. Apesar de no mercado já haver solução para estas pequenas e medias empresas, estas não estão alcançáveis por maior parte delas, devido ao facto de não ser economicamente viável.

Esta dissertação propõe uma solução simples e grátis para ajudar a transição digital destas empresas. Pessoas pouco instruídas na área das tecnologias ou pessoas resistentes a estas, terão facilidade a adaptar-se dada a interface amigável e sua simplicidade. É também previsível uma formação para estas empresas que decidam aderir a esta nova plataforma.

No futuro, pequenas e médias empresas, terão possibilidade de automatizar partes do trabalho para que sejam mais eficientes e produtivas.

Palavras chave: Transformação, Digital, PME

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ACRONYMS

AP	Accounts Payable
CQL	Cypher Query Language
DBA	Database Administrator
DBMS	Database Management System
DDL	Data Definition Language
EU	European Union
HR	Human Resources
HTML	Hypertext Markup Language
IBM	International Business Machines
IDE	Integrated Development Environment
NoSQL	Not Only SQL
PCI	Payment Card Industry
RDBMS	Relational Database Management Servers
RIS3	Research and Innovation Strategies for Smart Specialisation
SAP	Systems Applications and Products
SMEs	Small and Medium Enterprises
SQL	Structured Query Language

1

INTRODUCTION

This chapter presents an introduction to the dissertation.

The title of the thesis in question is "Portal for submitting travel expenses" and its main objective is to help the digital transition to digital communication between employee and employer regarding topics related to transportation costs.

The vast majority of enterprises are SMEs, and most of them still do a lot of their administrative or bureaucratic processes manually, *i.e.*, they use paper-based processes instead of computer-based processes. This way of working is clearly inefficient, consuming more resources than necessary (namely paper and trees), increasing pollution and waste, wasting more time, and making tracking more inefficient and time-consuming (Onu & Mbohwa, 2019).

The processing of travel expenses is the case study that this thesis wants to address. When employees spend their own money on a business trip, the enterprise only refunds them if the employee brings the physical receipt to the enterprise, and the receipt is validated by another employee that has this task as his job, which usually belongs to the Human Resources (HR) department, as demonstrated in Figure 1.1. This creates a lot of extra work for both parties involved, and can be a trouble making to employees and for the HR department. The employee must hold on to each receipt and the HR department spends a lot of time tracking and storing these documents. In this process, it is quite common for documents to be lost or misplaced.

This thesis is proposing a platform to mitigate the downsides of reporting travel expenses

Figure 1.1 - Reporting travel expenses process (ClipArtMax, 2022)

by hand. This platform will record the expenditure made and store it for later approval by HR. This will prevent lost receipts, the hassle to go personally deliver them, and make it much easier

for HR to control all the receipts. Having the enterprise expenses in one platform is, in itself, a big benefit.

1.1 Motivation for this thesis

The vast majority of enterprises, have their employees keep the receipts when spending on business travel so afterwards they can give them to HR, where they will validate or not all the receipts. Only then can the employee receive confirmation that the expenses are eligible and be reimbursed. This manual process is very common in Portugal, as Figure1.2 shows that less than twenty percent of enterprises use digital invoices. This fact makes a great opportunity to invest in the digitalization of this process.

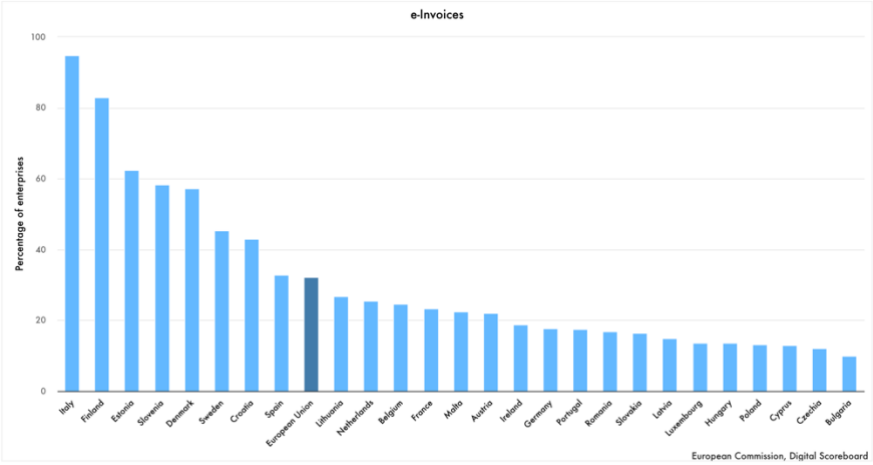

Figure 1.2 - Percentage of enterprises using digital invoices by country (European Commission, 2021)

Enterprises where there are few needs to report expenses (*e.g.* if an employee only needs to travel to another city for a meeting once a week) aren't going to spend money on a digital platform, as it wouldn't be economically profitable and they would rather choose to process the reports manually. This is the case of a lot of SMEs, where they have travel expenses but not so much that it pays to pay for a digital system. Note that, even if it's economically viable to use it, considering the big organizational leap that enterprises must take to introduce this new system is crucial.

However, there are clear advantages, in today's market to digitize all processes including reporting of travel expenses. At the moment, the existing options are only viable for large enterprises that move a large volume of data, as the existing digital platforms have very high costs. These are unjustifiable for small and medium sized enterprises.

The development of a digital platform capable of helping the efficiency (Chen et al., 2016) of SME is the main goal of this thesis. This platform is planned to be open source so that SMEs with few employees can afford to use it, although a business case could be made for supporting this platform with consulting regarding its implementation and maintenance. With this platform employees no longer have to keep track of all the receipts and HR isn't overwhelmed by paper. With this, HR can have every travel expense in one platform, which makes it easier to improve the enterprise organization.

Yet, the fact is that, as stated before, many enterprises, mainly SMEs, do not have their processes digitized and resist doing so.

There have been many studies regarding the adoption of information technologies, and many theories have been developed in this area. One of the seminal papers in this area is (Davis, 1989) that proposes the technology acceptance model (TAM), further developed in another highly cited paper by (Venkatesh et al., 2003).

According to the European Union (EU) Commission, (Commission, 2015) a SME is defined as an enterprise employing fewer than 250 persons, with a total turnover not exceeding € 50 million and with an annual balance sheet total not exceeding €43 million. The Table 1.1 is divided in four columns, the Total column shows that the biggest portion of enterprises are SME, as only 0,1% are big enterprises, as a result, they are the primary demographic targeted for digitalization (Müller et al., 2018). SMEs are the backbone of the 'non-financial business economy' in Portugal. They account for over two thirds (68.4%) of overall value added and over three quarters (78.0%) of employment, against an average of 56.8% and 66.4%, respectively, in the EU as a whole.

Table 1.1 - Percentage of small and medium enterprises in Portugal (Portdata, 2022)

	SME			
Years	Total	Micro	Small	Medium
2015	99,9	96,2	3,2	0,5
2016	99,9	96,2	3,2	0,5
2017	99,9	96,2	3,2	0,5
2018	99,9	96,1	3,3	0,5
2019	99,9	96,0	3,3	0,5
2020	99,9	96,0	3,3	0,5

One of the know factor delaying the implementation of digital transformation is the small number of employees in SMEs, and since, as stated, most enterprises are SMEs and so this is a far reaching problem. When there aren't many people in a firm, there aren't many visible benefits for changing to digital, mainly because it's a difficult process (Schwertner, 2017) and requiring specialized manpower to reengineer processes and write or adapt software. Numerous establishments are family businesses that have been doing the same thing for a long time and see digitalization has a hassle that brings no clear advantages. It is true that they have improved but never had to change the roots of the workflow.

The enterprises are better at "sensing" than "seizing", i.e., finding opportunities to growth with digitalization but unable to properly profiting from it.(North et al., 2020)

Studies show that there is a direct correlation between communication, competency/value measurement, governance, partnership, architecture and scope, and skills with the development of the IT department, indicating that improving the digital area of the enterprise leads to an overall contribution in making a more robust enterprise (Gutierrez et al., 2009).

SMEs can be viewed from two different angles. On one hand, SMEs are seen as financially constrained, conservative, inflexible, and averse to innovation. On the other hand, SMEs are seen as dynamic, flexible, and agile organizations, giving them a competitive advantage (Azevedo & Almeida, 2021).

Given the volume of a small enterprise there is no need to have someone focused on the technological side or there is not even the money for that. This lack of digital work will hinder the digital transition of the enterprise.

There are many opinions and strategist on how to help in this transformation (Hönigsberg & Dinter, 2019). One of them being the individual modules. Flexible enterprises demand flexible systems to implement and adapt to every situation. One way is to create small modules

capable of performing one or more task, they must be easily connected together for a rapid expansion. This way instead of making a big leap, make smaller ones and be more personalized. In this case this thesis will work on a module capable of submitting travel expenses, with a concrete scenario in mind.

1.1.1 Concrete motivation scenario

I have the privilege of knowing personally a rather successful small enterprise that is an interesting case study of how a small Portuguese business works. Firstly, there is an older person, beyond retirement age, who still goes there every day with the mindset to control most of the daily progress that has been made. Even though the younger workers want to step up digitally or to automate something, the owner refuses as a consequence of lack of trust in the new platforms as is described in literature (Alavi & Habel, 2021; Mattila et al., 2021).

Then there are the employees, some of which only have basic education. When introduced to new technology there is a significant push back. Other simply don't like new technologies, preferring to stick with what they know. Continuing to prefer the traditional method to submit the expenses, with paper or by Excel sheet form. As we all know, the unknown is scary.

Frequently some stay up all night sorting out data, with the material shown in Figure 1.3, which could be prevented if more automatizations were in place.

Many SMEs, when COVID-19 hit, had many difficulties in overcoming the digital step, as a result of not knowing how to use the cloud, machine learning, big data. Many didn't even know how to use a communication interface, like zoom, properly. (Nathan Calabrese, 2020)

Figure 1.3 - Material for expenses management (iStock, 2022)

1.2 Work methodology

The development of this thesis needs to follow important steps to ensure an efficient scientific investigation and experimentation. The information here presented is based on the recommendation of the thesis co-adviser and classical scientific methodology bibliography (Camarinha-Matos, 2012b, 2012a; Chinneck, 1999; Nordgren, 2004).

The main steps for this dissertation are taken from the mentioned source and are the following:

1. **Research Questions** – Enigmas that motivate the author to seek answers and information about an area of knowledge, to improve an existing solution, solve a particular issue, or find some new aspects.

2. **Context Observations** – Includes an overview of everything that is known about the specific topic.
3. **Hypothesis** – Typically in this format "Is it possible …, if so, …", where the "Is it possible" is the theoretical part of the thesis and the "if so" is the practical result of the thesis.
4. **Design Experiment** – Where the experiment was mould in order to test it. Takes into account several aspects such as control, variables, observation, and methods of data collecting. In the end, it may include the assembly of a prototype to be tested.
5. **Test Hypothesis (Data Collection**) – In this step, the hypothesis and prototype are tested and the data is collected from the experiment.
6. **Analyse Results** – The data is presented as a statement that explains or interprets it. This can result in a positive answer to the formulated hypothesis, or it can prove it wrong. In the latter case, a further different explanation should be made, or the research question must be reconsidered. In both cases, positive or negative results are considered helpful for the scientific community.
7. **Thesis Writing and Publishing** – The last phase incorporates the explanation and conclusion of the entire work, in this case, in a dissertation.

1.3 Research questions

The research questions will be answered at the end of this thesis.

Q1 – Is it possible to submit expenses through a graphical interface in order to make the process easier and simpler for the employee?

Q2 – Is it possible to organize the travel expenses and simplify the validation process of the enterprise by merging all of the employees expenses digitally?

Q3 – Is it possible to create an affordable and user friendly platform enough to help SME make the digitally transformation?

1.4 Hypothesis and approach

Regarding the researched information and the research question, made in the first chapter, this thesis follows the formulated hypothesis:

"It is possible to create a free and user-friendly portal for submitting travel expenses, if so, we can start to help SMEs to digital transform their operation"

This remark is going to be put to the test, implemented, and validated during the evolution of this thesis. The dissemination plan is provided in the next subsection and the results of the process are going to be presented in the resulting master's thesis and discussed in the final presentation.

1.5 Dissertation outline

One of the most important phases in the writing process is the dissertation outline. It facilitates the planning and organisation of your ideas and can serve as a guide for selecting the type of research you want to conduct.

The dissertation outline should contain an overview of what is planned to discuss in the dissertation. After that it can present the thesis statement which will be followed by a list of topics or subtopics for each chapter. Each topic or subtopic needs to have its own paragraph as well as a summary at the end of each chapter.

This dissertation has 7 chapters, each one plays a function for the cohesion of the dissertation. All of them start in an odd page as the etiquette demands. This is to be easily printable in a book.

The chapters are as follows: 1) Introduction; 2) State of the art; 3) Concept and Architecture; 4) Implementation; 5) Hypotheses Testing and Validation; 6) Real Test; 7) Conclusion.

Explaining each of these chapters, the dissertation must have:

1) Introduction – Provides the reader with a general overview of the topic and what they can expect to find in the rest of the document. It also helps to list the chapters and their topics.
   This introduction talks about the motivation for this thesis, the work methodology, the research questions, the hypothesis and approach and of course this subchapter the dissertation outline.
2) State of the art – Does a literature review on the relevant sources published so far. In this dissertation digital transformation is a big theme, and in section 2.1.3 it states the benefits of it and how it applies to the expense's reports. In this chapter is explained in detail how travel expenses work and the different ways to do it.
   The penultimate section in this chapter compares existing software's for submitting travel expenses. One of the conclusions is that they are not suited for SMEs.
   At the end is a review on different database types and servers. There is relational and non-relation databases, for this dissertation a relational database was chosen.
3) Concept and Architecture – Starts to describe an overview of the work done in this dissertation. With a depiction of the general architecture of the platform where the database, the backend and the frontend work together to make this platform. Then a more specific subsection about the database architecture and the backend architecture. The architecture of the database can be defined as the way in which data are stored and organized in a database. The backend architecture, on the other hand, refers to the way in which data are stored and organized on the server side.
4) Implementation – Refers to how it was implemented the platform from the description of each function to the conventions used in the code to make it more understandable.
   This chapter also includes a proof-of-concept that, despite the platform's limited functionality, demonstrates the validity of the idea.
5) Hypotheses Testing and Validation – One of the most important chapters where the hypotheses is tested to reach conclusions. For this, first was created a application scenario, to provide a context for the user to understand the problem and how it can be solved. This was divided in two subsection one for explain the steps the employee will take and another similar for the HR.

After a thorough explanation of the application scenario, the test started to prove if it was possible to create what was claimed in the introduction. A conclusion to the test is then reached in hypotheses validation. The aim of this section is to provide a brief overview of the process of hypothesis validation. This process is used to test the validity of a hypothesis, and to discuss the results and their implications.

6) Real Test – I went personally to a small enterprise and test the platform created in this dissertation. A small record of the experiment is written, follow by the opinion of the employee and the HR of that store.
7) Conclusion – This chapter contains the key points of the dissertation. It also contains a small view of the all dissertation, and some points it could be better and how to improve in the future. Finalizing with a phrase about the take way from the dissertation and how the implementation has contributed.

2

STATE OF THE ART

In July of 2020, there was a government organized conference in Lisbon, named Research and Innovation Strategies for Smart Specialisation (RIS3) with the participation of 260 experts from different areas. This conference was oriented towards creating a plan for the next 6 years (2021-2027) supporting research and innovation in Portugal, focusing on some key aspects to prepare for the future. First, they noted a dearth in technology infrastructure and then set two goals: to boost innovation and differentiation; and to take advantage of internationalization opportunities (Bunting, 2020).

The conference prepared several working teams, each team worked on one of six domains: Agroalimentary, Health, Tourism, Mobility, Sea and Creative. Digital Transformation wasn't one of them because it's transversal to all of them (as is higher education), meaning that it's fundamental for all research and innovation. In fact, there was a team of researchers only working on digital transformation and supporting all six domains.

This way it is clear that Digital Transformation is crucial to ensure efficiency (Alavi & Habel, 2021) in every domain and to increase competitiveness between enterprises and flourish new business models.

2.1 Digital transformation

Digital transformation is a buzzword that has been used a lot in recent years, sometimes without a clear definition. According to (Mergel et al., 2019) digital transformation is more than just using computers to store and process information. It's also about changing everyday life and implies a change in the way different stakeholders relate to each other using computers at every step of the interaction and improving productivity and simplifying the workflow.

In the Estratégia de Inovação Regional para a Especialização Inteligente (RIS3) conference it was concluded that to begin this transformation there should be an investment in infrastructures, as they are the support to promote and enable the adoption of digital technologies and methodologies. This can be achieved, amongst other means, through public laws (Almeida, 2020), that favour investment and the creation of new ways to interact with the digital world.

The next step should be to invest in digital education in schools, work, and unemployment centres. This second step is crucial since the lack of education is one of the biggest obstacles in developing a digital society.

Another important aspect to underpin is the symbiotic relationship between universities and enterprises, where one can offer knowledge and the other equipment. A studied was made

to evaluate this relationship and how it affected both parties (Brindley & Ritchie, 2000). SMEs and undergraduate students had significant changes in perception. While the student can educate the enterprise of emergent technologies, the enterprise can teach how the real world works.

With the growing volume of digital data, we have to be concern about security and more specifically personal data (Kamišalić et al., 2020). Every enterprise should ensure that there are rules and mechanisms in place to prevent a security breach.

Business Models will change, adapt, and diversify in the following years new remote internet services will become available, new smart utilities, and service network as for example a platform for reporting travel expenses like the one developed in this thesis (Garzoni et al., 2020).

They concluded this conference with several measures. Three of them are important to mention, the first being the profitability of SMEs, which consists of investing in the support system for collective actions and joint qualification projects to enhance the digital transformation of Industry 4.0 for SMEs.

"Financial support with co-participation in the implementation of the recommendations, complemented with a voucher for training employees and managers to use the new equipment and applications" is the next relevant measure that aims to accelerate SME's digitalization.

Finally, is the creation of a digital alliance, the measure's intention is to create a partnership between universities and enterprises in the digital sector. For that purpose, an entity was created from the ground up, solely dedicated to teaching the new digital areas, oriented towards students.

All of this strategy to digital transformation brings many benefits to SMEs and society as a whole.

2.1.1 Benefits of digital transformation

Changing to digital is a difficult but rewarding process, where it is necessary to alter one's physical and mental behaviour. When talking about small and medium enterprises the difficulties are perceived as being greater than the rewords, they have fewer employees and apparent benefit is low. The reality is different, the impact of every SME changing to digital is abysmal. SMEs compose 99% of all enterprises and most of them still are afraid of going digital. (Ulas, 2019)

When an enterprise stop using mostly paper, the first thing associate with it is the green impact it was. But if by looking carefully, it's just one of many benefits, for example, less time spent, and time is money for an enterprise. Forgetting something physical like paper is easy, on the other hand, digital is way harder to lose. When sending a document, via the internet, it's instant, otherwise, more time would be needed, more petrol, and other resources. Track and trace is another big benefit, when there is the need to search for a specific document, having a digital search engine instead of finding the right paper saves a lot of time, when there is the need to see the big picture and track the development of the enterprise, the only reliable way to do it is with a computer system . Therefore, the capabilities of firms are increased, and their processes are improved.

Looking to the future brings clarity to the benefit in transition to digital, over time there will be slight changes they have to implement, by having your systems digitally, these adjustments are very simple to adopt. By having digital platforms will be easier to adapt to the changes to come.

If no one helps firms upgrade to today's standard, they will perish like many already have. Blockbusters for example is an enterprise that didn't improve at the world rate and become obsolete.(Inga Henríquez & Caba Gajardo, 2015).

2.1.2 Expenses reports management

Managing expenses report is something enterprises have been doing for a long time. The need to keep track of expenses in an enterprise is crucial for its survival. To make rational decisions the owner needs to know where the money is being spent and how much of it. Management is a difficult process that becomes even more challenging by doing it manually, on paper and with physical receipts. By using report management software enterprises can track faster and with less errors and achieve a better management of expenses, leaving an overall better experience and trustiness on the employees.

Today there are the following three ways of managing expenses report.

- **Paper Tracking –** The traditional way before computers, where everything is done in paper by hand, the report would be approved in a monthly basis. A very slow and outdated model.
- **Spreadsheets –** The preferred way, and nowadays is the most used by enterprises which are not ready for a dedicated software, it's a good alternative to spend less paper.
- **Expense management software –** The best possible way in the modern world, a simpler process with alerts for the manager to review reports in need, being able to quickly approve or reject the expense. Resulting in a fast reimbursement of the employee.

The three ways of managing expenses reports can be subdivided. Figure 2.2 shows a graphic view of the ways enterprises do their expense management. The first two labelled are expense management software, and the last two are paper tracking. As stated, before the spreadsheet is the most common way to manage expenses.

There are multiple steps in expense management with different alternatives. By having

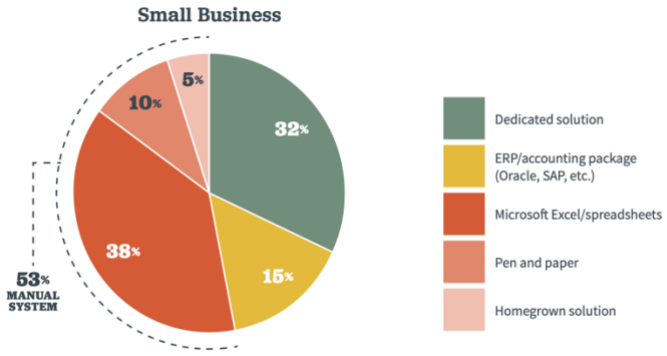

Figure 2.1 - Types of Expense Management (Certify, 2022)

the right software, enterprises can go through these steps, fast and with ease, making sure no one is taking advantage and exploring the system. Enterprises nowadays want their expense reports submitted automatically, and approving or denying too. Reimbursement scheduling is also desired. The grouping of expenses related to one trip or event is useful as is the ability to

accept or deny individually, inside the group, according to conformity with regulations. Also desirable is a way to alert employees if they are spending more than they should.

All these functionalities can be difficult to implement using a manual process when you have a growing team. Mistakes and missing information are a big problem that its most common with the manual process, ultimately it will waste employees' time and enterprise's money. As shown in Figure 2.3 losing a receipt or not submitting it is the biggest problem in recent years. This fact can be changed by upgrading from manual expenses reporting to a dedicated digital software.

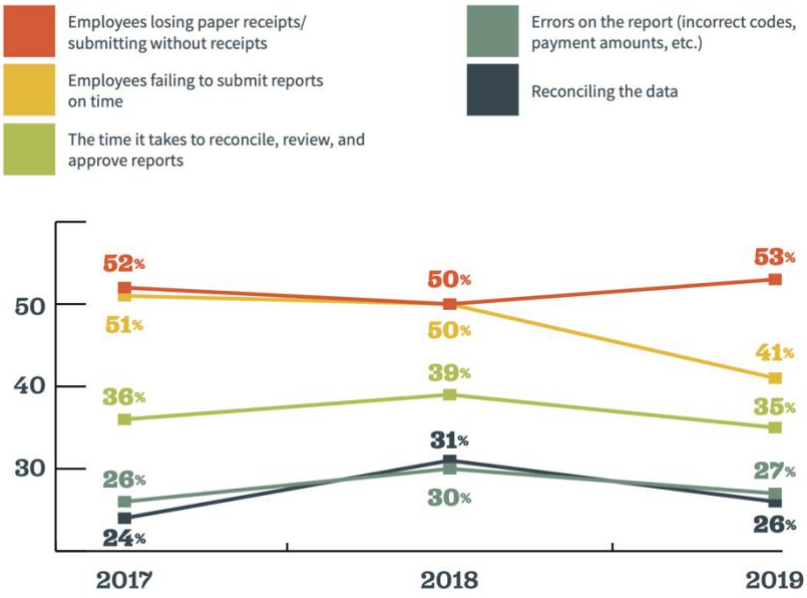

Figure 2.2 - Top five expense management pain points (% reporting) (Certify, 2022)

Implementing a cost control management policy is one of the best strategies to limit employee expenditure. A policy can provide justification for rejecting or disputing an expense and assist in determining whether to reimburse the charges in the end. To help everyone involved comply with the enterprise's policy, the following three elements ought to be present: a complete list of the costs that the enterprise will cover, a complete list of the costs that it won't and, finally and most important, the use of a clear and concise language to minimize disagreement. As the enterprise grows it's crucial to update expense management policy regularly, to accommodate for the changes. Examples of policies that follow good practices include clearly defined steps to report expenses and pre-approvals for particularly big expenses. Figure 2.4 shows how enterprises deal with the enforcement of their policies. Almost half of them don't even have a proper policy check in place. When creating policy rules enterprises must have into account some factors: the purpose, an effective time frame and expiration date, if applicable, the exact parameters and the desired outcome. These factors help guarantee enterprises stay within budget. In the unfortunate case of having disagreement throughout this process, the enterprise needs to think if it wants to have a separate account to deal with any credit card dispute.

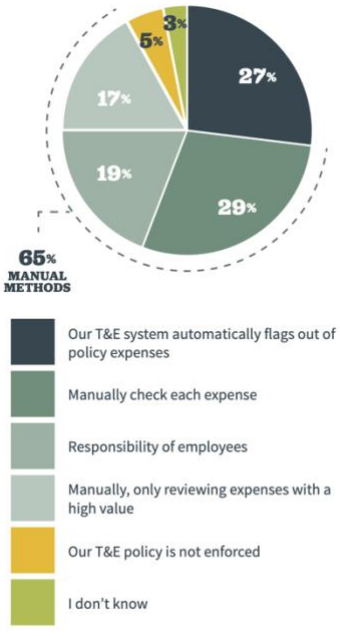

Figure 2.3 - Enterprise enforce policy (Certify, 2022)

By automating the expense management process enterprises can significantly reduce time, and cost spent on repetitive tasks. This automation allows for a better understanding of spending habits, making it easier to flag unusual high costs, and dealing with them. A survey done by Global Business Travel Association, to five hundred and thirty three managers around the globe in the year two thousand fifteen, shows that it takes on average around twenty minutes to complete one expense report, costing fifty eight

dollars to the enterprise, and eighteen minutes to correct one, adding fifty two US dollars to the total. This value can be drastically cut down by automating the expense management process. Thanks to streamlined automation and approval processes, there is less back and forth communication.

An expense management software can help with all types of reported expenses, some are regular expenses done by the enterprise that without them it couldn't function, others are the expenses employees make while working. Employees depending on the workflow of the enterprise spend money that later needs to be reimbursed, for that to happen they need to report their expenses and wait for their approval only then can they be reimbursed. This process is the same in almost every enterprise, as they need to be able to pay back on time to their employees, but the way it's done differs from one to another.

As stated and showed in Figure 2.5, there are two main processes when managing an expense done by an employee: traditional and automated. Figure 2.5 also shows the different steps in the two processes, being the automated process the one with fewer steps and less time spent on them. This difference will have a significant impact on enterprises and even so, many surveys say almost half of enterprises still use the traditional way. Some understand the upside of this transaction but don't want to change as it is a burden to adapt, others don't even know the benefits.

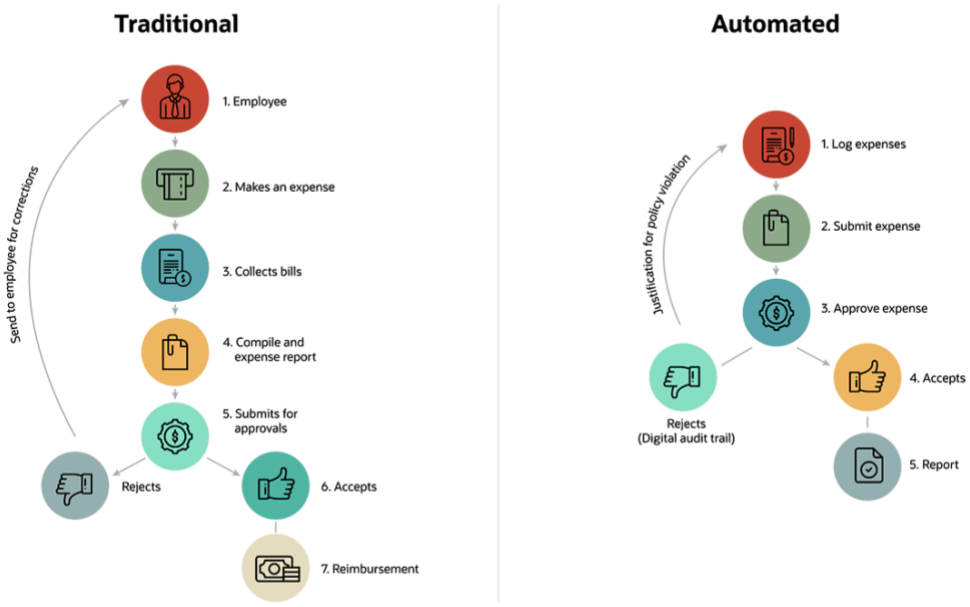

Figure 2.4 - Traditional vs. Automated means to expense management (Netsuite, 2022)

2.1.3 Benefits of digital reporting travel expenses

The employee won't have the hassle to save all the receipts and keep track of the money spent. By going digitally, it simplifies the storing of the important information in the moment, and afterwards, the employee just needs to confirm they were valid.

The person who validates travel expenses won't need to have papers and papers lying around, expect for does obligatory and for the more sensitive data as explained in (Campbell-Kelly, 1998; Poluvana, 2014). For some enterprises, the amount of paper that needs to keep

track of can get out of hand. By having everything in one place digitally, there are fewer mistakes and more organization. Another big benefit is the facility in keeping track of the enterprise's expenses like how much each employee has spent and how much in total is leaving the enterprise deposit, as seen in Figure 2.6.

Figure 2.5 - Travel expenses graph (*IAbacus*, 2022).

2.2 Case study: Reporting travel expenses

One of the common tasks in many enterprises is reporting travel expenses. Travelling for work proposes is fairly normal and the cost associated with these travels is supported by the enterprise. The way how employees must report the cost to be reimbursed varies widely and may include different items. For example, some enterprises assign a given *per diem* for all expenses while others will reimburse employees for meals and lodging when they present the receipts subject to maximum values for each. Another example is they may only allow the payment of train tickets or pay a given amount per kilometre or reimburse receipts of fuel.

In this thesis simplifying and generalizing will be a priority, to create a platform capable of fitting the generic enterprise. There will be only three types of expenses: travel; logging; meals. After selecting the appropriate category, you will manually input the value and a description. The data will be stored and sent to HR who will validate. After validation, you will receive a confirmation on your phone.

Figure 2.7 shows in a more graphical way, the process to report a travel expense. Starts with the submission of the invoice by the employee, and then the system will check if it obeys the enterprise policy, in case of a violation it automatically returns to step one. Next, a higher authority will do a quick check on the process, making sure everything is running smoothly. Then comes the reimbursement that occurs automatically to the employee bank account. The last step is the analyse of every expense and transaction to better evaluate the situation to be able to make more informed decisions.

Today there are many different solutions to implement this process.

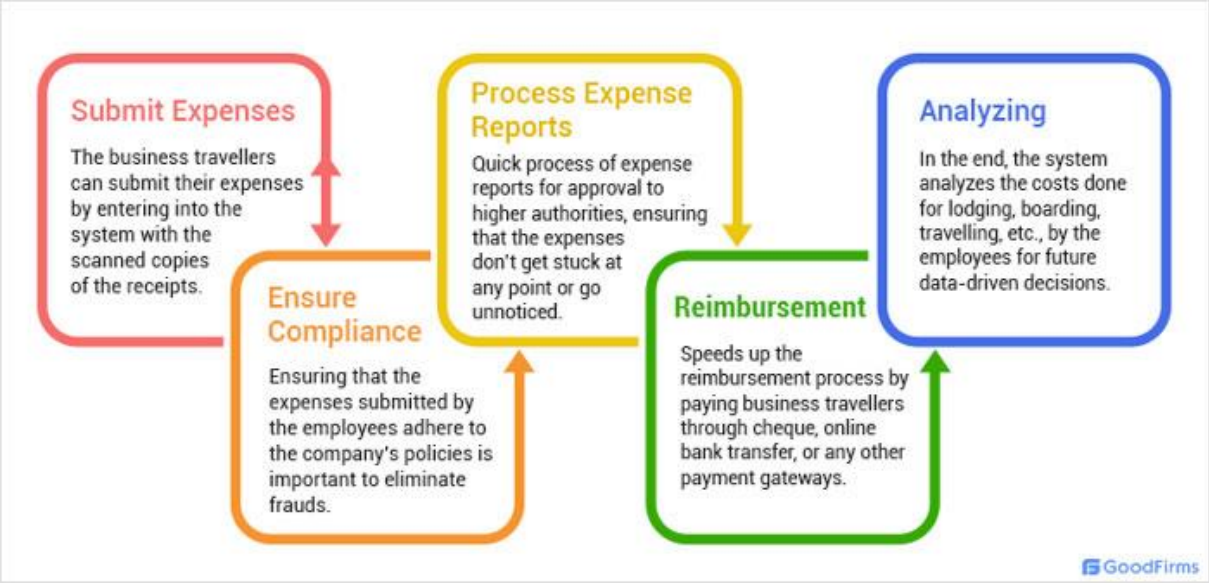

Figure 2.6 - Detailed expenses report (Jemimah Rodriguez, 2022).

2.3 Different solution

Big enterprises have their software, as is the case of Accenture (Figure 2.8). Others like International Business Machines (IBM) use pricy software available to everyone. In exchange for these high prices, you get an app capable of reading pictures of receipts and sending the right information to HR who will validate afterwards. Some even can do all of that without

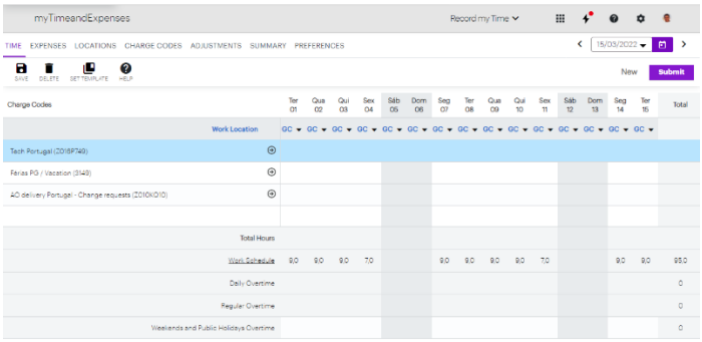

Figure 2.7 - Accenture travel report expenses

human intervention by being connected to the personal card and at the moment a transaction is made, the information is sent to the HR, this includes flight travels, uber rides, and meals.

They can also be automated and integrated with the Accounts Payable (AP) management to be more efficient, increase profitability, and control with ease and visibility into spending. This can be integrated with existing automation. Instead of checking every month that the right amount of money has been paid, you can simply see it on the platform.

Another solution involves an enterprise card, where everyone who has one hand can spend money with it but afterwards, the manager will validate and if it isn't valid the money is taken from the employee bank.

Many of them gather all the data and build a beautiful graph to better show where the money is going. They are also compatible with scalable enterprises and have 24h support. In Figure 2.9 is visible all the common features are presented in expenses report management software.

By comparing existing software in the market becomes apparent some of these features are better implemented in some cases.

Figure 2.8 - Software Features (Jemimah Rodriguez, 2022).

2.4 Comparison between software programs

Four of the most successful and well known commercial software programs for expense reporting were chosen to be analysed in order to understand the differences between them. The chosen software programs are Concur Expense from SAP (Concur, 2022), Abacus from Emburse (*IAbacus*, 2022), Expensify (Expensify, 2022), and TravelPerk (TravelPerk, 2022). Concur and Abacus do not have a fixed price, since they make customizable prices depending on the enterprise that is buying the service, Abacus has a starting price of 9$ per user. Expensify and TravelPerk have a free service but with paid plans that unlock more features or more storage.

All of them have an appealing "look and feel", with up-to-date marketing and graphic design. They all run on desktop (or laptop) computers, but with an app that runs on smart phones or tables to facilitate their use in different places. Expect for TravelPerk, all programs/apps can scan a receipt photo and read the important information. They also have good help service 24-7. In Table 2.1 is a side by side comparison between these platforms.

They work by registering the employee's expenses, sending them to the manager for future validation.

Concur is the most famous and pricier. This is due to their premium service and the seamless integration with the other systems provided by SAP. Concur can be installed in smartphones, and when a payment is done with the smartphone it detects that payment automatically and registers it without the need to take a picture of the receipt. In Figure 2.10 it displayed the Concur interface and its simplicity.

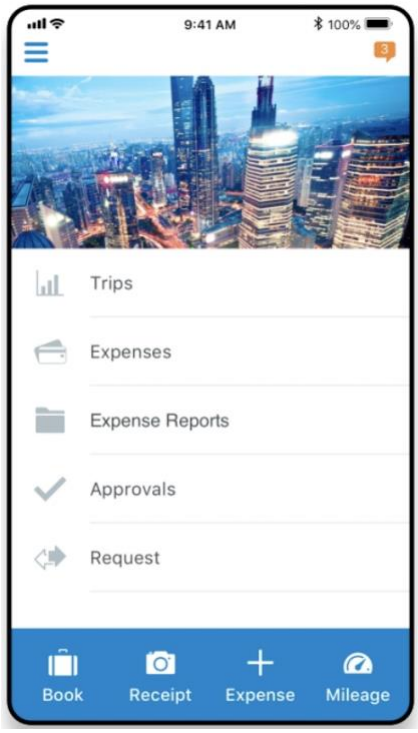

Figure 2.9 - Concur Interface (Concur, 2022)

Abacus is one of many products from Emburse, Abacus alone is not a particularly interesting program, however, when integrated with other software's from Emburse it gains a new meaning, and its value becomes apparent. With Abacus it is easy to automate how you reimburse the employees and to implement the enterprise policy.

Expensify provides free credit cards for it's users, where limits can be put on how much they spend. These credit cards can be used to book a flight, and the user does not need to scan their receipt, since it will automatically go to the HR and even has a 4% cashback.

TravelPerk specialized in flight travel expenses. They have a great platform for booking flights for groups and with discounts. It's more indicated for enterprises where employees have to take flights often. It can easily reschedule if a flight gets cancelled. It offers good health care when travelling abroad, and you also have the possibility to pay your carbon footprint.

In table 2.1 the software is compared based on the following features:

- Price – The value of the product;
- Receipt scanning – The ability to scan a receipt and automatically take the important information form it;
- Expense Management – The ability to see in an ordered way the overall expenses of the enterprise;
- Book Transport – The ability to book same transport from the platform;
- Group Booking – The ability to easily book transport for a big group of employees;
- Easily Integrated – Can integrate with other systems for an overall better experience;
- Expense Auditing – The ability to check and confirm the legality of the expenses made;
- Automate Policy – Employees before making a payment can see if it falls under the internal policy guidelines;
- Customer Support – Personalized support on the go.

Table 2.1 - Software Comparison

Enterprise	SAP	Emburse	Expensify	TravelPerk
Software	Concur Expense	Abacus	Expensify	TravelPerk
Description	Most famous of the four. High primum service	Made for small and medium enterprises, you only pay accordingly to the number of users	A very user-friendly site. The end goal of the enterprise is helping homeless people	More focused on booking flight travel, used by enterprises like: Booking; Airbnb
Price	Custom	Custom	Free	Free
Receipt scanning				
Expense Management				

Book Transport				
Group Booking				
Easily Integrated				
Expense Auditing				
Automate Policy				
Customer Support				
Significant Features	When paying with your phone, it detects automatically; Easily automated with AP; .(Concur, 2022)	Real time expense reporting; Can separate different expenses and notifying so you know here should you focus; Approval hierarchy.(*IAbacus*, 2022)	Expensify card; Personal trip planner; Multilevel approval workflows; PCI-Compliance security; Credit card import.(Expensify, 2022)	Largest inventory for booking train travel; 80% of cost back for cancelled trips; Offset your carbon footprint; .(TravelPerk, 2022)

From these 4 programs, the best is without a doubt Concur (G2, 2022), since no other can compete with its simplicity and efficiency. Simplicity because the interface is simple and easy to understand. Efficiency because most of the time it can report expenses without human intervention. Expensify can't be as efficient but with its own credit card, it took a different approach that can be considered almost as efficient. By having a card connected to the enterprise account it can be very efficient but not as simple as Concur.

TravelPerk is the best of them in terms of booking transportation, and housing. By purchasing some extras, you can achieve the same result on the other three platforms, even though it isn’t better. Being very good at one thing is good but it also implies enterprises that don’t usually book stuff aren’t going to adhere to TravelPerk.

Abacus is all around a great software, but it hasn’t anything very characteristic, that makes it stand out. It is easily connected to other Emburse services and has a great variety of utilities.

The great disadvantage of Concur and Abacus is the price, Expensify and TravelPerk start free but can easily add on if you want the full experience.

All of the systems mentioned above have a database capable of securing the expense report.

2.5 Expenses data storage

A database is a system where data and information can be stored. This chapter will examine digital databases and the difference between relational and non-relational databases. Throughout history the necessity to store information has been a necessity. Until recently it was done by writing books. Now with the digital era, starts the change from physical databases to digital ones, stored in computer systems. Physical databases have a better longevity but can't store as efficiently or be as fast as digital systems, which can store the same information occupying less space and spend less time (Fraczek & Plechawska-Wojcik, 2017; Jatana et al., 2012).

C. J. Date wrote (C.J.Data, 1982) what some call "the bible of databases". Date has the ability to explain complex technical material in an easy-to-understand way. In this book he explains databases very thoroughly and despite the fact that the last revised version is from 2004, it is still generally up-to-date with modern database systems. The most widely known and used programming language used for databases is Structured Query Language (SQL) often pronounced "sequel" (Date, 1989), that is a relational language, and as the book suggests it is the dominant language on the market. Databases are integrated and normally shared, with several components or application and use it to store persistent data.

Databases interact with users, of which there are three types: of users, human or "user", computer programs (the application program), and the Database Administrator (DBA). The most beneficial aspect of digital databases is data independence as it is defined by the immunity to changes in the way data is psychically stored and accessed.

Looking at the architecture of databases it is possible to divide them into three levels: the internal level as it is the one closer to the physical storage, the external level that is the boundary to the external world, in other words what the user can see, and finally the conceptual level that makes the connection between the two other levels. The information at each level is described as a schema, and mappings make the link between the external schema and the conceptual schema and they also make the link between this one and the internal schema. These mappings are very important to the logic and the independence of physical storage. Users interact with the external level through a sublanguage, which is separated in two components, a Data Definition Language (DDL) and Data Manipulation Language (DML), ideally the user can differentiate between the two. The Database Management Systems (DBMS) is the responsible for implementing the DDL and DML request from the user.

2.5.1 Relational database

Edgar Codd with his article (Codd, 1970), in 1970 changed the way to store information. Since then, SQL systems have dominated the relational databases, and both have dominated the DBMS market. In a SQL system the data is stored in tables and only tables. The relational model is based on mathematics and logic as the term relation can be synonymous to table in a mathematical context.

This model can be described by three aspects, an integrity aspect, a structural aspect and a manipulative aspect. They are the formal foundation that sets the rules for this model to work.

"Tables are the logical structure in a relational system, not the physical structure. At the physical level, in fact, the system is free to store the data any way it likes - using sequential files, indexing, hashing, pointer chains, compression and so on - provided only that it can map that stored representation to tables at the logical level. Another way of saying the same thing is

that tables represent an abstraction of the way the data is physically stored. (…) The relational model is indeed a model, it has nothing to say about implementation." (C.J.Data, 1982)

Operations that are made to the table can only be made to the whole table not just individual rows (Chamberlin & Boyce, 1974), as opposed to non-relational databases. This model doesn't have the notion of a pointer, at a logical level, connecting one table to another, or in a more graphical way the arrows pointing from one table to another (Figure 2.11) can't be called pointer even though the value is the same. On the contrary, on the physical level there is no such restriction, as the only requirement is to support the logical structure. This means a relational database is only relational in the conceptual and external level, as the internal level can take any shape or form, as long as the user perceives it as a table.

Figure 2.10 - Relational Database
(shutterstock, 2022)

2.5.2 Non-relational database

In contrast to SQL only table format, in a non-relational database the user can see other types of structures and can see tables too. Consider that there is a document, that can store detailed information the way you want just like this thesis, making them much more flexible. Non-relational databases have great advantages when using large, complex and diverse data. In these cases, non-relational queries take less time as it doesn't have to check several tables to give an answer (Li & Manoharan, 2013). They are the best choice for databases with rapidly changing information, and different types of data. For growing systems requiring a dynamic database, which supports a lot of complex and unstructured data, the non-relational architecture fits better in these contexts, which are becoming more predominant.

Non-relational databases are all the other types of databases that aren't relational and almost all of them have these common characteristics:

- Personalized query language, for example CQL for Cassandra (Hewitt, 2010)
- The lack of links between data;
- Cluster methodology;
- Flexible data model.
- Simpler design

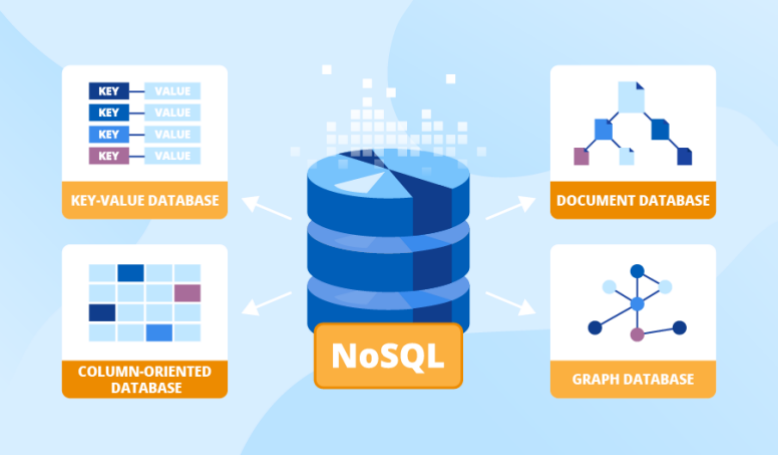

Figure 2.11 – NoSQL (scnsoft, 2022)

Query language differs from one database to another. A query is a request for data from the database, this request can be made in several ways even if it is requesting the same thing. The non-relational structure is very different, so it implies a different query language. Almost all of the relational databases use the SQL query but for Not Only SQL (NoSQL) there are more specific languages to correctly connect with that database (Reisner, 1981). The use of clusters to store information is very beneficial for non-relational databases, as it can write and read on every node in a cluster and replicate the data between them for more security to data loss. Unstructured data is stored in non-relational databases as such there isn't the need to make a complex structured, making the design much simpler than SQL.

In a test made by (Gyorödi et al., 2015) the writing and reading speeds of both database types was compared. The result showed that relational databases are faster at writing, but non-relational databases are better at reading. As stated before, queries for relational databases are more complex, making them slower.

When creating an expense management reporting system, the need for a database appears for keeping the reports stored. Having the expenses report well stored gives a better and easy access in the future to them. In summary its crucial to have a database to store reports being the most adequate database an relational database since the data to be stored is structed and well defined (Li & Manoharan, 2013). If it wasn't the case the best choice between non-relational databases in the market would be MongoDB, as it is open source and free to use (Lourenço et al., 2015).

3

CONCEPT AND ARCHITECTURE

This thesis aims to develop a software program capable of managing different users and keeping their information safe and dynamic.

3.1 General architecture

In generic terms, this platform has three components, the database the backend and the frontend which are all connected. The frontend is used as the interface between the backend and the user. It's constructed in a way that allows the user to easily interact with the software. Every input by the user has an indirect connection to the backend through the frontend.

The backend is the bridge between the database and the frontend. The backend can write and read in the database which it does following the frontend commands.

This architecture starts with the human input on the PC – the most common of these are the keyboard and the mouse. These peripherals talk with the frontend (HTML) and in turn it talks with the backend (Python) that will make queries to the database (MariaDB). At this point, the communication reverses, and the database responds to the backend. Then the frontend displays what the backend commands. This is shown to the human through the output peripherals, mostly the screen. This flow is represented in Figure 3.1 - General Architecture.

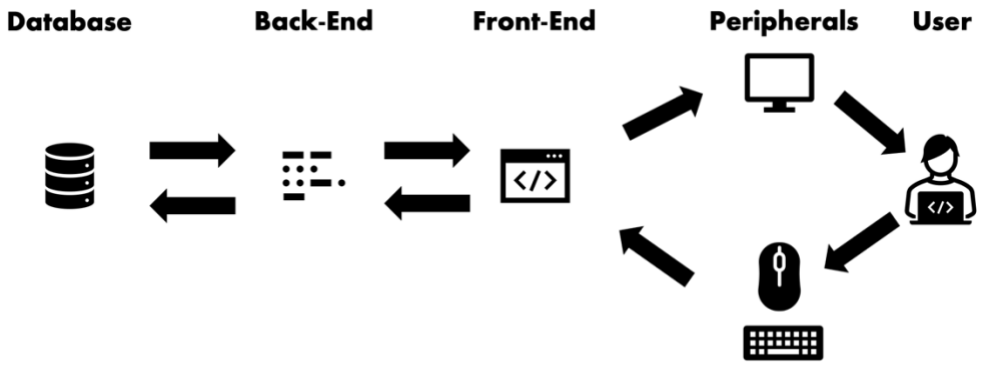

Figure 3.1 - General Architecture

In this thesis the database keeps the receipt of the employees in a table that's connected to another that links it to the user, this way the database has all the receipts linked to the correct user. For a more in-depth explanation please refer to section 3.2.

The backend gets from the database everting the user requests for example the data of all the receipts from one process and shows it to the user through the HTML. When a user wants to insert a new receipt, the backend will process the data and create a new entry on the database. For the cases when the HR wants to validate a receipt the backend sends an update instruction to the database. For a more in-depth explanation please refer to section 3.3.

The frontend shows to the user in a user-friendly way the receipts and all the other information stored in the database. It does this through HTML a frontend language capable of creating a page that can receive inputs from the user and respond through a nice graphical interface. The first thing the frontend shows the user is the login page and depending on the type of user it will show different pages.

3.2 Database architecture

A graphical way to see the database architecture can be seen in Figure 3.2 - Database Entity-relationship Model. The database was constructed in MariaDB Server. Today we have many options to choose from and generate a good database. As explained in the last chapter a relational database is what is aimed at, the most famous being MySQL (DuBois, 2008). This company was bought by Oracle so now it’s a paid software. To make the most affordable product MySQL was excluded as a viable option, leaving others like PostgreSQL (Drake & Worsley, 2002) and MariaDB. Of these two free options, the chosen one was MariaDB.

MariaDB is better suited for smaller databases and has the additional ability to store all data entirely in memory, which PostgreSQL does not. Both are established relational database management servers (RDBMS) that are free source. When inserting or updating data, MariaDB is more understanding and automatically corrects data types that don't fit the schema being used; PostgreSQL does not have this feature and is rigorously typed. MariaDB has a reduced memory footprint than PostgreSQL since it is a lightweight database (Pilicita Garrido et al., 2021). In terms of reading and writing performance, PostgreSQL surpasses MariaDB and is hence more effective. It is clear that the community of MariaDB takes security very seriously because it receives frequent security patches.

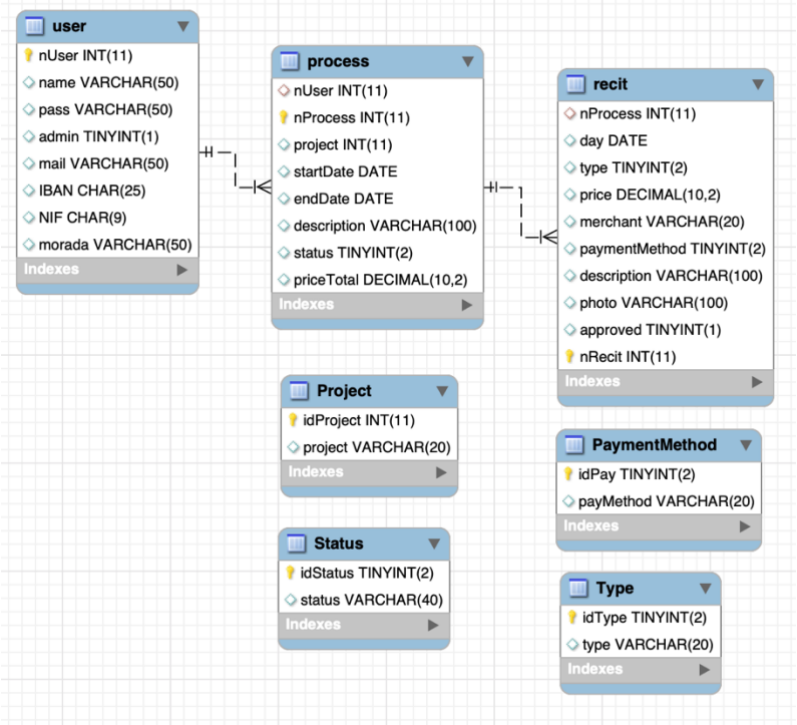

Figure 3.2 - Database Entity-relationship Model

In the database there are three main tables represented one in each column of Figure 3.2. The User table is the one with the information about the user login credentials and billing data. The second, Process, is the one that saves the process each user has which includes all the receipts from the trip. The information about the receipts is in the third column. All the receipts from the same process are connected through a foreign key and all of the processes are connected to the user through a different foreign key.

The next four tables in Figure 3.2 are very similar in shape but with very different content. The Type table has the different types of possible expenditures: transportation, accommodation, food and others. The Project table is a dynamic table as opposed to the other three. At each point in time it has all the existing projects. The Status table has the possible states of a process: Requisition, Waiting for Requisition Authorization, Requisition Authorized, Requisition Rejected, Reimbursement, Waiting for Reimbursement Validation, Validated Reimbursement, Rejected Reimbursement, Reimbursement Delivered, Reimbursement Paid. The last one is the PaymentMethod which has four different types of paying options: Coins, Card, Check and others. In the simulated example explained before the HR will, first of all, create this project, by adding a new entry to the project table. For the other tables there will be no changes as they serve as indicators.

This structure is made for one enterprise only. This means a replica of the structure is needed in order to have more than one enterprise.

Imagining a practical case to illustrate the details, an employee that goes on a work trip to Oporto must have a process previously inserted into the database. In this process, that relates to the specific trip to Oporto, the fields that should be present are:

- date of the beginning of the trip
- date of return
- name of project paying for the trip

- a description

The employee may edit the contents of these fields but the following ones, that are read-only:

- status for this process
- a value of the total price

For every receipt, the employee will create an entry into the tool and introduce all the necessary data. In our example, there will be a record for the receipt of the transport that took them to Oporto and others for the receipts of food and accommodation.

Internally, each of these elements recorded will be a line in the receipt table of the database and each one will individually be connected to the process defined earlier, which describes the trip as a whole.

The employee can change the contents of almost all the columns of the receipt table expect for the *approved* column. This one is only modified by an administrator user.

After the trip and the correct filling in of the data by the employee, an HR responsible person will validate this information and change the database the columns that have to do with the status of the receipt or the process. In the end, if everting goes well, all receipts should be accepted and the status of the trip should be set to the "reimbursed" state.

This database is being queried by the backend, by reading or writing in it.

3.3 Backend architecture

The backend serves as a connection between the frontend and the database as shown in Figure 3.3, with four main types of endpoints, which are for inserting, for viewing, for updating and to delete.

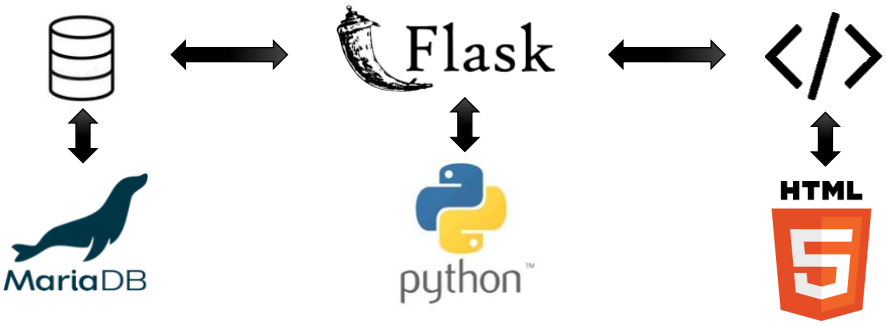

Figure 3.3 - Internal Architecture

The backend was done in Flask a web framework with Python. There is a large selection of web frameworks available in the Python programming language that web developers can utilize to create websites. This gives the web developer the opportunity to select the framework that best suits their project and task. Django and Flask are the two that are most frequently contrasted in terms of popularity among the many popular options. This is most likely the outcome of the fact that they both have many distinctions as well as some similarities. Each framework has distinct qualities that allow us to use it in accordance with the needs of a specific project. Flask is a lightweight, extensible framework that enables you to create small web applications, whereas Django is a full-stack web framework that works well for creating large and complicated web applications (Ghimire, 2020).

To access the database the backend needs to configure several parameters such as: host; port; user; password; database. This information is configured at the beginning but needs to be called in every function that uses the database.

To interact with the database the backend uses only four different SQL commands to achieve the necessary functions. These are:

- INSERT – 4 types of insert operations are:
  - Insert into user – This occurs whenever a new user is created, only administrators can execute;
  - Insert into process – This occurs whenever a new process is created;
  - Insert into receipt – This occurs whenever a new receipt is created inside a process;
  - Insert into project – This occurs whenever a new project is added, and can only be executed by an administrator.
- SELECT – The select SQL command is used in many different functions such as to select and sort by date the processes from a given user, or get the receipt data that a user wants to change.
- UPDATE – 4 types of update operations are:
  - Update process Set priceTotal – This occurs whenever a new receipt is added or edit;
  - Update receipt - This occurs whenever a new receipt is created;
  - Update receipt Set approved – This occurs whenever an administrator changes the status of a receipt;
  - Update process Set status – This occurs whenever an administrator changes the status of a process.
- DELETE – 2 types of delete operation are:
  - Delete receipt – This occurs whenever a user deletes a receipt;
  - Delete process – This occurs whenever a user deletes a process.

Most of these queries will modify the database to accommodate for newer information and updates. In every single one of them it is needed to select what table, and of that table which columns will be affected

To change the database the backend needs to request to the frontend the variables through the “request.from[]” function. Inside the square parentheses, it’s the name of the object in HTML that going to have the value pretended.

Objects in HTML can vary a lot, some of the more used in this platform are:

- Text – This type is represented as a box, where you can type anything. The text written in the box will be sent to the backend.
- Date – This type is represented as a fill-in form in the shape of a date. The data in here will be sent to the backend;
- Number – This type is represented as an insert box where it only accepts numbers. The value of the number inserted in the box will be sent to the backend.
- Radio – This type is represented as a list of options you can choose from. Depending on the choice of the list a different value will be sent to the backend.
- Submit – This type is represented by a button, when pressed it will send the value of its label to the backend.

Sometimes the data isn’t sent by the frontend but rather a command that tells the backend what to change in the database.

3.4 Implementation

A proof of concept implementation of the system was developed. This proof of concept in reality is a complete and fully functional system that can be used by any SME as stated in the introduction. However, it is considered just a proof of concept because it could still be improved and packaged in a more user-friendly way to be more appealing to the mass market. This concept uses a MariaDB server and a Flask framework that would need to be well packaged to mass deliver to the market.

Each function has a standard header comment section, where the name, purpose, input/output parameters, observations, version, data and author are identified. A sample of one function is presented in **Error! Reference source not found.**. This header is very important for maintainability and version control. By explaining how the code operates or providing yourself or a future developer with some kind of description of what this code does, it saves time. This also applies to in-line comments. Even if you have a comment header, when there is the need to change the logic behind it it's way easier if there are in-line comments. In a collaborative environment with other programmers on the same project as a team, a well-commented functions and logic aid is better understood by other programmers. They can quickly grasp the reasoning behind any problem's solution.

Comments were introduced whenever necessary, and all variables have a comment explaining what they are, even though most of the variable names are self-explaining. All variables use lowercase, except constants that use uppercase. An effort was made to never extend beyond column 80 so as to enable printouts and facilitate viewing on a standard screen. However, for simplicity, certain select functions do extend beyond column 80.

It is easily seen in the buttons of the platform all of them have different numbers. This is for the backend to know which one did the user pressed. The numbers most of the time are in order of appearance. The backend reads the number in the button to know which entries to get from the database.

The best way to see the code is with an Integrated Development Environment (IDE) that colour codes each line, as shown in Annex B. We used Microsoft Visual Studio Code (Michael Plainer, 2020), and found it to be very helpful (even for copying code to this Dissertation document).

The different components have been explained in the previous chapters so here is the actual function used:

- home – This function is the first to be called, it presents the login page and asks for the user and password;
- menu – This function is the menu of the employee. It shows the processes that employees can perform. As such, each employee may see different options. After selecting the options available for the user and showing them on the screen, it waits for the user input, validates that input, and branches out with a cascade of "if…then…else" to call the other functions. The menu function itself does not do any processing, since this is done by the called functions; The python code for this uses 65 lines and uses the flask library.
- process – This function is the list of receipts from one process, it can delete, update or create a new receipt;
- insertrecit – This function gets the data of a receipt and creates a new entry on the database for this receipt;
- editrecit – This function shows the parameters of one receipt and if there are changes to the data it will update the database with it;

- insertprocess – This function gets the data of a process and creates a new entry on the database for this new process;
- adminmenu – This function is the menu of an administrator and shows a list of all the employees and their information;
- adminlist – This function shows the list of all the processes and receipt ordered by the date of one employee;
- admindef – This function can create a new project and create a new user;
- defi – This function updates the personal information of an employee.

```
#########################################################
#
# Name: AdminMenu
#
# Objective: View the employees and their info
#
# Input Parameters:
#   nil
#
# Return value and output parameters:
#   numb - ID number of the employee
#
# Obs:
#   nil
#
# Version 1.0, 02/09/2022, by David Lobo
#########################################################
@app.route('/adminmenu', methods=['GET', 'POST'])
def adminmenu():
    if request.method == 'POST':
        if request.form["botao"] == "Log Out":
            return redirect(url_for('home'))
        if request.form["botao"] == "Definições":
            return redirect(url_for('admindef'))
        botao = request.form["botao"]                    #botao - Label of the button
        botao = botao[:-17]                              #Erase the last 17 letters
        numb = int(botao[0])
        return redirect(url_for('adminlist',numb=numb)) #Go to the list of procces from one user
    elif request.method == 'GET':
        conn = mariadb.connect(
```

Figure 3.4 - Sample of code

To test this proof of concept it was created three different accounts. Two of them simulating two employees and one with the administrator privilege. The employees were able to create processes and receipts, they could also delete them or update them. They were able to see all of the processes and receipts created organized by date.

The simulated HR account could select one employee between all of them, and after that see all the process and the receipts inside of them, with the possibility to approve or disapprove a receipt and to change the process status. For a more in-depth instructions on how to use the platform please refer to Annex A.

4

HYPOTHESES TESTING AND VALIDATION

4.1 Application scenario

This scenario was made to test the platform created in this thesis. In this application scenario, there are two employees that will make a trip and an HR (who naturally is also an employee) with the HR credentials. In this simulation, the two employees go on a work trip, one to Oporto and the other to Almada. Let's pretend this enterprise is, for example, the Red Cross and the two employees were going to other enterprises to teach how first aid works. These two different trips to these places were paid out by different projects. As a consequence, the HR had to create two new different projects.

Employee B went to Almada. As this is a small trip, so it only took part of the day. Employee A went to Oporto, and that took him a full day. They both went on the 15th August 2022, but employee A only came back the next day. As for employee B, he come back the same day.

Employee B only spent money on lunch and petrol for the car. Employee A spent money on public transport (CP – Portuguese Train Company) to the destination and back, on dinner and breakfast, on accommodation for the night at an Ibis hotel, and on an ice cream.

The next few days after the trip, preferably the next day, the two employees must submit their claims on the system. This can be done at their workplace, in the comfort of their homes, or even on their mobile phones anywhere. After they have made their submission the HR must review their claims in the system and validate them or refuse them. The validated claims will be reimbursed, and the employees will know if their claims were refused, and why.

This application scenario was actually played out with volunteers (my brother and uncle), and was inspired by my brother's internship at the Portuguese Red Cross in Coimbra. My brother by being one mouth in the red cross could better explain how this type of process work, and help simulate a close approach to the real thing.

Screenshots of the different screens that the users will see are presented in section 4.2, and the code functions used to perform these tasks have already been reviewed in chapter **Error! Reference source not found.**.

The simulated scenario can be better understood with a graphical display in Figure 5.1 - Application Scenario. Not every case is presented for simplicity as it would not be possible to fit in one page. The details of the other cases are provided below.

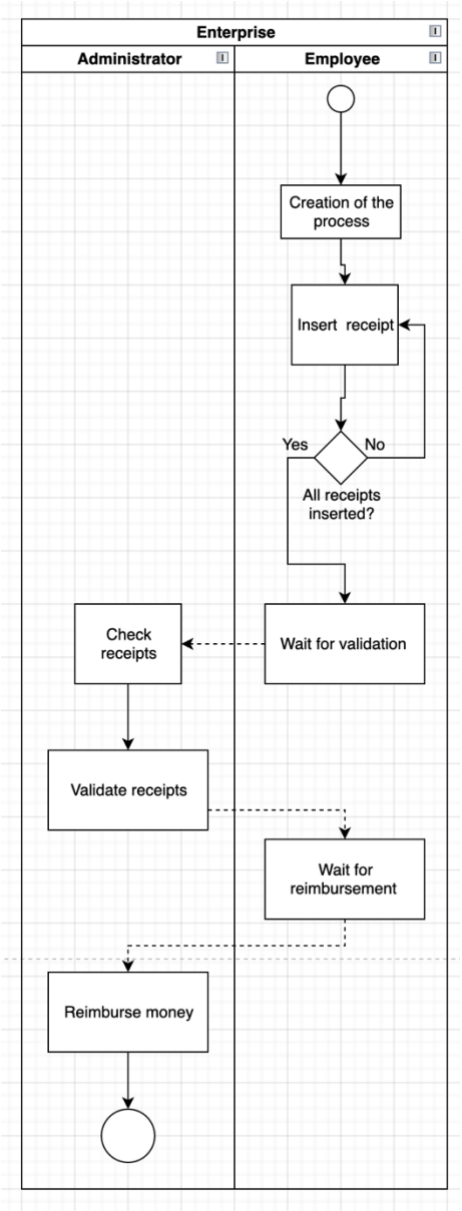

Figure 4.1 - Application Scenario

4.1.1 Employee's tasks in the application scenario

After their trip, both employees, in the comfort of their homes, have to submit their expenses, so that the Red Cross can reimburse them. To do this they must perform four operations: 1) open the application; 2) create a process; 3) create a submission for each of the receipts; 4) log out of the application.

Explaining each of these steps, the employees must:

i) Open the Application

The application must be opened in a browser. Any common browser that supports HTML5 can be used. The application has actually been tested on Internet Explorer (Figure 5.2), Google Chrome (Figure 5.6), Mozilla Firefox (Figure 5.3), and Apple Safari on an iPad.

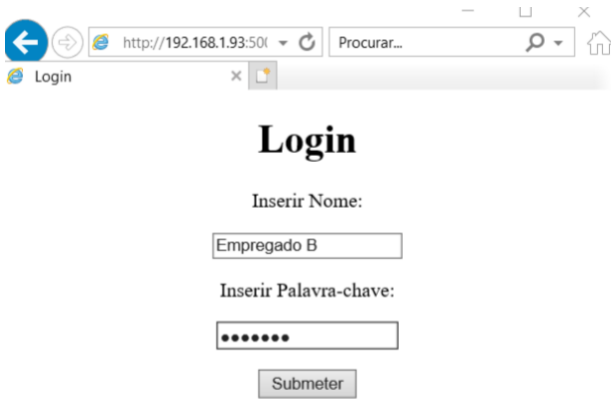

Figure 4.2 - Internet Explorer interface

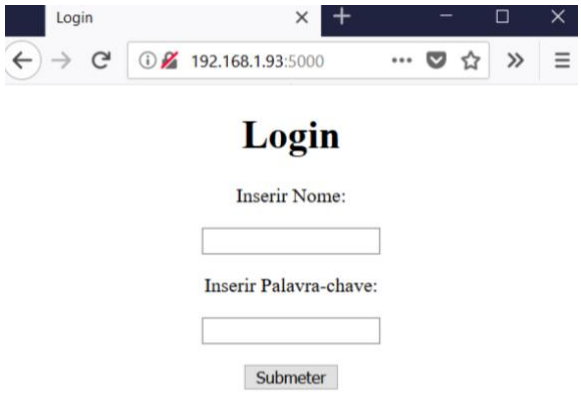

Figure 4.3 - MozilaFirefox interface

The first screen that appears is just a Login Prompt (Figure 5.9). The user must click on the box just after “Inserir Nome”, and insert the username.

ii) Create a process for the trip they made

To do this, they must, click on the button “Adicionar novo processo”. This button is in the top left corner. This button redirects the employees to a page where they have to full fill the start date, the finish date, the project that is paying for this trip and a short description of it. To validate this information the next step is to press the key “ENTER” or click on the “Validar” button.

This will return to the last page but with the new process, if this process is the most recent among all the processes of this user, it will be presented at the top.

Lastly, the employee needs to select this process by clicking on the button below the process “Editar”. This action will redirect the employee to the list of receipts from this trip but as it was just created it will be empty.

iii) Create a submission of each of the receipts

To do this the employee needs to click on the button “Adicionar nova despesa”. This button is in the top left corner. In this case it is the first process so it wouldn’t be difficult to locate it but has the employee inserts more receipts it can get a bit more difficult. This will redirect the employees to a form where they have to fill in the information that can be gathered from the receipt they have of the expenditures.

In this form they have to fill in the type of expenses, the amount they pay for it, the date of purchased, the name of the enterprise that supplied the goods, the payment

method and lastly a description to summarize this expenditure. When every field in the form is filled in the employee must click on the "Validar" button, which will redirect to the last page where it can see a list of all the receipts from this process.
After each receipt is inserted into the platform by repeating the above step, the employee should double check double-check the information.

iv) Log out of the application
To complete this task the employee must return to the main page where we can see a list of all the processes of the employee. For this purpose, the button "Voltar" enables to go back to the first page.
On the main page in the same place the button "Voltar" was there is now a button "Log Out" this button will terminate the session of the user.
This completes the first and most troublesome part of the employee side.

After performing these operations and logging out, employees A and B don't have to do anything else, and they will be reimbursed if the claim is correct. In this version of the application, if the claim is not accepted, the employees will not receive a notification, but if they want to, they can check the status of the claim at any time. In a future version, an email can be generated to notify the employees about the decision on their claims. A graphical representation of the task an employee has to do is shown in Figure 5.4. This Figure doesn't contemplate the steps needed to perform after the HR actions, but it is explained in the last part of the subsection 5.1.2.

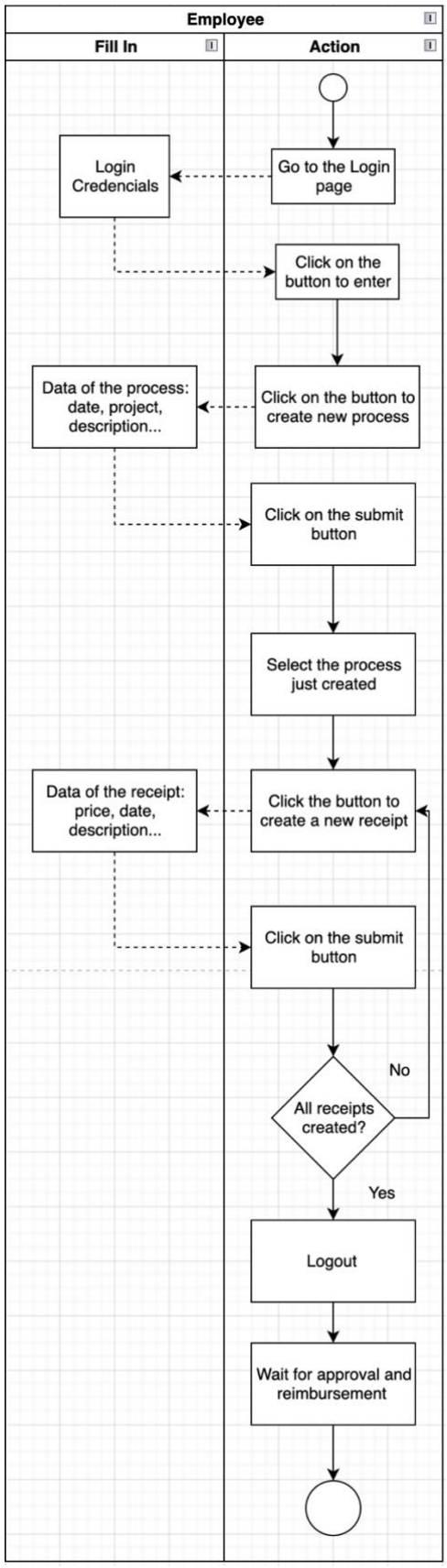

Figure 4.4 - Steps of Employee

4.1.2 HR's tasks in the application scenario

The next steps must be performed by the HR representative. In this application scenario, the next day after the employees have submitted their claims, the HR representative saw these new expenses and started validating them. The HR will approve every receipt except for the ice cream one. To do this the HR representative must perform four operations: 1) open the application; 2) select the employee; 3) check and validate the receipts; 4) log out of the application.

Explaining each of these steps, the HR must:

i) Open the Application

The application must be opened in a browser that supports HTML 5 as stated in section 4.1.1.

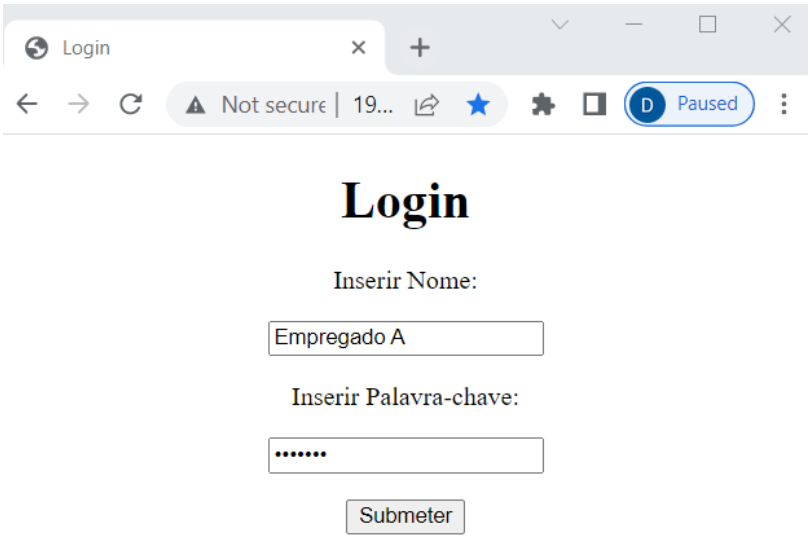

Figure 4.5 - Google Chrome interface

The first screen that appears is just a Login Prompt (Figure 5.9). The user must click on the box just after “Inserir Nome”, insert the username. After everting is correctly fulfilled the user can also click directly on the button “Submeter” with the mouse instead of the “ENTER” key. This action will redirect to the next page, in this case as it is the HR logging in with administrator permission the next page will be a list of all the employees.

ii) Select the employee

To complete this task the HR, will check the list of all the employees with the respective information below, and select the one it wants to validate their expenses. Below every user there is a button “Editar processo”. This button redirects the HR to the pretended page with all the receipts separated by the processes, of the chosen employee.

iii) Check and validate the receipts

To complete this task the HR has to see if the new receipts (the only ones without validation) are in terms with the enterprise policy.

After confirming the veracity off each receipt, the HR will validate them by clicking in the “Aprovar” button. This action will also change the interface of the employee by blocking any other modification or deletions of the receipt.

In the case of the employee B all the receipts will be validated but for employee A the receipt from the ice-cream will be rejected since it doesn’t correspond to the enterprise policy of this scenario.

In the end the HR will have to change the status of all the processes, in this case to “Reembolso Valido” that means the reimbursement is valid. To do this the HR has

to click on the drop-down menu next to “Escolha” and select the correct option. After that click on the “Submeter” button.

iv) Log out of the application

To complete this task the HR will click on the top right corner button “Voltar”. This will allow to return to the main page where in the same position there will be another button “Log out” that will permit to log out of this section and thus completing the task.

In the end the HR does the same thing for the other employee.

As this is an application scenario there will be no more steps to validate. In a real case after this the HR will reimburse the employees and when finished it will change the process status to “Reembolso Pago” in English this means “Paid reimbursement” this action will conclude all of the processes of this trip.

The ice cream incident will be handled with 3 steps: 1) Rejection of the receipt, 2) Correction of the receipt, 3) Revalidation of the receipt.

Explaining each of these steps, the employees must:

i. Rejection of the receipt

The HR will reject this receipt has it doesn’t follow under the rules of this trip expenditures. To do this it will have to click on the “Desaprovar” button below the receipt.

He as to also change the process status to “Reembolso rejeitado” in English this means “reimbursement rejected”.

ii. Correction of the receipt

This task should be in the employee section but for simplicity it will be here.

The employee follows all the task mentioned above in section 4.1.1 until it reaches the ice cream receipt where it will click on the “Eliminar” button. This button will delete the receipt. In this scenario the ice cream receipt would never be accepted, but in some cases if there are other types of problems that can be resolved by changing, for example the data of the receipt in question, it can be done by clicking in the other button, the “Editar” button. This one instead of erasing the receipt it can change some of its parameters.

iii. Revalidation of the receipt

The HR will log in again in his account and go to the process of this trip from employee A to Oporto. After checking if the old receipt was been eliminated and all of the others are validated. The HR will change the status of this process to “Reembolso aceite” and follow the steps mentioned above to Log Out. The change to the status will indicate to the employee A that all of his expenditures in Oporto will be reimbursed.

After they fix the problem both of them were reimbursed.

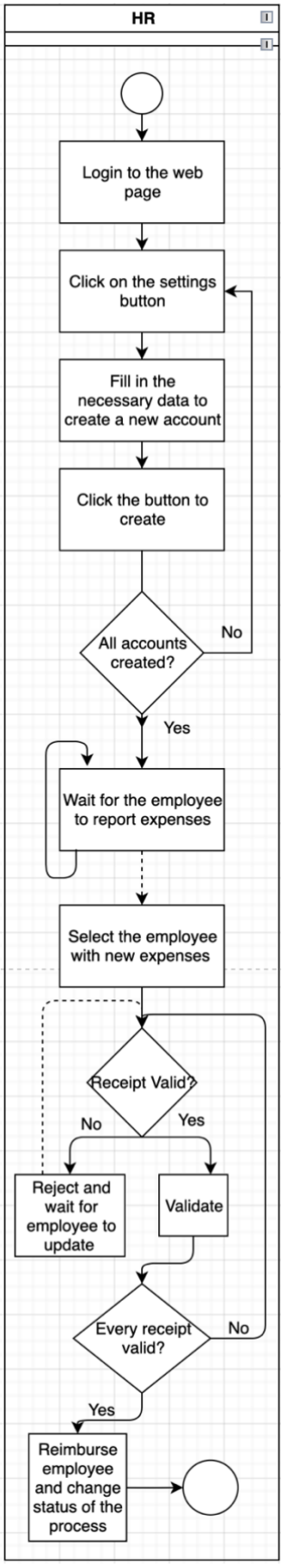

Figure 4.6 - Steps of HR

4.2 Testing

In the last section 4.1 we proposed a simulation to test this platform. This simulation covers every part of the program, from creating a new account for the employee to ending with the reimbursement of the employee and passing through the correction of an error in the receipt.

The first thing to validate is the creation of a new employee.

For a proper test, at the start a username and a password were introduced on the login page, as shown in Figure 5.9 - Screenshot of the login page. As expected, it wasn't possible to enter as this user is not created yet.

Figure 4.7 - Screenshot of the login page

The HR has to first enter with his account to create an account for each employee. For each of them, the HR needs to fill in the name, the password, the email, the IBAN, the NIF, and lastly the address, as shown in Figure 5.10 for employee A. Exactly the same screen will appear to introduce the date for employee B, but for simplicity, we will not show it here.

If the HR miss spells a number, the employee later can change it, he can also change the password. This can be seen in Figure 5.19

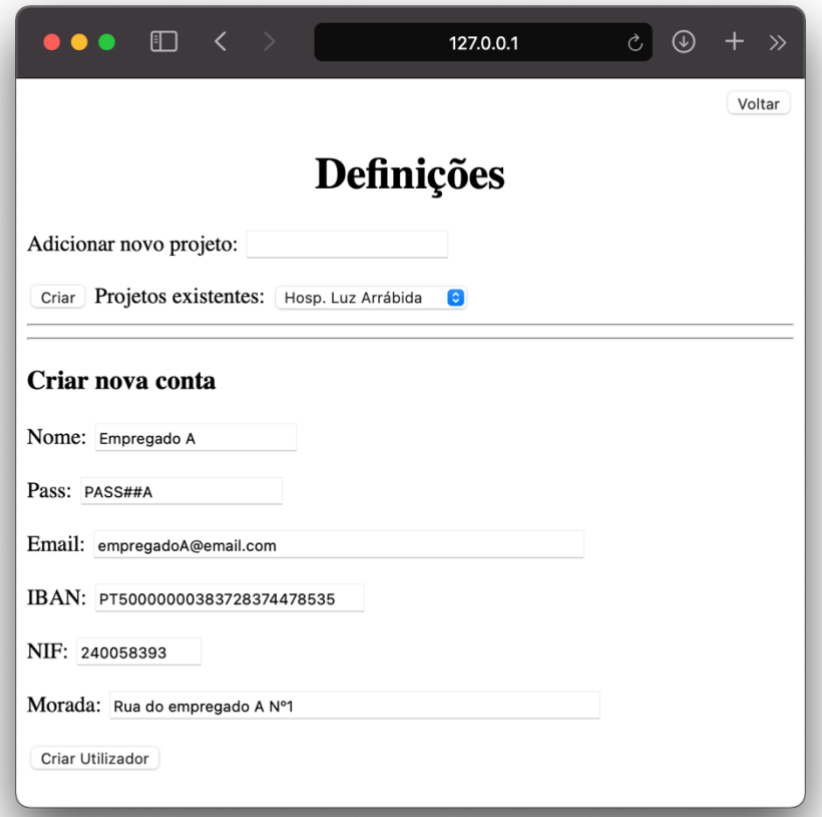

Figure 4.8 - Screenshot of the creation of a new account, with all the fields that need to be filled in

Now the employee can enter with his credentials. After login, the page will be almost empty as this is a new account. The employee needs to create a new process, this is done by filling in the first and last day of this process, the name of the project, and lastly a short description, as shown in Figure 5.11. In here it's presented the creation of the process the employee A had by going to Oporto to an enterprise to teach first aid. The same was done in the employee B account but with slightly different parameters.

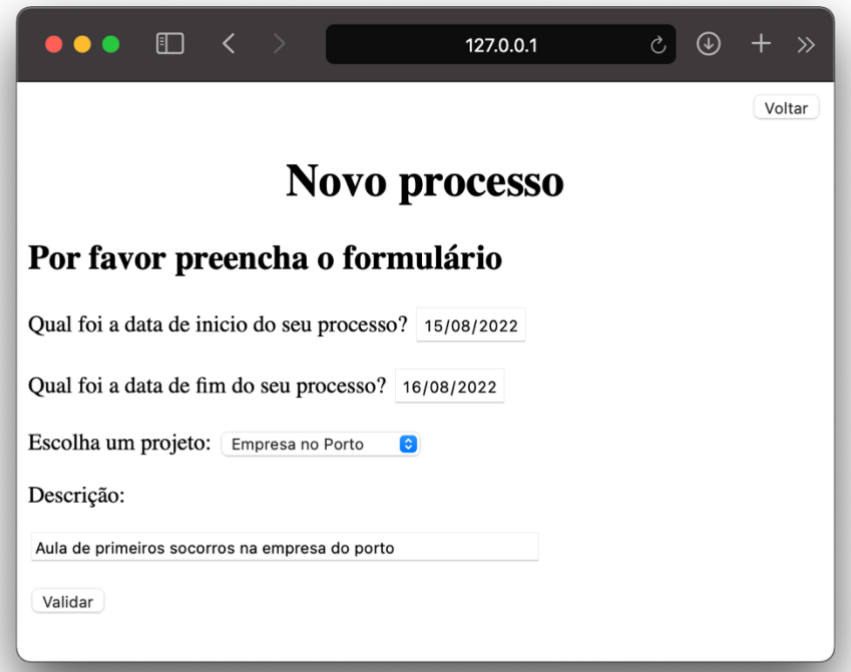

Figure 4.9 - Create process

These processes represent trips, so for every trip an employee does, he has to create a process for it. In this case the employee A and B created a process representing their trips to Oporto and Almada respectively.

In the main page the employees can see a list of all the process created so far.

By creating a process, now the employees can insert the receipts information of that process. This is done by filling in the type of expense, the amount paid, the date, the seller, the method of payment, and lastly a description, as shown in Figure 5.12. In here we can see the information of one receipt from employee A.

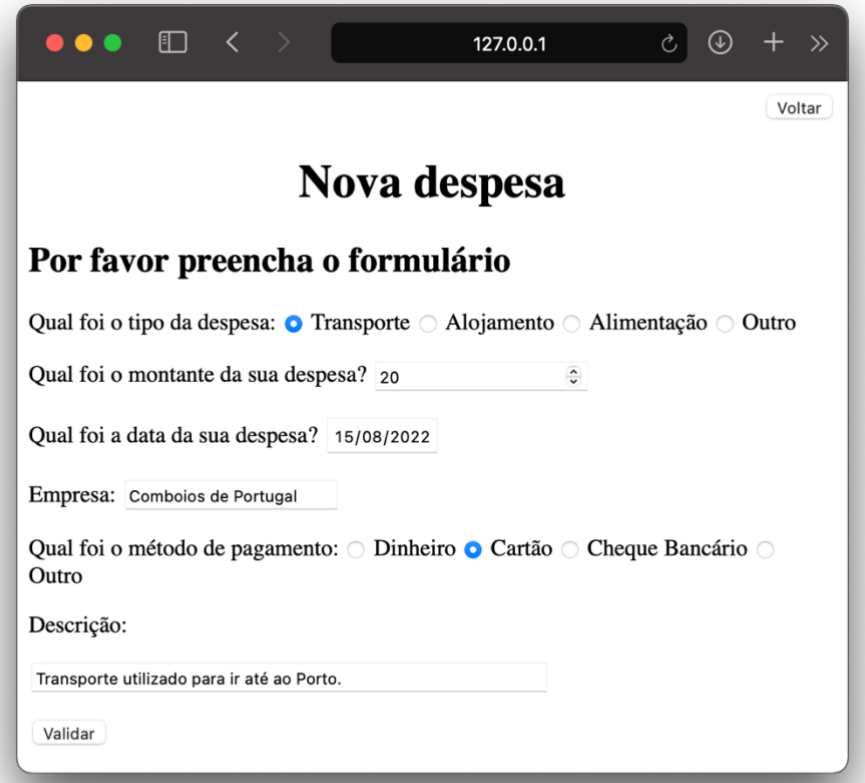

Figure 4.10 - Create receipt

The other receipts from employee A and B were also inserted but for simplicity there is no graphical representation. Although in Figure 5.13 is presented a list of some of the receipts from employee A.

These receipts have to be manually inserted one by one. Every single one is associated with one process. To know in what process the receipts are being associated, in the top of the page is a information that tells us in what process the changes are being made.

Figure 4.11 - Receipt list

After that, it waits for the response from the HR.

The HR will now enter his account and first selects which employee he wants, as shown in Figure 5.14. Here the creation of two employees is shown, employee A and B.

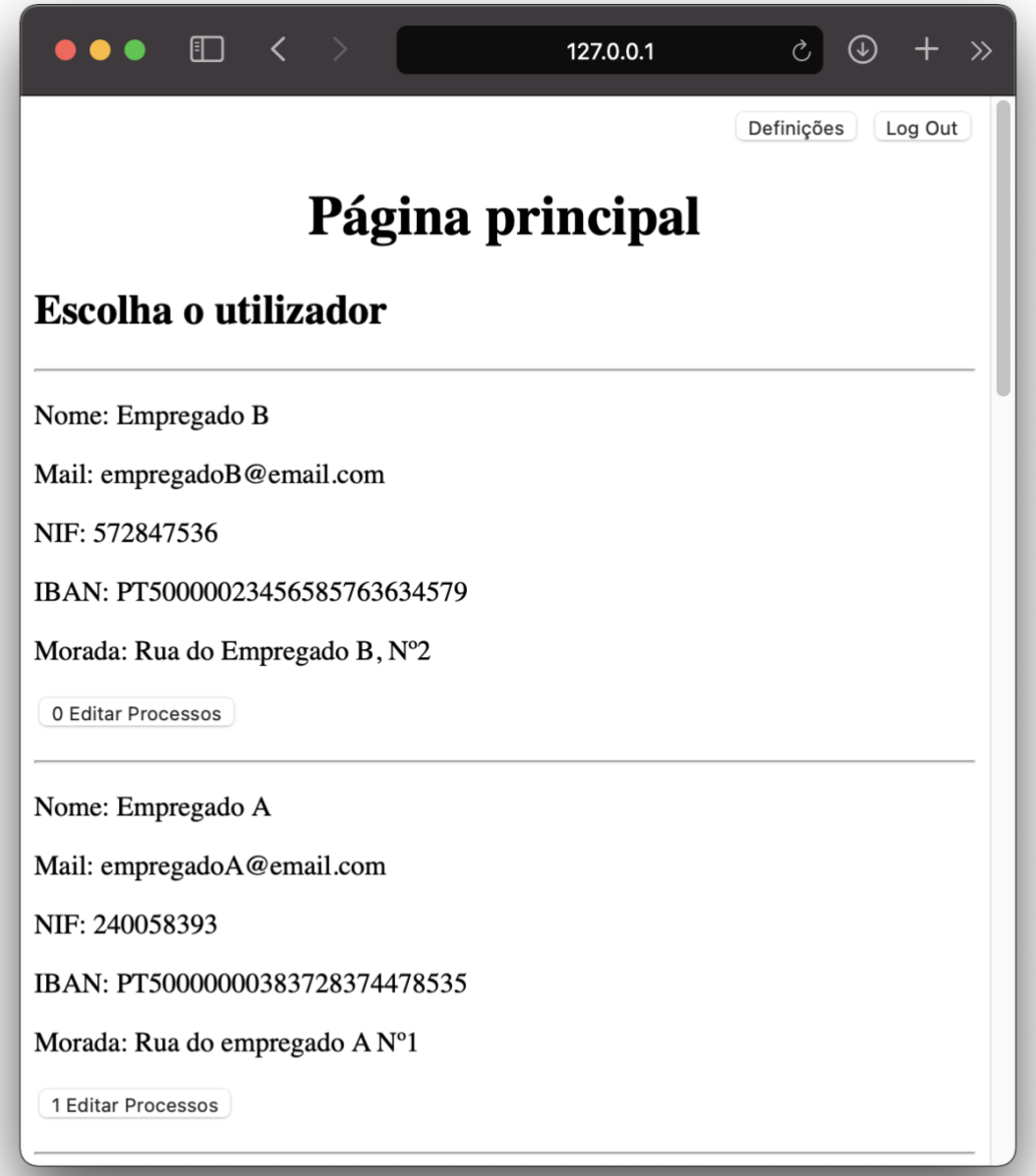

Figure 4.12 - Main page for HR

After selecting the employee, the HR will be able to see every process and receipt from that employee. As shown in Figure 5.15. This shows the receipts inside the process of employee A that went to Oporto and did many expenditures. It can also be noted that the two visible receipts in this list are already validated but because of the ice cream receipt was rejected the status of the all process is rejected until further changes. This can be seen in the status of the process below the description.

Figure 4.13 - View of the HR of the receipt list

Employee B has also a similar list but with less receipts. In this scenario they will all be validated, this will not be represented for simplicity. But in Figure 5.16 it can be seen from the employee B perspective what happens to the edit and delete button. They are disabled, so that no one can alter the parameters after they are approved.

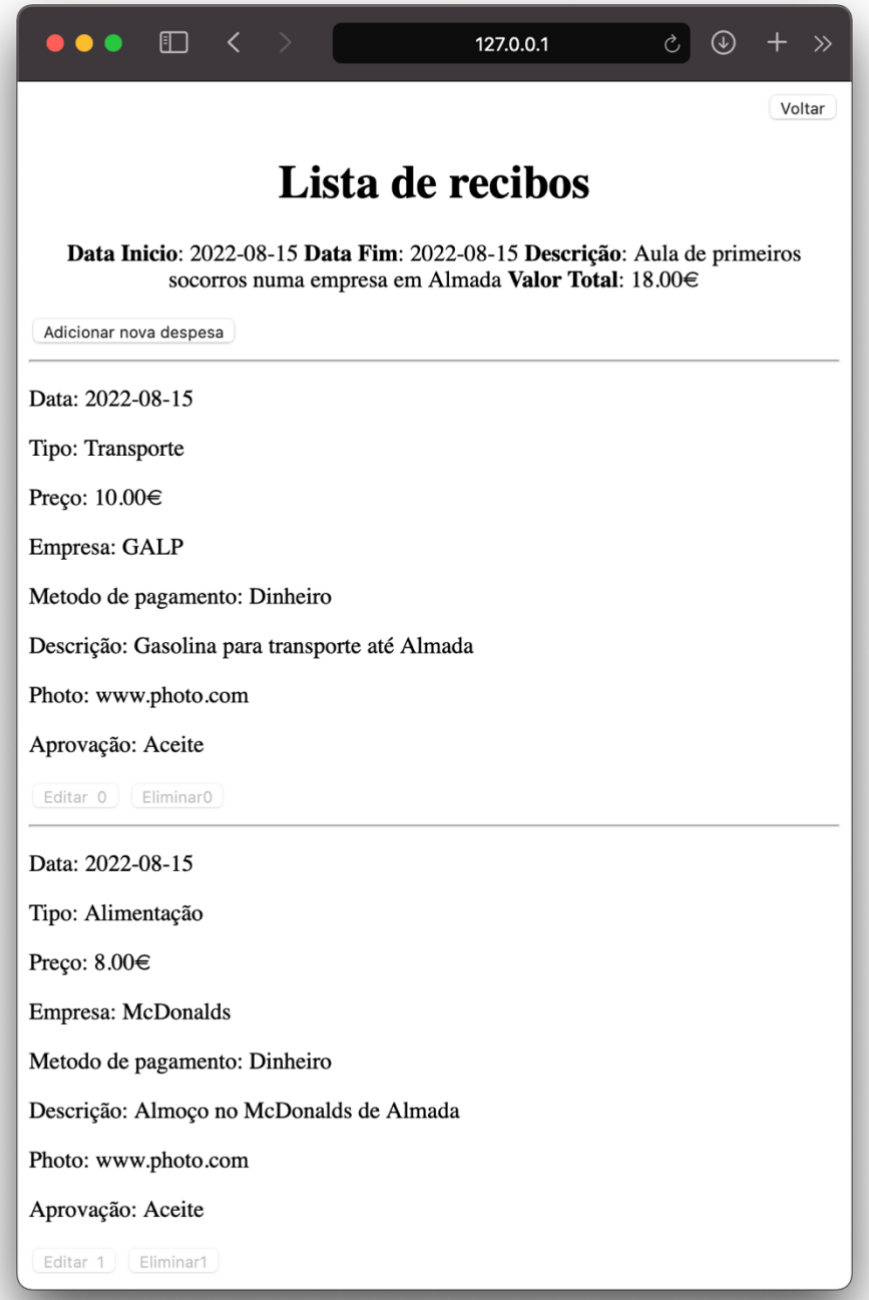

Figure 4.14 - Receipt list of employee B

In contrast to employee B, employee A will have a receipt rejected and in this scenario, he needs to delete it. This action is difficult to represent graphically with still pictures, but in Figure 5.18 when the HR is validating the process it can be seen that there is no ice cream receipt.

Even though its not mentioned in this scenario there is the possibility to alter the parameters of the receipts I they are rejected. The interface of the employee that wants to do this changes is shown in Figure 5.17.

This scenario doesn't have a editing part because as stated before this was done with the help of my brother and as a matter of fact when we has in the internship there was a similar case where one employee submitted a receipt that wasn't valid so afterwards he had to delete it. Even though it is a application scenario it represents the reality.

Figure 4.15 - Edit receipt

Lastly in Figure 5.18 it is showed the interface of the HR with the process of the employee A to Oporto that initially had a wrong receipt but now is in accordance with the enterprise policies. It can also be seen that the status of this process is already updated to reimbursement accepted. This lets the employee know that shortly after we will be paid back the full amount.

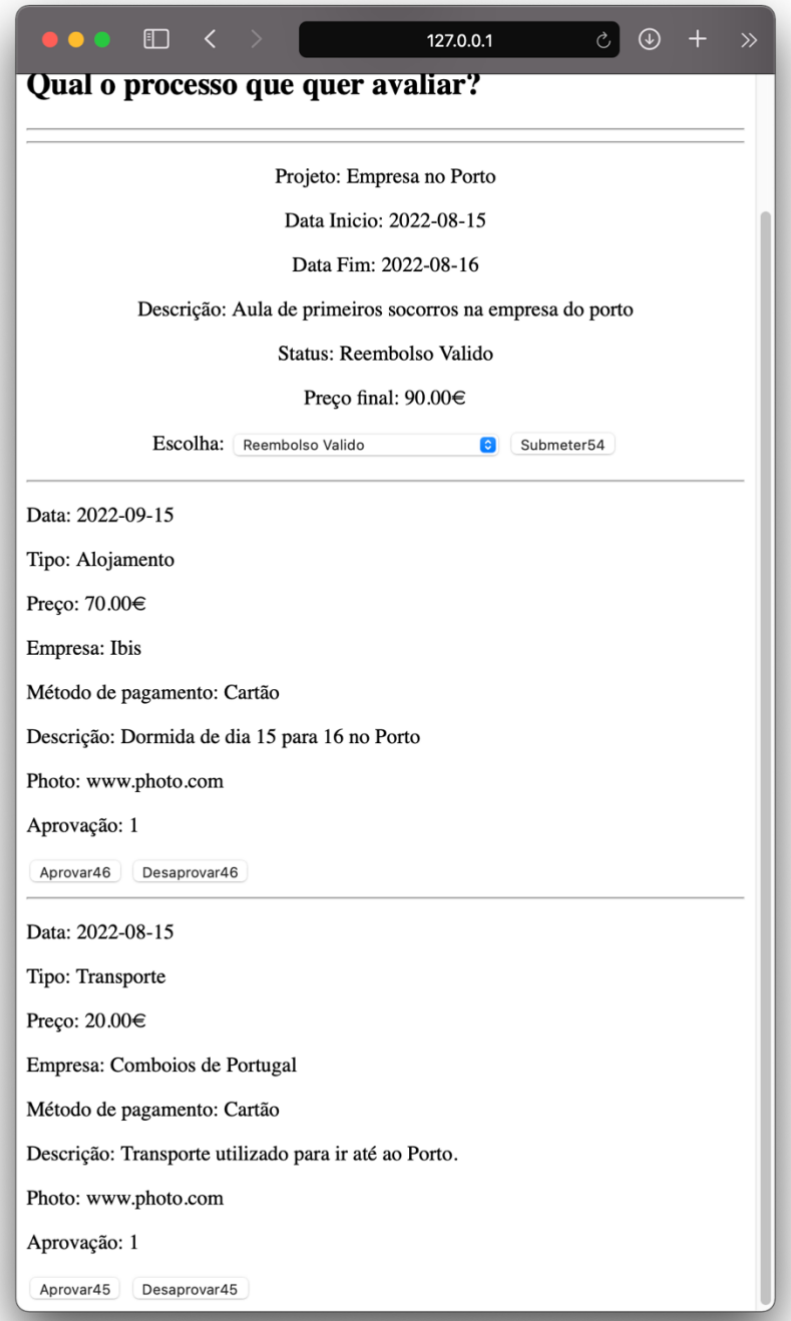

Figure 4.16 - HR view of employee A receipts

After the reimbursement is proceeded, the HR will return to his account and change the status to reimburse completed. This terminates the application scenario.

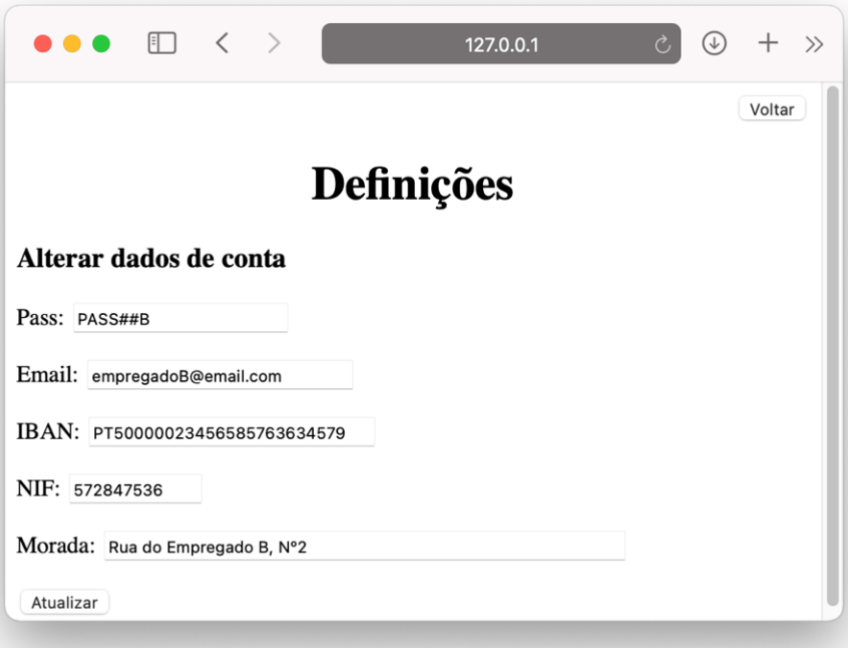

Figure 4.17 - Employee settings

4.3 Hypothesis validation

The original hypothesis of this dissertation was "Is it possible to create a free and user-friendly portal for submitting travel expenses, if so, we can drastically change how SMEs operate, making them more efficient and productive".

Section 6 is a good validation of the hypothesis formulated. It shows a it can be validated in a real environment.

As shown in section **Error! Reference source not found.**, a program was written to process the report and process travel expenses. This program was written in Python, runs in a server and is accessible via a standard browser (provided it supports HTML 5.0), using client/server environment, and updates a SQL database with all relevant data. The first part of the hypothesis is thus validated.

With this application scenario it was possible to validate many functions of the platform. First, the creation of a new user was validated positively with, and to do so, two new accounts for employees A and B were created. The creation of the accounts is shown in Figure 5.10. This image shows the interface the HR uses to create new accounts, the interface enables the input

nUser	name	admin	mail	morada
10	Empregado A	0	empregadoA@email.com	Rua do empregado A Nº1
11	Empregado B	0	empregadoB@email.com	Rua do Empregado B, Nº2

Figure 4.18 - Database table User with two employees

of data about the new accounts. This information goes through the backend and finally reaches the database, where it's going to be stored in the User table with a unique primary key.

This was followed by the possibility to create new processes for the trips the employee made. The process created represents the work trip made by the employees. For this, the employees had to fill in the necessary data for the backend to send it to the database. In the database there is a table called Process, this table keeps the data of the process. This is shown in Figure 5.11, where it's presented the form needed to fill in for the creation of the process.

The next step was to validate if it was possible to create receipts. All the receipts created in this application scenario are shown in Figure 4.19. Receipts are saved in the database within a table called receipts. Every receipt is associated with one process, because when the employee does an expense, this is associated to one and one only process or in other words a work trip. The creation of a receipt can be seen in Figure 5.12, where it is a form that needs to be filled with the data from the physical receipt the employee got.

nrecit	nProcess	day	type	price	description
45	54	2022-08-15	1	20.00	Transporte utilizado para ir até ao Porto.
46	54	2022-09-15	2	70.00	Dormida de dia 15 para 16 no Porto
48	55	2022-08-15	1	10.00	Gasolina para transporte até Almada
49	55	2022-08-15	3	8.00	Almoço no McDonalds de Almada
50	55	2022-08-15	3	30.00	Almoço

Figure 4.19 - Database table Recit with receipts from the employees

These last three steps were validated and with this most of the phases by the employee are achieved. The big last step is done by the HR.

The first thing to validate in the HR environment, is if it is possible to check and evaluate the receipts from the employees. This interface can be seen in Figure 5.15 where is a list of all the receipts from employee A. This data was selected from the database and is presented with the frontend, the query made to the database not only requests data from the Receipt table but also from the Process table. The reasoning behind it is to facilitate the HR understand which receipts are from the different processes. This validates the possibility to check the receipts.

To validate the evaluation of the receipt by the HR, it is shown in Figure 5.18. Where the list of receipts from employee A is already evaluated, as can be seen by the status in every receipt. To evaluate them the HR changes the value of the approved column in the Receipt table. This column has a Boolean value that indicates if the receipt has been accepted or not.

HR can also evaluate the process after evaluating the receipts within the process. This will change the status column to the desired state, this can be different depending on the situation.

A portal for submitting travel expenses entails the employee's need to report them and the HR needs to validate them. This application scenario enabled to validate if this platform could achieve all these steps.

As shown in the next chapter, the system proved to be useful for an SME. This proved digital transformation helps SMEs improve in the market. This improvement can be seen as this platform enables them to be more efficient and productive.

4.4 Real test

On the 14th of September of 2022, in Alverca do Ribatejo on a small store that sells Liquefied petroleum gas (LPG or LP gas) named Elvira & Vieira Lda. It was possible to have two workers

available for this experiment, one responsible for HR and another responsible for managing the field workers, in other words an employee. The week before this test took place, the employee was told to save some receipts of his expenses, this allowed it to be a better trial.

First of all the administrator was given the admin credentials that she used to enter and create an account for her employee. Then the employee entered with his credentials and created a process to insert the receipts of that week. This was followed by the filling of the receipts data. After the employee completed every step it was time for the HR manager to validate the reports.

The HR opened up her account and proceeded to analyse the receipts, and check the enterprise policies. Everything was accordingly so the HR validated everything except of a price error from the employee. The employee quickly edited the receipt data, at the same time noticing that every other receipt was accepted and he can no longer change or delete them.

The HR didn´t even close his session just refresh it and the old receipt was already with the new changes. Then he advanced to validate it, but before he double-checked if the update was correct.

In the end the HR changed the status of the process to reimbursement valid and pressed submit. While submitting he realized there were many more possible states a process could be in. I explained the other possible ways the report could have gone.

This is when in some enterprises the employees first has to request the expense, and only after approval could he make the purchase.

Figure 4.20 - Picture of store front

After the resolution of the incident the employee and the HR manager concluded the test.

4.5 HR experience

There were 2 main topics from the HR:

- As the enterprise uses paper for reporting travel expenses, the HR gave big importance to the image of the receipt. With this saying it's the only way to prevent fake reports.

- There isn´t a way to see the total value of the receipts from all the employees of the enterprise. This fact goes hand in hand with the first point the HR made. He wants a way to see detailed information about the value of the receipts.

4.6 Employee experience

The employee was really focused and could more easily navigate through the platform. As this was all new he didn't have much to criticize.

The employee made 3 remarks:

- Practical. The first thing the employee thought about was the practical use of this kind of platform. He realized this would mean a faster reimbursement and was very happy about it. He thought of the facility of use when at home in his comfort and could report and analyse the status of the process.
  He told that compared with the manual system in place, this was more useful and practical to complete the report.
- Intuitive. The second thing the employee thought was how intuitive it was. The method for reporting expenses was easy and understandable. He talked about the other workers and said they would probably understand quickly how to manoeuvre on the platform.
- At last he said the process could be more agile but at the same time couldn't give a way to do it. My take is that by doing everything in one take, the process looked like it could be different.

5

CONCLUSION

The work developed for this thesis demonstrates that is it possible to create a free and user-friendly platform to submit travel expenses, so we can provide SMEs with one more tool to make their digital transformation.

The key point was to help SMEs achieve the digital transition with the help of a cheap and easy platform to validate travel expenses. A practical demonstration was detailed as an example, and it validates the tool as being effective in achieving its desired goal. This tool does in fact allow the transition to digital since, being a completely digital, computer-based process, it does not require any extra use of paper and allows all the advantages normally associated with digital, like easy and powerful analysis and control and cheap and durable archival options. With the exception of the receipt given to the employee at the moment of the transaction, there is no other physical printed paper involved – not even for approval signatures. The platform as a whole, effectively helps enterprises manage their overall expenses with travel in an efficient and less cumbersome way, relative to what is normally used in these family sized businesses. This is achieved while reducing the overhead costs to a minimum.

The work developed, and the proof of concept that it exemplifies, shows how this methodology is capable of fulfilling the requirements of an SME. This is clearly stated with the practical example of a real-world business that operates in the greater Lisbon area and that employs ten people, including the owners.

This thesis started by exposing the issues regarding digital transformation and giving some insights into possible ways to turn it into reality in the case of enterprises that do not have the means, awareness, capital, and know how to achieve it, mostly because of their small size.

After that, it looked deeper into the issue of reporting travel expenses and clarified one solution road map.

As such, it was shown that not only big enterprises can improve their systems going digital, but also SMEs can compete in digitalizing their processes. This means that enterprises big or small have a fighting chance in digitalizing the way they work on everyday business.

For distributing this platform and letting others contribute for its improvement, it has been posted on GitHub. There is a user manual attached to the software in the platform, to help install and use the tool.

As stated before, this platform has some shortcomings and could clearly be improved upon in the future.

These are some further work points that have been identified:

- The security could be improved by adding encryption to the sensitive credentials, and by using a more conservative approach to programming. This would be critical in a real environment where consequences are serious and potentially very damaging.
- The platform where the tool runs could be better, since it would be more usable if the employee could have an app on their phone. This would increase the ease of use and it would not be necessary to use the PC – at least for some of the procedures involved.
- The frontend could be more appealing to the user enabling a better experience. This can be achieved with programming languages like CSS and JavaScript.
- The program could be more well packaged for mass distribution. This can be achieved with programs like Docker.

As a final conclusion it can be safely stated that it is possible to supply small businesses with a practical and cost-effective way to manage expenses.

This tool may be one of the first steps towards a deeper digital transition of the SMEs that adopt it, and its benefits might go beyond just managing travel expenses. The benefits in productivity, control and even carbon footprint of this digital solution will, hopefully, fuel the enthusiasm of all stakeholders regarding a global digital transition which gives us, and our planet, a better future.

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A

USER MANUAL

This annex is a complete guide, from the installation to the actual user manual. The installation has all the necessary third-party software to install and their version. The user manual has the details of how an employee or HR can use the platform.

A.1 Installation

This platform requires the installation of three main parts. The database server, the web framework, and the programing language. After this it will also be needed to install small tools for programing.

Let’s start by the database. It was used the MariaDB server, to install it, first open the command line and go to the desired folder for this project. To install MariaDB on a macOS or Linux terminal first its needed the HomeBrew, this package install the “stuff” missing in your system to install programs like MariaDB.

In the Terminal type – $ /bin/bash -c "$(curl -fsSL https://raw.githubusercontent.com/Homebrew/install/HEAD/install.sh)" follow the steps of the command line until it finishes installing.

Next comes the installation of MariaDB with the help of HomeBrew, for this type:

```
$ brew install mariadb
```

In the terminal. After installation start the server with:

```
$ mysql.server start
```

To auto-start MariaDB Server, use Homebrew's services functionality, which congits auto-start with the launchctl utility from launchd:

```
$ brew services start mariadb
```

Then install an environment do isolate this version of packages

```
$ brew install virtualenv
```

Now that the virtual environment is installed, we need to create one environment specific to this project, the name of the environment is at your choosing, for this we will use venv.

After navigating to the folder you want to create your virtual environment type:

```
$ virtualenv venv
```

At last, to activate our newly created environment type:

```
$ . venv/bin/activate
```

It is possible to see if the environment run properly by seeing the name surrounded with curved paretencies, of the virtual environment before the name of the folder. In this case (venv).

Next step is to install Python or to update it. This application is running the Python 3.8.9 version. The command for installing this version of python is:

```
$ Pyenv install 3.8.9
```

To install flask, it should be done inside the virtual environment. In this case is as it follows:

```
$ (venv) $ pip install flask
```

After installing all the components, the last thing is to import the folder with the code (python and HTML). For this go to GitHub (https://github.com/uates8/Tese.git)

A.2 User Manual

The user manual is divided in two subsections, one for the employees and another for the HR. This user manual helps the user use the platform.

The first step is to log on to the user account this is done by inserting the right credential. First the backend will see if there is entry in the database with that name, after that it will check if the value from the pass in the database is the same it got from the frontend.

Almost all pages will have a button in the top right corner to go back to the previous page, labeled “Voltar”.

A.2.1Employee

Login to http://127.0.0.1:5000 on any browser.

This platform uses Single Sign-On (SSO), if prompted, log in with your enterprise account.

In the main page there are 4 options: Log Out; Settings; Create new process; Edit process.

- Log Out – If you want to log out click on the top right corner button with the label “Log Out”.
- Settings – If you need to change the password or any other information of your account, click on the button left of the “Log Out” button. This being in the top right corner.

- Create new process – If you want to create a new process, click on the button in the top left corner.
- Edit process – If you want to check or change the receipts click on the button below the associated process. This button is labeled “Editar”

In the receipt page there are 4 options: Go back; Create new receipt; Edit receipt; Erase receipt.

- Go back – If you want to go back to the previous page, click on the top right corner button labeled “Voltar”.
- Create new receipt – If you want to create a new receipt click on the top right corner button labeled “Criar novo receibo”.
- Edit receipt – If you want to edit a receipt, click on the button below the supposed the receipt, with the label “Editar”
- Erase receipt – If you want to erase a receipt, click on the button below the supposed the receipt, with the label “Eliminar”.

A.2.2HR

Log in to http://127.0.0.1:5000 on any browser.

This platform uses Single Sign-On (SSO), if prompted, log in with your administrator account.

In the main page there are 3 options: Log Out; Settings; Select user.

- Log Out – If you want to log out click on the top right corner button with the label “Log Out”.
- Settings – If you want to create a new project or want to create a new account for an employee, click on the button left of the “Log Out” button. This being in the top right corner.
- Select user – If you want to see the expenses from one employee, click on the button below the user pretended, with the label “Editar Processos”.

By selecting a user, it redirects to the user page where its all of the receipts from that user. There are 3 options: Go back; Approve/Reject; Changes status.

- Go back – If you want to return to the last page.
- Approve/Reject – If you want to approve or reject a receipt just click the button below the receipt.
- Changes status – If you want to change the status of the process, first click on the drop down menu and select the correct status. Then click on the button to its right to change the status of the process.