

Masters in Informatics Engineering
Project
Final Report

Platform to support Human Resources

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Abstract

With the company's growth, saving time on routine tasks becomes a priority in order to allow resources to be used in other areas. The human resources processes, if not streamlined, may lead to hours to collect data that otherwise would be available in minutes.

This Internship of the Masters in Informatics Engeneering aims to develop a tool that will support the WIT's recruitment process.

The recruitment process consists of several activities and relies on manual tasks using isolated tools. In order to automate some of the tasks of the process and ensure that the elements required in the process are available it was decided to develop WIT Jobs project. The WIT Jobs project is composed by several components: the application form and the WIT Jobs platform.

The application form will enable the integration with the WIT's website, where candidates will submit their application.

The WIT Jobs web platform allows the user to view all data attractively and intuitively, managing all information concerning the recruitment process and visualizing reports that can be exported and enable to take conclusions about the process.

The goal of this work is to develop a web platform to support the process of recruiting of WIT-Software, expecting significant improvements in team performance optimizing the whole process.

Keywords

"Human Resources", "Reports", "Dashboard", "Recruitment and selection", "Online candidacy", "Vacation Scheduling", "Email Notifications".

Acronyms

Acronyms	Term
API	<i>Application Programming Interface</i>
ERP	<i>Enterprise Resource Planning</i>
HTML	<i>Hyper Text Markup Language</i>
HTTP	<i>Hypertext Transfer Protocol</i>
HTTPS	<i>Hypertext Transfer Protocol</i>
HR	<i>Human Resources</i>
KPI	<i>Key Performance Indicators</i>
MVC	<i>Model-View-Controller</i>
OLAP	<i>Online Analytical Processing</i>
SVN	<i>Subversion</i>
SOAP	<i>Simple Object Access Protocol</i>
SSO	<i>Single Sign-On</i>
UI	<i>User Interface</i>
URL	<i>Unified Resource Locator</i>
XML	<i>Extensible Markup Language</i>

Glossary

Term	Description
<i>Dashboard</i>	“an easy to read, often single page, real-time user interface, showing a graphical presentation of the current status (snapshot) and historical trends of an organization’s key performance indicators to enable instantaneous and informed decisions to be made at a glance” ^[53]
<i>SCRUM</i>	Iterative and incremental framework for managing complex work. ^[32]

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1 Introduction

The development of this project is part of the internship from the Master in Informatics Engineering, University of Coimbra. The work was developed at WIT Software S.A., under the guidance of Professor Dr. Paulo Rupino and the Engineer Sérgio Cardana.

1.1 The institution

WIT-Software is a company specialized in developing applications for the world of mobile communications.

Founded in March of 2001 as a spin-off of the University of Coimbra, WIT-Software has a strong position on the world market, having clients in more than 15 countries including the major operators: Vodafone, Telefonica and Teliasonera.

The company has offices in Coimbra, Lisbon, Porto, Leiria and San Jose in California (USA).

1.2 Context

This project addresses the management of vacation days, absences and licenses, hence aiming for the area of human resources since it is this area that are major problems in these processes.

The recruitment process at WIT is divided into several stages where there are several intervening parts such as the candidate, the curriculum evaluator, the test evaluator, the interviewer and the responsible for human resources. Therefore, to improve the recruitment process in the company, the focus will be on the tasks that can be optimized.

Vacation and absences management has an extreme importance for a company. On one hand we have to meet the deadline of several projects and on the other we have the employee rights and the necessary communication with the accounting department to ensure that employees are paid according with their working time. So, it's crucial to keep all the information together through a process that ensures that all requirements mentioned above are met.

1.3 Motivation

Along with the company's growth in recent years, came the need of building up its workforce and a growing concern in selecting the right candidate for a given position.

Thus, it is fundamental to optimize the recruitment process by analyzing where the major part of resources and time is spent. The development of a platform to aid the recruitment process can reduce the time spent by human resources in routine tasks, improve the way contracts are made in order to find people with skills adequate to the company's needs. The creation of a report module will allow analyzing the data in detail, saving time and resources, seeing what stage of the recruitment process candidates fail and evaluate the company's growth.

With the company's growth in size and number of workers, the complexity of vacation booking increased, due to difficulties in storing all necessary information without errors. Currently, the vacation and absence booking system has a few flaws since all the information is managed using Excel. Losing the reference to the employee vacation map is enough to have to redo all the references for the global vacation map. Besides, since the company teams change often, it becomes quite difficult to keep a map of vacation per team or delegation. This leads to tasks that consume a lot of time and becomes important to optimize and improve this process.

1.4 Existing Processes

To know where recruitment and vacation scheduling processes can be optimized, it is important to analyze in detail each of them to see where time is being spent unnecessarily on routine tasks.

Therefore, one of the tasks carried out in this internship was a detailed analysis of the recruitment, the absence and vacation day processes, before and after construction of the respective platform.

A detailed analysis of the processes can be found in Annex A. In this chapter we will only make a brief summing up of the tasks that can be optimized.

1.4.1 Recruitment and selection

One of tasks that is repetitive and time consuming is saving the candidate's information. The responsible HR need to store the candidate's curriculum and application, which nowadays starts with the candidate sending an email to WIT-Jobs. Someone will save the CV file in to a specific folder, giving an ID to the candidate, changing the file name and saving the details in an Excel file. Then, HR will send an email to the candidate requesting to fill the application form. After the application form, they search for the candidates details, change the file name to correspond to the candidates ID and store it in the same folder as the CV. Then the human resources will update an existing spreadsheet where the CV reviewers will check for updates and introduce their evaluation for the candidates CV.

Although these tasks take little time, it becomes challenging given the amount of applications sent to WIT. The construction of a platform will not only simplify the process, it will also reduce the time spent for each of the people involved in this process and enable the analysis of data concerning this process, as well as improve the selection of candidates.

1.4.2 Absences and vacation management

Nowadays managing holidays and absences of the WIT's employees is done through excel. Each employee has an excel file, that should fill out each time he wants to schedule vacations or request an absence, and there is a general map with the absence and vacation days that has references to the file on vacation from each of the company's employees.

With the company's growth in recent years, the management of this information has become quite complex and there are certain requirements that make this process difficult to be analyzed. This process is very susceptible to mistakes, every year it is necessary to redo

the mapping of excel files which is very time consuming and prevents the execution of some tasks.

1.5 Objectives

Initially, the goals of this work were mainly two:

- To construct a web platform to manage all the information within the recruitment process;
- To construct a web platform to manage all the information about the vacation and absence of a collaborator and make the payments according to that;

Saving time and avoiding errors are the largest occupations in relation to the recruitment process and the process of managing absences and vacation scheduling therefore is intended that the construction of the two platforms will simplify tasks and increase productivity.

A detailed analysis of the comparison of the company processes, before and after the construction, can be found in Annex A. This document also includes an estimate of the time it takes to perform each task and what the gain (in minutes) of the utilization of each platform.

The conclusions about the recruitment process say that for each candidate, depending in which phase the process is conclude, is possible to reduce the time spent during the process in about 35 minutes.

To the holiday management platform predicts that for each leave request the gain will 15min and the elimination of the several hours (over 12 hours) spent to create templates annually.

1.6 Document structure

This report it's divided into seven chapters:

1. **Introduction-** In the first chapter we make a context of the project, the motivation and the goals of the internship;
2. **Work Plan and methodology-** In the second section of this report is present the work plan of this internship and the used methodology is described;
3. **State of the Art-** Chapter 3 is divided into three sections where we analyze the tools existing in the market about recruitment and the tools about the vacation, at the end of this chapter we do a comparative analyses of the studied tools;
4. **Platform Design-** In the 4th chapter of this report presents the platform requirements, some technologies are analyzed and is described the architecture of the platform.
5. **Tests-** This chapter presents the case testes created and discuss the results.
6. **Final Product-** The chapter 6 is composed by a brief presentation of resulting product with images of the main screens of the platform.
7. **Future Work and Conclusions-** In the 7th chapter, is discussed the features that will be implemented in the future and the final thoughts on the implementation of the project are presented;

2 Work Plan and Methodology

In this chapter is documented the development process used and the project planning. The planning stage is divided in two semesters and the presented versions include the changes that have occurred during the 10 months of this internship.

2.1 Initial Planning

The initial planning of this internship, started at September 3 of 2012 ending in June 1, 2013. As can be seen in Image 1-Initial planning, the first task of this stage was the requirements analysis followed by the analysis of the state of the art and *mockups*.

After the analysis of all these points, the development preparation should start by defining the application architecture and creating the ER diagram. The creation of ER diagram took several iterations to get to the data model correct.

Following the analysis of the technologies to use, the development could start and is divided into three modules:

- **Recruitment and Selection**- module to manage all information concerning the recruitment process;
- **Employees Management**-module responsible for managing information about employees;
- **Vacations**- module responsible for managing the information about the global vacation map and the map of every employee, team and delegation. Besides, this module would also manage the information about the various absences of employees to make salary payments accordingly.

After collecting all necessary data, the work would proceed with the creation of a platform including each of the three modules mentioned above. After creating each of these modules it would exist a testing phase for corrections. The internship would end with a phase to analyse and implement the non-functional requirements.

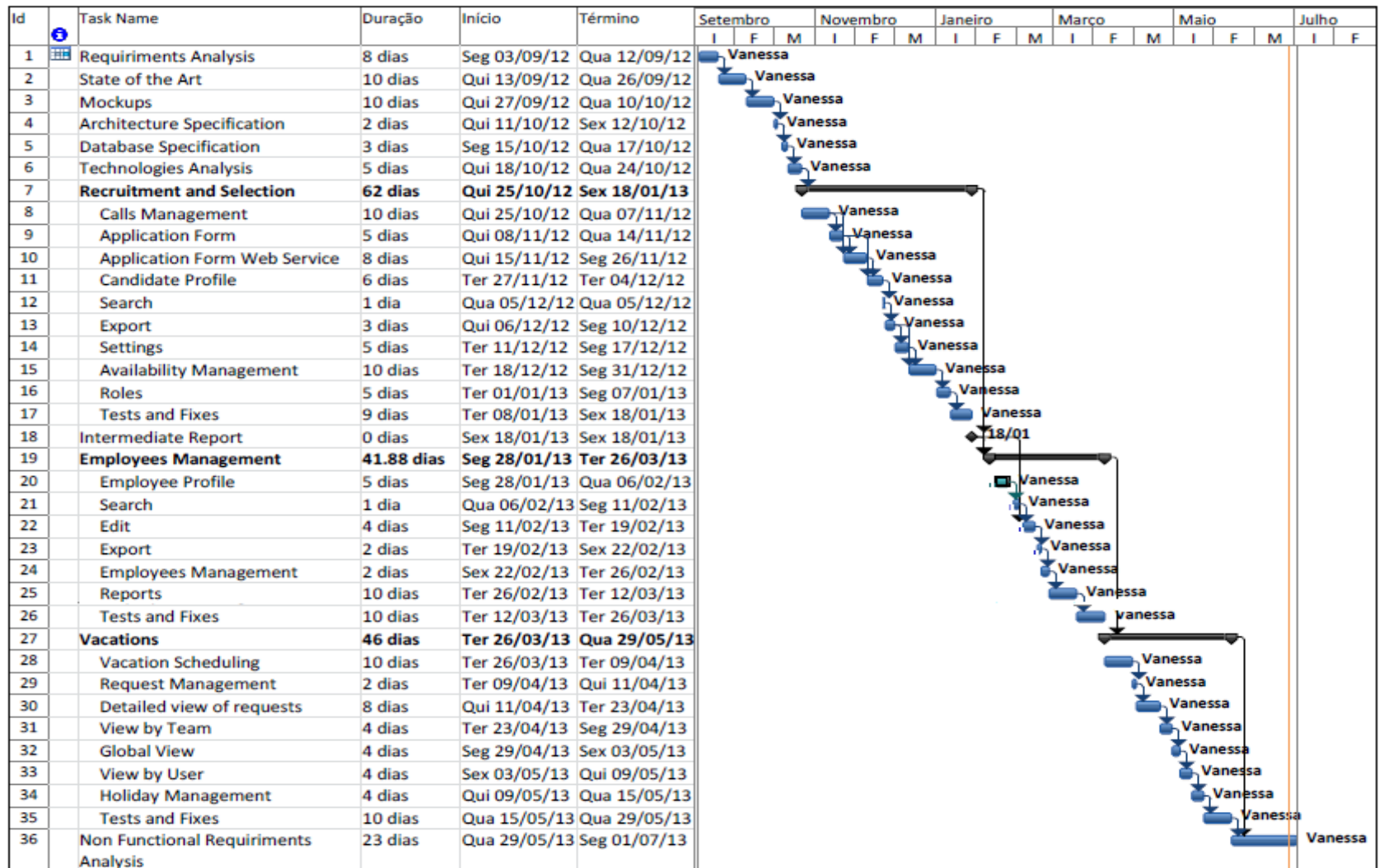


Image 1-Initial planning

2.2 Intermediate Planning

In the Image 2-Intermediate Planning and in the Image 3- Intermediate Planning (continuation) is presented the planning of this internship presented in February.

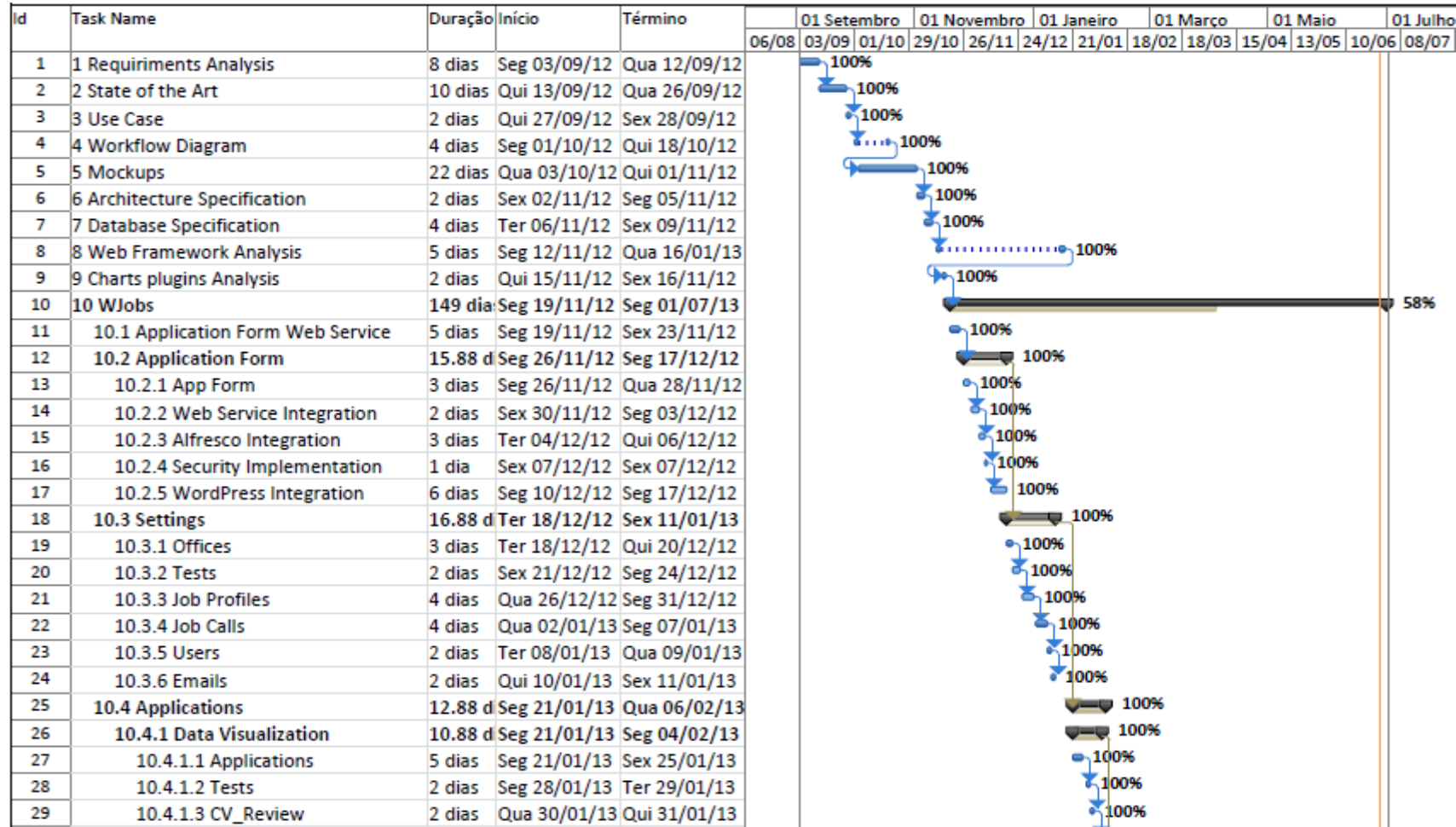


Image 2-Intermediate Planning

PlaneamentoFinal																
Id	Task Name	Duração	Início	Término	01 Setembro		01 Novembro		01 Janeiro		01 Março		01 Maio		01 Julho	
					06/08	03/09	01/10	29/10	26/11	24/12	21/01	18/02	18/03	15/04	13/05	10/06
30	10.4.1.4 Interview	2 dias	Sex 01/02/13	Seg 04/02/13						100%						
31	10.4.2 Export	2 dias	Ter 05/02/13	Qua 06/02/13						100%						
32	10.5 Intermediate Report	0 dias	Seg 28/01/13	Seg 28/01/13						28/01						
33	10.6 Profile	9 dias	Qui 07/02/13	Ter 19/02/13						100%						
34	10.6.1 CV Evaluation	3 dias	Qui 07/02/13	Seg 11/02/13						100%						
35	10.6.2 Tests	2 dias	Ter 12/02/13	Qua 13/02/13						100%						
36	10.6.3 Interview	2 dias	Qui 14/02/13	Sex 15/02/13						100%						
37	10.6.4 HR Details	2 dias	Seg 18/02/13	Ter 19/02/13						100%						
38	10.7 Recruitment Reports	15 dias	Qua 20/02/13	Ter 12/03/13						100%						
39	10.7.1 Dashboard	4 dias	Qua 20/02/13	Seg 25/02/13						100%						
40	10.7.2 Applications	3 dias	Ter 26/02/13	Qui 28/02/13						100%						
41	10.7.3 Test	2 dias	Sex 01/03/13	Seg 04/03/13						100%						
42	10.7.4 Interview	2 dias	Ter 05/03/13	Qua 06/03/13						100%						
43	10.7.5 Proposals	2 dias	Qui 07/03/13	Sex 08/03/13						100%						
44	10.7.6 Hiring	2 dias	Seg 11/03/13	Ter 12/03/13						100%						
45	10.8 SSO Integration	1 dia	Qua 13/03/13	Qua 13/03/13						100%						
46	10.9 Tests and Fixes	11 dias	Qui 14/03/13	Qui 28/03/13						100%						
47	10.10 Linkdin Integration	43 dias	Seg 01/04/13	Sex 31/05/13						100%						
48	10.10.1 API Analysis	8 dias	Seg 01/04/13	Qua 10/04/13						0%						
49	10.10.2 Requirimens Analysis	5 dias	Qui 11/04/13	Qua 17/04/13						0%						
50	10.10.3 Development	25 dias	Qui 18/04/13	Sex 24/05/13						0%						
51	10.10.4 Tests and Fixes	5 dias	Seg 27/05/13	Sex 31/05/13						0%						
52	10.11 Non-Functional Requiriments	19 dias	Seg 03/06/13	Sex 28/06/13						0%						
53	10.11.1 Performance	5 dias	Seg 03/06/13	Sex 07/06/13						0%						
54	10.11.2 Scalability	5 dias	Ter 11/06/13	Seg 17/06/13						0%						
55	10.11.3 Security	5 dias	Ter 18/06/13	Seg 24/06/13						0%						
56	10.11.4 Dependability	4 dias	Ter 25/06/13	Sex 28/06/13						0%						
57	10.12 Final Release	0 dias	Seg 01/07/13	Seg 01/07/13						0%						01/07

Image 3- Intermediate Planning (continuation)

Due to the changes on requirements and due to the acquisition of a commercial platform to manage all information concerning the scheduling of absences or vacations, there was a need to adapt the internship planning.

In the Image 2-Intermediate Planning and in the Image 3- Intermediate Planning (continuation) is possible to see that besides the tasks preceding the beginning of the development, it was added a new task to analyze the tools to build graphics and the development time of the platform WIT Jobs increased. The deadline for the development of the platform WIT-Jobs became the 21st and March followed by a period for testing and corrections.

Upon completion of the platform would be done a study on the LinkedIn API, to analyze which features may be useful, in the context of the recruitment process. After developing all the functionalities, there will be a new period for tests and corrections followed by a period for an analysis of non-functional requirements.

In short, once it was found that the creation of the module to manage the information of the employees didn't bring any gain to the company and from January 2012 the company began to use the "Time Off Manager" to manage vacation requests it was decided that there would be room for the development of recruitment platform giving emphasis to its usability and there would be still time for an analysis of LinkedIn then the subsequent integration of these features. Also, since the time available for the development of the platform increased it was decided to give emphasis to the creation of custom screens so that each user sees directly the information that intends to see.

2.3 Final Planning

This section presents the final planning of this internship and contains an analysis of the tasks performed and the changes that were made to final planning in relation to the initial planning and to intermediate planning.

The final planning of this internship can be found in the Image 4-Final planning and in the Image 5-Final Planning (Continuation).

By reviewing the final planning and comparing it with the planning presented at the beginning of the semester we can see that some tasks were removed, some tasks were added and that the duration of any of the tasks was adjusted to include time to perform the alterations that were ordered at the end of each sprint.

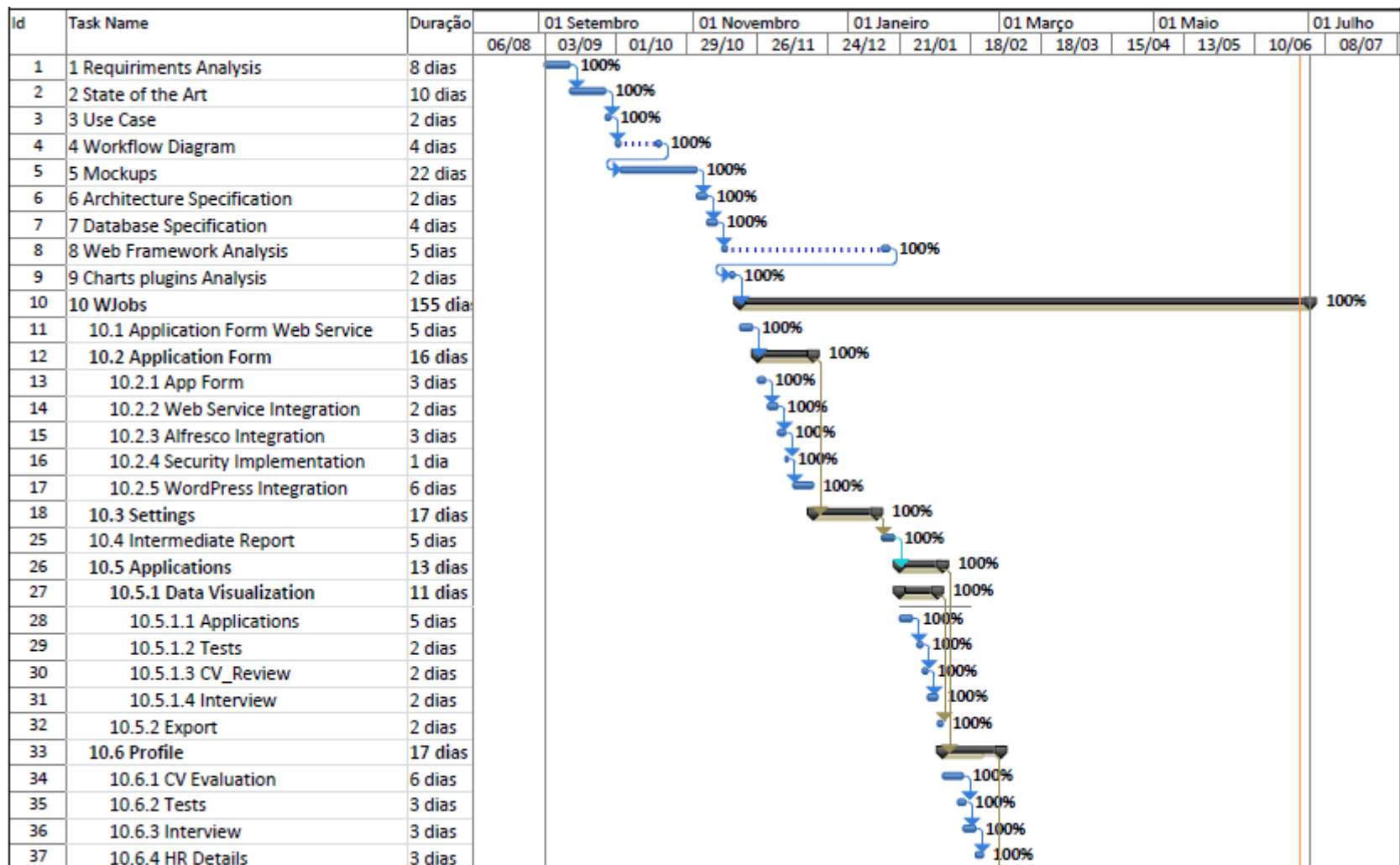


Image 4-Final planning

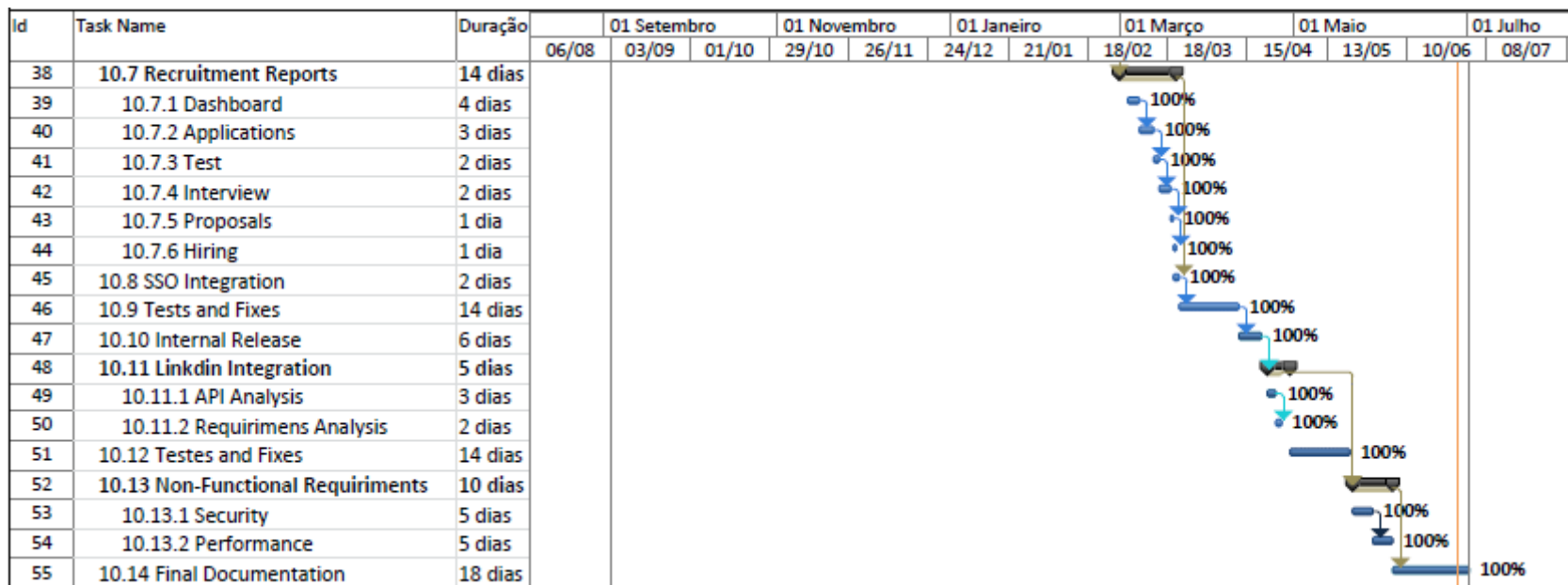


Image 5-Final Planning (Continuation)

One of the added tasks is related to the allocation of time for preparation of the internal release. During this preparation it was necessary to make some settings on machines and it was detected a limitation of the system architecture. Thus, it was necessary to change the system architecture, which, among other things, led to being necessary to analyze the API Alfresco documentation for JAVA once instead of the Application Form to keep the CV's in Alfresco now is the Web Service that performs this task.

During the internal realize, a problem was encountered in the application form that prevented its operation. Although, the form is presented to the user correctly, after trying to submit an application the result of the submission wasn't presented to the user and the data of the application were not saved. Thus, due to the severity of the problem found, after the analysis of the LinkedIn API, it was decided that it was more important to detect the cause of this problem and protect the application and the platform form for similar problems then the development of the integration of LinkedIn.

As we can see in the Image 5-Final Planning (Continuation) after internal release, was followed another period of testing and fixes where, besides correcting the problem referred, were made some improvements to the platform, result of suggestions received, and the other problems

encountered were corrected. In addition, other task that was added to the planning was the creation of the final report that wasn't covered in any of the earlier versions of the planning.

Comparing the initial plan with the final plan is possible to verify that there was the removal of two modules: the module to manage collaborators information and the module for schedule vacations. The initially planning was very tight and was made an analysis of the importance of the various modules. After this analysis it was found that the usefulness of the module to manage the collaborators information was very low and so this module has been eliminated. During the realization of the state of the art, it was decided to use a commercial tool for marking holidays which came to provide more time for recruitment platform. In addition to the many features that were intended to develop, it was decided to give a greater prominence to the user's profile, allowing the creation of pages depending on the user privileges. Another addition to the requirements was the creation of a settings module allowing greater customization and the creation of a module dedicated to reports on recruitment.

Besides creating the platform was made an analysis of the LinkedIn API which was created and left for future work list features that can be integrated with the platform developed.

2.4 Methodology

The software methodology adopted is based on agile development^[30]. In particular it sought inspiration in the Scrum agile process that is of the most acclaimed, popular, simple, and lightweight and is widely used within the company.

During the development of the project, there were Daily Scrum meetings lasting 5-10 minutes. The sprints had the duration of two/three weeks and at the end of each one exists one meeting with the product owner to review what has been done and draw conclusions for planning the next Sprint. The team was composed by the mentor and product owner Sérgio Cardana, the product owner Marta Coelho, by Monica Graça as Scrum Master, by Margarida Marça (application design) and intern Vanessa Ramos.

During the first semester, before the implementing started, the outcome of the Scrum daily meetings was emailed daily to Monica Graça to increase transparency and inspection. In this reports, it was referred: what was done during the day, what is planned for next day and any problems encountered. After the start of deployment it was decided to use the Scrum DO platform. This platform allows the entire project management since the creation of the scrum backlog to the creation of sprints and burn down charts. Since the utilization of this platform the result of the daily scrum meetings began to be introduced in the scrum log.

3 State of the Art

In this chapter, we make an analysis of the existing commercial software tools that enable the monitoring of the recruitment process and/or managing the absences and vacation days inside and the enterprise.

The choice of the studied tools was made taking into account some of the functions that was intended to develop, such as: online applications, managing the recruitment process, creation of reports to analyze the process, online submission of applications for marking holidays, approval of such requests, etc.

The content of this chapter is divided into two parts: in the first part, tools to aid the recruitment process will be presented, in the second the tools with utilities for the process of managing absences and scheduling vacations will be analyzed. At the end of each of these sections will be the comparison of the studied tools.

3.1 Description of tools for managing the recruitment process:

This section provides a brief description of several existing tools on the market and allow aid for the recruitment, the studied tools are: Employee Life Cycle Management, Recruiting and Talent Job Science, Sage HRMS, Open Hire, Applicant track, SAP, Open Applicant, People Track, bSwift, Mentis, Airframe HR, Conrep, NuView HR, Zoho Recruit, WayPoint HR, IceHRM, Orange HR, RAMCO Human Capital Management, HRM's Niit and Vista HRMS.

A complete analysis of these tools lies in Annex C.

3.1.1 Comparative Vectors

To compare the several studied tools was created the following list of criteria:

- **Online Application;**
- **Upload CV;**
- **Dynamic application form;**
- **Schedule Test;**
- **Save Test Score;**
- **Schedule Interview;**
- **Save interview notes;**
- **Block candidate;**
- **Automatic email notifications;**
- **Reports/Dashboards;**

These comparative vectors are described in the Annex C.

3.1.2 Employee Life Cycle Management ^[1]



The Employee Life Cycle management tool has an extensive list of features which allow monitoring an employee from recruitment to retirement; however, in this study we analyze only the utilities regarding the recruitment process.

The tool, created by Crederyty, includes a section devoted to the validation of information, such as: the number and the social security history, the CV references, criminal records, certification of documents, etc. with this background verification, is possible to make a verification of candidate to help with the decision to hire or not a particular candidate. After the verification is complete the application sends a notification. This application has a testing stage where is possible to define tests to be carried by the candidates.

In short, although this tool has some important features, the recruitment process is more complex and different than the one practiced by WIT.

3.1.3 Recruiting and Talent ^[2]



The Job science company has created a product to help with the task of recruiting new employees named “Recruiting and Talent”. One of the differentiating features of this software is that it allows recruiters to search and publish information through social networks.

Through Jobscience Recruiting and Talent is possible to create a requesting job in seconds using predefined templates. By placing a new job call, it is published automatically in several places like the company's website and social networks. This tool also allows the evaluation of CVs, rejecting candidates, email and seeking possible candidates on social networking sites like LinkedIn. Finally, it should also be noted that there are several reports and dashboards that can be created.

3.1.4 Sage HRM ^[3]



The SAGE Group is a company that develops software for businesses and the product is divided into several modules. One of these modules is Sage HRMS Cyber Recruiter to support the tasks of the recruitment process.

With this tool, a manager can create a new job call and submit it by email, if it was approved is possible to place it on the company website where candidates can make their online application and submit their resume. Thus, it creates a database of candidates where is possible search and filter the information to find candidates with certain capabilities.

In summary, it can be said that despite having several useful features, the recruitment process does not correspond to what is practiced in WIT. Since there is no free version of this application it is not possible to say whether the features for creating reports and dashboards have a match the ones desired by the WIT's human resources team.

3.1.5 Open Hire ^[4]



The Open Hire aims to help with recruitment process allowing the creation of job calls on the website, where candidates can make their online application, share a job call on social networks, or register to be warned when a job call is opened.

With Open Hire is possible to create reports and dashboards to analyze the status of the recruitment process. These reports, can be exported in several formats like csv and excel.

Furthermore, this tool also has some helpful features like the search for information, which allows, for example, finding candidates with the right profile for a particular position despite not having a particular job candidate. Through this tool is possible to schedule interviews, depending on the availability of what was previously entered.

The main drawback of this tool is the fact that it doesn't include all of the phases in the WIT process.

3.1.6 Applicant stack ^[5]



The Applicant stack, has a set of features that allow aid during the recruitment process, it allows creating a job call and enables the candidates to make their application online, saving the time spent entering data into excel files.

This tool is also useful as it makes it possible to contact candidates through email and arrange interviews as well.

Finally, another purpose of this application that is also part of the needs of the company is to create reports with important informations as the case of: the number of jobs created, at what stage did the candidates fail, etc.

The main disadvantage of this tool is doesn't fill all the stages of WIT's recruitment process.

3.1.7 SAP HR Recruitment ^[6]



SAP "Systems, Applications, and Products in Data Processing" is a German company, a market leader in business management software and its flagship product is the integrated enterprise management (ERP). This product is composed of several modules and these modules are the "SAP HR Recruitment" that was designed in order to automate recruitment processes.

This module has several features, including the option for candidates to make their online application, with or without an announcement. This allows the creation of a database of candidates and search, which is available in various fields of candidates to occupy a certain position, without the need to publish an advertisement.

The application also sends emails to candidates, reducing administrative tasks, and offers a wide range of reports, which allows the analysis of data related to candidates (skills, status, activities, etc.), offers, job calls, and costs and so on.

3.1.8 Open Applicant ^[7]

Open Applicant, is the name of one of the tools that simplify the recruitment and selection process. This tool is open source and has utilities that allow saving the candidates' information and the results of tests conducted to be stored. Through the tool, it is still possible to contact the various candidates and create job calls via email.

The Open Applicant enables the creation of analytical reports, graphs and the definition of what tests the candidates will perform.

The main disadvantage of management tool is that communication with the applicants is not optimized, and the great purpose of the recruitment module cannot be achieved since it still continues to be necessary to manually enter the information of the candidates.

3.1.9 People Track ^[8]

The People track is a tool that can easily help optimize business processes by facilitating the recruitment process and promote productivity.

This tool enables the creation of forms, checklists and the policy that can help with the recruitment. Since the candidate will fill out the form directly it saves time that would have been spent entering this information manually.

The disadvantages of this application are that the recruitment process is quite different from WIT's, since it presents a phase for drugs and physical tests and it doesn't show a phase for the technical testing phase that exists in the WIT process. Although the application is made online, based on the list of job calls available, the application form is not created dynamically based on the required skills.

3.1.10 bswift ^[9]

The bswift presents an integrated solution that allows managing the employee's information and simplifies the tasks of human resources. This solution offers a vast number of modules and one of them is "Applicant Tracking".

In this module, administrators can create and publish job calls and candidates can make their online application. Thus, it becomes easier to find the right candidate through the database of candidates and is possible to follow the various stages of the recruitment process. Although the application allows the creation of reports, it was not possible to know what type of reports can be created.

Since there is no free trial version of the product available, it was not possible to make a detailed validation of the functionalities. It should also be noted that, through contacts made with the responsible from bswift, we were informed that this solution is designed for large enterprises; the number of employees exceeds thousands, which is not our case.

3.1.11 Mentis ^[10]



Mentis the software is web based and allows the management of human resources to automate the payroll system. This software has several modules, in this analysis we will focus on the recruitment module

Through the module "E-Recruitment", is possible to create job calls with requirements and allow the online application. It is also possible to arrange interview, evaluate candidates and contact them through email.

The main drawbacks of this application are that the recruitment process of this tool doesn't include a stage for technical tests, the application form is not dynamic and the report functionality is not available.

3.1.12 Airframe HR ^[11] AIRFRAME™

Airframe the company has several software products for managing small businesses and aims to automate processes and track documents and data over a long term period. The solution for human resources can be divided into four parts which are: Recruitment, retention of records of employees, providing employees with a self-service and evaluating the performance. In this section we will analyze in detail the recruitment part.

With regard to the part of the recruitment, the process begins with the creation of a job call defining the qualifications and experience required, and then the job call goes online. Through the application is possible to search for the existing candidates, enter data applications, evaluate resumes and applications, and create reports about the process. It can also store information such as the notes made during interviews and conversations.

Although this product has some useful utilities it was not possible to assess whether it was possible for candidates to make the online application and therefore it is not possible to evaluate the usefulness of the tool for the company.

3.1.13 Conrep ^[12]



In the candidate's management module, it is possible to highlight the fact that it is possible to create and place job calls on the website with requirements and it can internally or externally add candidates. We can define templates to send emails to candidates and search the profiles of the candidates. This tool allows searching for candidates through social networks like Linked-in. It is also possible to create reports on the various activities of the process.

3.1.14 NuView HR ^[13]



The NuView HR Company provides a human resources platform where we have several modules available including a module for recruitment management and a module with functionalities for candidates.

In the recruitment management module, it's possible to create job calls, transform applications into candidate profiles, analyze candidate profiles, change the status of the candidates and assign candidates to job openings.

In the module dedicated to candidates, they may submit their application to a job opening directly from the company website and an email is sent to the applicant to confirm that the application was received. Candidates can also apply for more than one job call, edit and share the data sent.

3.1.15 ZoHo Recruit ^[14]



The Zoho Recruit is a tool that has several features that allow optimizing the recruitment process of a company; it simplifies the tasks of recruiters, since it reduces the data entry time. Through this platform, which can be accessed from anywhere, it is possible to customize the fields for a job opening, create or import a job opening and post it online. Through the advertisement, it is possible for all candidates to make their online application and send documents in various formats and configure the various fields of the form of an official.

Through this platform it is still possible to arrange interviews, view and send emails, set up email alerts, create and export reports. These reports consist in several types of information such as job openings, candidates, interviews, etc.

3.1.16 Waipoint HR ^[15]



The WayPoint HR software is an open source information system for human resources created by HR-Fundamentals. In its free version, more basic, it has the functionality to create records of employees and users. This tool presents a set of modules in its On-Demand version which can be integrated to handle the recruitment process.

In the recruitment module, it is possible to create a job call online, make an online application and schedule an interview online. Besides these utilities it is possible to export data, create alerts and create dashboards and reports.

3.1.17 Ice HRM ^[16]



The IceHRM is a tool that can be accessed from any location that has a fairly complete set of features useful in the recruitment process.

In the features related with the recruitment process, we must emphasize the creation of an online portal with several job calls and the ability for candidates to make the online application. Besides this, it is also possible to see the details of candidates and schedule interviews.

Although these features are very important, this tool turns out to be incomplete and it is unable to adapt to the needs of the company.

3.1.18 Orange HR ^[17]



The Orange HRM is a company that produces software for human resources. The product is available in two versions: one is open source, less complete and the other includes all the features of the open source version and some new features.

In the open source version, we can find utilities like the creation of the company structure defining positions and projects. This version allows the online application, the creation of job calls and the definition of email notifications and the Key Performance Indicators (KPI).

In the full version, besides all utilities mentioned above, is possible to customize the application form fields, create reports, create notifications to schedule interviews and manage the recruitment process.

3.1.19 RAMCO Human Capital Management ^[18]



RAMCO is a company whose mission is to create and deliver solutions that enable companies to improve their competitive capabilities using new technologies. One of the company's products is the Human Capital Management (HCM) which has in its features a set of tools that allow to manage the cycle of an employee from recruitment till retirement.

The main concern in a company during the recruitment process is to choose the right person for the job. This tool will facilitate the process, allowing applicants to view the list of requirements and apply for a specific position in collaboration with recruitment agencies. Through the application a candidate's database is created, which can be filtered, updated, searched and modified when necessary.

3.1.20 Niit's HRM ^[19]



The software human resource management of NIIT, was built with the aim of helping companies deal with the challenges of human resources such as: records management, benefits management and workflow automation.

As Niit's HRM's utilities can highlight the creation of jobs within the organization, send alerts/notifications for each stage of a workflow. It is also possible to store documents and create reports and dashboards on the wear of the organization by location, year, department or on the leadership of the organization by date, location, age, etc.

Since Niit's HRM isn't a free software and it doesn't have a free version, it was impossible to verify the functionalities analyze whether there were also other useful features.

3.1.21 Vista HRMS ^[20]



The Vista HRMS company has product suite tools to manage information of employees of a company. Unlike other systems that offer separate modules, the view HRMS includes several management tools into a single system. From these tools, the following stand out: the management of the recruitment process and the creation of reports that can be exported later.

In the case of the management of the recruitment process, this tool has features such as job call creation, with requirements that are placed on a portal in the company website where candidates can submit their application and documents or seeks for a job. Through this tool, it is possible to schedule interviews.

In summary, we can say that this tool has some helpful functionality in regard to the recruitment process, but it lacks the ability to adapt to the company process. Since there is no trial version of the product it was not possible to test the features mentioned and see if there are other interesting features.

3.1.22 Comparative Analysis:

This section presents a comparative analysis of the studied tools, in the Table 1-Comparative table of the recruitment tools and in Table 2-Comparative table of the recruitment tools (part 2), can be seen a resume with all the comparative vectors defined in the section 3.1.1 and all of the studied tools.

	Online Application	Collect CV	Dynamic application form	Schedule test	Save test scores	Schedule interview	Save interview notes	Block candidate	Automatic email notifications	Reposts/ Dashboards
Employee Life Cycle Management	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗
Recruiting and Talent	✓	✓	✗	✗	✗	✓	✓	✓	✗	✓
Sage HRM	✓	✓	✗	✓	✗	✓	✗	✗	✗	✓
Open Hire	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓
Applicant Stack	✓	✓	✗	✗	✗	✓	✗	✗	✗	✓
SAP-HR	✓	✓	?	✓	✓	✓	✓	?	✓	✓
Open Applicant	✗	✓	✗	✗	✗	✓	✓	✗	✗	✓
People track	✓	✓	✗	✓	✗	✓	✓	✓	✗	✓
bswift	✓	✓	✗	✗	✗	✓	✗	✗	✗	✓
Mentis	✓	✓	✗	✗	✓	✓	✗	✗	✗	✓
Airframe HR	✓	✓	✗	✗	✗	✓	✓	✗	✗	✓
Conrep	✓	✓	✗	✓	✗	✓	✗	✗	✗	✓
NuView HR	✓	✓	✗	✗	✗	✗	✗	✓	✗	✗
Zoho Recruit	✓	✓	✗	✗	✗	✓	✓	✓	✗	✓
Waypoint HR	✓	✓	✗	✗	✗	✓	✗	✗	✗	✓

Table 1-Comparative table of the recruitment tools

	Online Application	Collect CV	Dynamic application form	Schedule test	Save test scores	Schedule interview	Save interview notes	Block candidate	Automatic email notifications	Reposts/ Dashboards
Ice HRM	✔	✔	✘	✘	✘	✔	✘	✘	✘	✘
Orange HR	✔	✔	✘	✘	✘	✔	✘	✘	✘	✘
RAMCO-HCM	✔	✔	✘	✘	✘	✔	✘	✘	✘	✘
Nit's HRM	✔	✔	✘	✔	✘	✔	✘	✘	✘	✘
Vista HRMS	✔	✔	✘	✘	✘	✔	✔	✘	✔	✔

Table 2-Comparative table of the recruitment tools (part 2)

Legend: ✔ -Feature Supported ✘ - Feature not Supported ? -No information found

As we can see from the Table 1-Comparative table of the recruitment tools, most of the analyzed tools can solve part of the efficiency problem because they allow the online application, avoiding manual entry of all data. The only tool that does not have this feature is the "Employee Life Cycle Manager."

Analyzing the criteria and the products presented, it's possible to conclude, through the comparison table, most of the tools that suggest a process that does not include the CV evaluation phase or the phase of testing. The tools that have this gap are: "Recruiting and Talent," "Sage HRM", "Open Hire," "Applicant Stack", "Open Applicant", "Track People", "bswift," "Airframe HR", "Conrep "" NuView HR ", " Zoho Recruit ", " HR Waypoint, "" Ice HRM ", " Orange HR ", " RAMCO-HCM "and" Vista HRMS ".

From the analyzed tools, the recruitment module of SAP is the one that shows compliance with the highest number of criteria, since it allows the adaptation through workflows, besides allowing the online application, associated with a job call; it also allows the creation of multiple fields of information needed for all phases of the process. Another feature included in SAP is the report creation. The only feature that was impossible to know whether exist in SAP, due to lack of information, was the blocking of a candidate.

In short, we can finish the analysis of the table saying the big problem of the tools analyzed is the inability to adapt to the company recruitment process.

Moreover, the developed platform has to meet some basic requirements, namely: integration with SSO-Single Sign On - way to control multiple existing accesses to different, but related, web applications and is not supported by most of the solutions analyzed.

The recruitment process of WIT is very specific and contains several steps, in each of these steps there is information that need to be managed and alerts to be sent. These particularities lead to being difficult to use any of the products analyzed.

3.2 Description of tools for managing absences and vacation days

In the market, there are several tools with utilities to simplify and streamline the process of scheduling absences, holidays and licenses. In this section, we present several business solutions that have the intended utility, they are: SAP HR, PHC-dpessoal, Time-Off, TimeTrex, Schedule Tech, Who's Off and Time-Off Manager bSwift, Mentis, Airframe HR, Turbine , Conrep, NuView HR, Quick Personnel, Staff Files, Sage HRM, HRmoize, WayPoint HR, IceHRM, Orange HR, RAMCO Human Capital Management and Vista HRMS Softworks.

The detailed analysis of these tools can be found in the Annex C.

3.2.1 Comparative Vectors

To compare the several studied tools was created the following list of criteria:

- **Make a Online Request;**
- **Keep Information about Absences, vacation and licenses;**
- **Validation by a superior;**
- **View Vacation Map;**
- **Customize Calendar;**
- **Calculate number of days for payment;**
- **Update vacation days remaining;**
- **Reports;**

These comparative vectors are described in the Annex C.

3.2.2 SAP HR Self-services^[21]

To be able to increase efficiency and productivity it is necessary to give the power and capabilities to our employees and managers. Thus, in the SAP ERP we can find Self-services for managers and employees who, among other things, allow employees to send requests for vacations or absences.

An employee can access the platform, see how many days are available, which dates he have already taken on vacation, see the requests submitted last year and send a request for a vacation. After the application is evaluated, the employee will receive an email alert with the result.

A manager can access the application to see the alerts received or access the email and see who received an email saying that an employee sent a request to take a vacation at some point.

3.2.3 PHC-dPessoal^[22]



The PHC is the software used by the company to process wages, this tool has a module (dpessoal) that allows users to manage and view the vacation days and enter information.

Since the main purpose of this tool is to optimize the financial processes, the PHC only cares about keeping the information to process salaries. Thus, the unique features that the PHC has and that are interesting in this process are: the introduction of absences, holidays and the introduction of data visualization of staff.

Once this tool has an associated price for each license and that each employee would need to access the application to enter information about their vacation, and there would be a necessary large number of licenses which would be very costly for the company. As the company only has two licenses of this software, all of this data must be manually entered.

3.2.4 Time-Off^[23]

REPLICON

The Time-Off is one of the studied tools since it has some of the features necessary to schedule a vacation and manage absences within a company. With this tool is possible to see the map of absences and set some restrictions when it comes to the vacation scheduling according to the company policy.

The vacation map is constructed based on a table with all the requests. Another utility of this tool is that the map can be built automatically after the request sent by an employee is approved.

3.2.5 Timetrex^[24]



The Time-trex is a web tool that can be accessed from anywhere and allows integrating time working with the payments. To achieve its goal, this tool needs to know the days in which an employee has been absent in order to keep the information about days and vacation payments made to date.

So with the time-trex it is possible to see the vacation map of a company but the process of approving applications is different from that practiced by the company since the application only needs to be approved by a user.

3.2.6 Schedule Tech^[34]



The Schedule tech tool was built to help the companies to create a map of their employees on vacation, thus creating an application for vacation in just a few clicks and without the need to fill several excel files.

The schedule Tech allows the holidays customization and is possible to keep the collaborators number of vacation days remaining updated.

Besides that, it allows managers to create reports and vacation maps by department with the information ordered in different ways.

In short, this tool is useful in marking the holiday but once the requests for the vacation are not approved by a superior but by the application according to several policies, it is inadequate to the needs of the company.

3.2.7 Who's Off^[35]

One of the tools that allow the creation of a vacation map online is who's off. Through this tool, company employees can access their own personal page to submit requests, which will require approval by a superior, checking the status of previews requests and checking the amount of vacation days remaining.

Who's off sends alerts when a request is created or analyzed and there is the possibility to customize the calendar with all the existing holidays.

Therefore, this is a very complete tool in what concerns the holiday scheduling and the main disadvantage is the presenting of a price depending on the number of employees.

3.2.8 Time-Off Manager^[36]

The Time-Off Manager tool is a tool to manage vacations, licenses and absentees inside of a company, avoiding the need to fill several excel files, is only necessary to send a request to a representative superior.

If a request is approved, the remaining number of days of vacation that an employee has is updated as well as the company vacation map. During the creation of a user it is possible to choose what type of user it is, the application comes with three different categories: employee, manager and administrator.

The Time-Off Manager tool has other features as data exports in multiple formats (XML, CSV and Excel).

3.2.9 Bswift^[9]

As we saw in section 3.1.10, bswift presents an integrated solution with multiple modules. Earlier in this report we analyzed the modulate "Applicant Tracking", in this section we analyze the module "Vacation/Time-off tracking".

In this module, there is a system that allows the management of vacation and PTO (Time-off Period) requests that are submitted by an employee and are waiting for an assessment by a senior. Employees can view the status of their requests at any time and are notified when an application is evaluated. A manager can also set several classes of employees and set the number of vacation days that each employee has entitled.

As stated earlier, this tool has no trial version precluding a detailed validation of its functionalities.

3.2.10 Mentis^[10]

The software Mentis, discussed in section 3.1.11, is divided into several modules, in the referred section we analyze the module to help with the recruitment process, in this section we will analyze the "Employee self-service Module" and the module to manage absences.

In the module "Employee self-service" employees can initiate workflows, such as vacation requests, do self-assessments, make training requests and make requisition of assets among many other workflows.

In Absence management module it is possible to customize the calendar, define the types of absences and define the type of e-mails and notifications related each type of absence. Besides the referred features, it is possible to approve requests submitted by employees, view a vacation map (current or from previous years) and create reports.

3.2.11 Airframe HR ^[11]

By analyzing the Airframe HR in the context of the recruitment process we saw that this solution could be divided into four parts which are: Recruitment, retention of employees records, a helpdesk service and self-service and evaluate performance.

In the section devoted to "self-service", every Employee access to policies, procedures, request forms, self-training materials and benefit information, is a knowledgebase they can search on their own. In this section the superiors can also respond to benefit questions and employee concerns. So it is expected that with this tool employees are able to send requests, however it was impossible to verify whether these requests could be vacation requests because these features were not available in the trial version.

3.2.12 Turbine^[39]

Turbine provides a set of tools to manage office tasks, such as requests for vacation, sick days and time off. In this section is made an analysis of the functionality of scheduling vacations.

The application has a section called "Time-off" where employees can submit vacation requests, sick days or absences by selecting one or several days. The request stays as "pending" and a notification is sent to the responsible superior warning them that the request is awaiting approval. After the request evaluation a notification is sent to the employee and if necessary the vacation map is updated.

The application allows the customization of the leave entitlement to each employee and type approval required. It's possible to define for how many people a request needs to be approved, set limits for each type of request and view the vacation map.

The evaluation of this product was made using the trial version valid for a 30 day period.

3.2.13 Conrep ^[12]

As mentioned in the section of study tools for the recruitment module, Conrep is focused on the optimization of business processes having a dedicated solution for human resources.

The human resources module can be integrated with the recruitment module that allows importing and exporting data. In this module there is also the possibility to store information about sick, vacation and absent days of an employee, and update the payment system accordingly. Since it wasn't possible to test any version of the application, it is

impossible to know whether the information is entered manually or through applications and consequently to know how much it could be helpful to the company.

3.2.14 NuView HR ^[13]

In section 3.1.14 we studied the product of human resources at NuView HR where we saw that there was a platform and a system for payment of salaries within a company.

Previously, we analyzed the recruitment module; here we will continue to analyze the human resources module but now focusing on the analysis module "self-service" for managers and employees.

In these two modules, there is the possibility that the employees have to be able to submit requests for time off, register in formations edit data and check their health insurance and other benefits. They can also view the status of pending applications, requisitions and enter "timesheets". The pending timesheets will require a manager approval.

3.2.15 Quick Personnel^[37]

Quick Personnel is a company that offers software to Human Resources, in a fast and efficient way, allowing them to store information about employees and it's possible to keep several companies in the same system. This system is multi-user and we can define the privileges of each user.

This application allows saving, editing, searching the information of all the employees of a company; it is also flexible with respect to the different categories of users. The system allows for control of holidays and absences (illness, vacation, etc.). It is also possible to see a global map of the vacation days.

In short, this product has features that can only help the process of marking the holiday, but those features do not match the company's needs. The product would be useful if we intend to make the management of information for each collaborator. These features were tested using the trial version, available for 30 days.

3.2.16 Staff Files^[38]

The Staff files facilitate the maintenance of data from one employee and keeps personal documents. Some of the information kept is the time-off, so this application can store information about the absences of a particular employee and it is possible to see this information: the date, time of absence, the time deduced, notes about each absence for each employee per year and it is possible to print this information.

With this information, which is inserted manually, one can see and print an absence calendar with all employees or some of them and choose the employees order.

This tool was evaluated by using the trial version which is available for 15 uses.

3.2.17 Sage HRMS^[3]



Other of the solutions analyzed by presenting relevant features in the context of marking the holiday was the "Sage Employee Self Service" and "SAP Crystal Dashboard Design for Sage HRMS." The first was because the company allows employees to place orders online, "Time-off" that will later be approved by a manager and / or higher. The second allows viewing information quickly and perceptively using data that will be starting in a spreadsheet and is transformed into charts.

Although the product does not meet all the needs of the company, it has some utilities. As we saw for the recruitment module, there is no free version of the application making it impossible to see if the functionality to create reports and dashboards match is desired.

3.2.18 HRmonize^[40]



HRmonize is a tool to manage the information of several employees of a company and some features that are useful in the process of managing vacations, absences and licenses.

The employee sends an online request to schedule a vacation or absence and is possible to define for each role, among other things, for how many people the request needs to be approved. After a request approval, the information will appear on the application home page dashboard, where is possible to filter the information through the various filters available.

Another feature of this application is the creation of reports where is possible to specify how the information is presented: graph or table and what kind of information we want to analyze. These reports can be printed, saved or exported.

It is also worth mentioning that this application also has the option to customize the calendar and these features were tested through the trial version available for 30 days.

3.2.19 WayPoint HR^[15]



In section 3.1.16 we saw that WayPoint is an HR software with an open source version, created by HR-Fundamentals and it is composed of several modules. Among these several modules available in the paid version of the software there is a module for managing absences.

The absences management module allows to send/assess online requests which can be from several types like: vacation, illness, maternity, injury, half day of absence, etc. With this information, an absence map is created and each employee can access it to see their vacation days. Besides these utilities it can also export data, create alerts and create dashboards and reports. Since all of these features are only available in a paid version it was impossible to validate them and check what kinds of reports can be created.

3.2.20 IceHRM^[16]



IceHRM is a tool to support human resources that has several features allowing the process optimization within a company. Earlier in this report we saw that this software has

utilities for the recruitment process, in this section we will analyze the utilities it has to assist the process of managing vacations, absences and licenses.

In regard to this, this tool allows sending requests but it is necessary to specify to who it should be sent. In short, this tool has the main features that are necessary for the company but it is somewhat incomplete and it also has a high cost.

3.2.21 Orange HR^[17]

In Section 3.1.18 we saw that Orange HRM produces software for human resources management and it is available in two versions: one open source, less complete, and the other, with all the features from the open source version with some extra features.

In the paid version of the application there is a module dedicated to managing absences, which is the "Leave Management Module". This module allows the creation of a vacation map based in the absence requests approved previously by a superior and by extracting reports from there. It is possible to configure notifications on changing the states of the requests that are sent by email and even filter the vacation map information for the department. There are also some utilities to customize the calendar according to the existing holidays and define the absence types .

Since these features are only available in the paid version of the application it was not possible to test them.

3.2.22 RAMCO Human Capital Management^[18]

In section 3.1.19 we analyzed the Human Capital Management (HCM) of RAMCO which allows to manage information from various employees and make assessments for employees to ensure that they remain satisfied and to ensure the company's growth by creating KPI (Performance Indicators).

This application comes with utilities for the management of the employees attendance, employees benefits and compensation, competency management, complaint management, loans and delays. In this section we will focus on features related to the process of managing absences.

Regarding the vacation scheduling, employees have at their disposal a service that, among other things, allows them to submit requests for an absence. These requests, created online, can be from multiple types, and will be sent to a superior to be evaluated. Employees can also check the status of their applications.

3.2.23 Softworks^[41]

Softworks is a company that aims to streamline the company and increase productivity through proper management of employees and their working time. The goal of this application is to adjust the payment system with the working time of each employee and thus avoiding errors.

So, in that sense, the study of the application was focused on the features related to the management of vacations, absences and licenses. This tool has the following features: employees can submit requests, which require approval from a superior, and if the request

is approved it will be included in the holiday chart and payments are made accordingly with the days worked. This application has the utility to send an alert when an employee is sick for a long time, or when there are violations of company policies.

3.2.24 Vista HRMS ^[20]



The company Vista HRMS has in its product suite tools to manage information of company's employees. Unlike other systems that offer separate modules, Vista HRMS includes several management tools in a single system. From these utilities we highlight the following: human resources management, managing the recruitment process, processing the payment of salaries and creating reports that can be exported later.

In the self-service tool, among other features, it is possible to submit requests for vacations, illness, birth of a child, adoption, marriage, divorce, etc. and consult their state.

In summary, we can say that this tool has some useful features for scheduling vacations but it doesn't fit all of the company needs. Considering there is no trial version of the product it was impossible to test the mentioned features and to investigate whether there are other utilities.

3.2.25 Comparative analysis

In this section we will make a comparative analysis of the several studied tools that aim to help with the process of manage vacations, absences and licenses.

The Table 4- Comparative Table of tools to manage absences and Table 4- Comparative Table of tools to manage absences (cont.) presents a summary of the features of each one of the studied tools.

Wit's process to schedule vacation is quite similar to the one practiced in other companies. So, is expected that in the products currently on the market there are some of them that would include the required functionalities.

	Online Request	Save Info. about absences,	Validation by superior	Vacation map	Customize calendar	Calculate no. of days to payment	Update vacation days	Reports
SAP	✓	✓	✓	✓	✓	✗	✗	✗
PHC-dpessoal	✓	✓	✗	✗	✓	✓	✗	✗
Time-off	✓	✓	✓	✓	✓	✗	✓	✓
Trimetric	✗	✓	✗	✓	✓	✓	✗	✗
SheduleTech	✓	✓	✗	✓	✓	✗	✗	✓
Who's Off	✓	✓	✓	✓	✓	✗	✓	✓

Table 3- Comparative Table of tools to manage absences

	Online Request	Save Info. about absences,	Validation by superior	Vacation map	Customize calendar	Calculate no. of days to payment	Update vacation days	Reports
Time-Off Manager	✓	✓	✓	✓	✓	✗	✓	✓
Bswift	✓	✓	✓	✓	✓	✗	✗	✗
Mentis	✓	✓	✓	✓	✓	✗	✗	✓
AirFrame HR	✓	?	✓	?	?	?	?	?
Turbine	✓	✓	✓	✓	✓	✗	✗	✓
Conrep	✗	✓	✗	?	?	?	?	?
NuView HR	✓	✓	✓	✓	✓	✗	✗	✗
Quick Personnel	✗	✓	✗	✓	✓	✗	✗	✗
Staff Files	✗	✓	✗	✓	✓	✗	✗	✗
Sage HRMS	✗	✓	✓	✓	✓	✗	✗	✓
HRmonize	✗	✓	✓	✓	?	✗	✗	✓
WayPoint HR	✓	✓	✓	✓	?	✗	✗	✗
Ice HRM	✓	✓	✓	✓	✓	✗	✓	✗
Orange HR	✓	✓	✓	✓	✗	✗	✓	✓
RAMCO-HCM	✓	✓	✓	✓	✗	✗	✓	✓
Softworks	✓	✓	✓	✓	✗	✗	✗	✗
Vista HRMS	✓	✓	✓	✓	✗	✗	✗	✗

Table 4- Comparative Table of tools to manage absences (cont.)

Legend: ✓ -Feature Supported ✗ - Feature not Supported ? -No information

Some of the tools analyzed, despite possessing some of the characteristics necessary, do not solve the efficiency problem, the need to manually insert the information. These tools are: Quick Personnel, Staff Files, Sage HRMS, the HRmoize, Waypoint and HR.

A few of the studied tools, besides requiring the insertion of data are focused on the process of paying salaries and don't actually manage the vacation days, absences and licenses. Examples of such tools are: PHC-dpessoal, the WebTime Sheet and TimeTrex.

There are some tools that facilitate the absence management process and allow the visualization of information but don't allow an analysis of the data and don't update of

remaining vacation days of the employee in order to be possible to make payments in accordance with this information. Examples of tools in this case are the tools: SAP, BSwift, Mentis and Turbine, NuView HR, HRM Ice, Orange HR, Ramco HCM, and Vista HRMS Softworks.

The tool Schedule Tech besides doesn't update the number days to pay and the number of vacation days remaining also has the disadvantage that it is the application itself to create the map and the vacation requests do not require approval by a superior.

As can be seen by comparison table, some of analyzed tools are quite complete and have a great part of the properties listed in vectors of differentiation.

The tools that had better classification were the "Who's Off" and the "Time Off Manager", these applications have almost all the functionalities needed. Despite these tools have a price variable with the number of users, the creation of a platform from scratch has also a production cost. After an analysis by the human resources it was decided that in long-term the TCO (total cost of ownership) would offset the investment because if there are changes that need to be made accordingly the law, each of these tools will allow easily and without additional costs, change the policies of the company.

After presenting the comparison made, to the company responsible, it was decided that it would be done a trial of these two tools in order to decide which company would adopt. It was concluded that, since both have features that allow performing all tasks relating to process to manage vacations, absences and licenses cease to exist reason for the development of the platform to aid with that process and after the internal trial the company decided to buy the "Time-Off Manager" tool.

4 Platform Design

This chapter presents: the requirements that the application wants to achieve, the system architecture and also the analysis of technologies adopted for platform development.

4.1 Requirements

In this section, the requirements of the platform are identified and described so that they can be known and approved.

The requirements were identified based on customer needs and the gaps that exist in actual processes analyzed in section 1.4 and in the Annex A.

The first section presents the analysis of functional requirements which are divided into modules: session, recruitment platform and lastly the platform to manage vacation map and absences. The Recruitment and Selection is divided into three sub sections corresponding to the three components developed: the web service, the application form and the WIT jobs platform.

4.1.1 Requirements Analysis

The process of gathering requirements was conducted with the assistance of Human Resources responsible. During this stage, there have been several meetings, a careful analysis and a detailed document describing the features necessary for the company.

After analyzing the requirements, it was decided that some requirements should be removed and some should be added. There was a meeting where the importance of each requirement was analyzed according to the time taken to perform a task manually and how could it be optimized. The requirements have been defined into three modules: Session, Recruitment and Selection and Management of vacation and absences.

4.1.2 Functional Requirements

In this section are presented the list of functional requirements of the several components deployed. These requirements are described in the Annex D.

4.1.2.1 Session

The system must allow the user to perform login/logout and that and the occurrence of the session time-out. Login must be authorized; a user can't access the platform if he doesn't have permissions, which are configurable platform. The session must also expire after a set time (30 minutes).

ID	Name
FC-SE-01	Start Session/login
FC-SE-02	Start Session/logout
FC-SE-03	Session time-out

Table 5-Session Functional Requirements

This section presents the functional requirements related to the components that involve the recruitment and selection process.

4.1.2.2 Web Service

This section presents the requirements of web service developed to import the data of the job calls for which candidates can apply and also to send the data from submitted applications to the database. The list of web service requirements is in the Table 6-Web Service Functional Requirements.

ID	Name	ID	Name
FC-WS-01	Get Call List	FC-WS-06	Save application
FC-WS-02	Get Call Offices	FC-WS-07	Find applications
FC-WS-03	Get Call Skills	FC-WS-08	Save candidate skills
FC-WS-04	Get Call Status	FC-WS-09	Save application offices
FC-WS-05	Save candidate	FC-WS-10	Save candidate CV

Table 6-Web Service Functional Requirements

4.1.2.3 Application Form

The application form must be placed on WIT website of and use the web service to display the list of available job calls. Besides this, it should also be dynamic, presenting a list of offices and skills according to the selected job call.

The application form is also responsible for sending the information submitted by the candidate to the Web Service and the candidate's curriculum to Alfresco.

ID	Name
FC-AF-01	Integration with Website
FC-AF-02	Form fields
FC-AF-03	Dynamic Form
FC-AF-04	Submit Application Details
FC-AF-05	Save CV
FC-AF-06	Mandatory Fields

Table 7- Application Form Functional Requirements

4.1.2.4 WIT-Jobs Application

The application WIT-jobs is responsible for allowing the visualization of the details from the submitted applications and manages all data of the recruitment process. Moreover, this application must permit the customization of all necessary information to the recruitment process. This information includes all the details necessary to create a job call and to associate the offices where the job call is available and the skills required by the position with it. The application will also allow the creation/exportation of reports with detailed information about each stage of the recruitment process.

ID	Name	ID	Name
FC-WJ-01	Privilege management	FC-WJ-27	Block Application
FC-WJ-02	Add User	FC-WJ-28	Move CV File
FC-WJ-03	Delete user	FC-WJ-29	Open CV File
FC-WJ-04	Insert Office	FC-WJ-30	Save CV evaluation
FC-WJ-05	Edit Office	FC-WJ-31	Edit CV evaluation
FC-WJ-06	Delete Office	FC-WJ-32	Save CV evaluation result
FC-WJ-07	Insert Type of test	FC-WJ-33	See other CV evaluation comments.
FC-WJ-08	Edit Type of test	FC-WJ-34	Save test Scores
FC-WJ-09	Delete Type of test	FC-WJ-35	Save Test result
FC-WJ-10	Insert Business Unit	FC-WJ-36	Save interview scheduling
FC-WJ-11	Edit Business Unit	FC-WJ-37	Save interview notes
FC-WJ-12	Delete Business Unit	FC-WJ-38	Edit interview notes
FC-WJ-13	Insert Job Call	FC-WJ-39	Save interview evaluation result
FC-WJ-14	Edit Job Call	FC-WJ-40	See other interview comments.
FC-WJ-15	Delete Job Call	FC-WJ-41	Save proposal details
FC-WJ-16	Insert Job Profile	FC-WJ-42	Edit proposal details
FC-WJ-17	Edit Job Profile	FC-WJ-43	Save proposal result
FC-WJ-18	Delete Job Profile	FC-WJ-44	Save hiring details
FC-WJ-19	Update email content	FC-WJ-45	Edit hiring details
FC-WJ-20	Send email notification	FC-WJ-46	View report chart
FC-WJ-21	List Applications	FC-WJ-47	View report table
FC-WJ-22	Search candidate	FC-WJ-48	Export report in Excel
FC-WJ-23	Sort Application	FC-WJ-49	Export report images
FC-WJ-24	Filter Applications	FC-WJ-50	Dynamic homepage
FC-WJ-25	Export Applications	FC-WJ-51	Show applications accordingly with user permissions
FC-WJ-26	Unlock Application	FC-WJ-52	Slide between applications

Table 8-WIT-jobs Functional Requirements

4.1.2.5 Management of Vacations and absences

This section describes all the functional requirements related to the application of management vacation, absences and licenses. The application is responsible for allowing the employees to send several types of requests. These requests will require an approval by hierarchical superiors. Besides this, the application should update the number of days to pay the meal allowance and allow the user to view the vacation map. The list of these requirements is showed in the Table 9-Management of Vacations and Absences Functional Requirements.

ID	Name	ID	Name
FC-AM-01	Send request	FC-AM-06	Update payment Information
FC-AM-02	Approval Request	FC-AM-07	Reports
FC-AM-03	Email notification	FC-AM-08	Filer Reports
FC-AM-04	List notifications	FC-AM-09	Vacation Map
FC-AM-05	Calculate payment Information	FC-AM-10	Filter Vacation Map

Table 9-Management of Vacations and Absences Functional Requirements

4.1.3 Non-functional requirements

Non-functional requirements are all application requirements related to performance, scalability, security, availability and usability. These are not necessarily ordered by the customer but are also very important for the final result of the developed application.

The Table 10-Non-Functional Requirements has a list of all of the non functional requirements. These requirements are described in the Annex D.

ID	Name	ID	Name
NFC-WJ-01	Browser compatibility	NFC-WS-03	Use HTTPS connection
NFC-WJ-02	<i>Backends</i> in Java	NFC-WS-04	Verify mime type
NFC-WJ-03	Visual Style	NFC-WS-05	Encrypted authentication
NFC-WJ-04	Integration with SSO	NFC-AF-01	Browser compatibility
NFC-WJ-05	Capacity	NFC-AF-02	Programming technologies
NFC-WJ-06	Response Time	NFC-AF-03	Integration with Web Service
NFC-WJ-07	Availability	NFC-AF-04	Client Side Validations
NFC-WJ-08	Security	NFC-AF-05	Ajax Requests
NFC-WJ-09	Security HTTPS	NFC-AF-06	Handle latency
NFC-WJ-10	Browser Compatibility	NFC-AF-07	Server Side validations
NFC-WJ-11	Volatile Session	NFC-AF-08	Visual Style
NFC-WS-01	Limit Web Service privileges	NFC-AF-09	Spam protection
NFC-WS-02	One Way connection	NFC-AF-10	Save fields in the session

Table 10-Non-Functional Requirements

4.1.3.1 Performance

Nowadays, the performance of an application is very important. Besides being important to provide a good user experience, performance is crucial to determine if a user will re-use the application or not. Since, the goal of this internship is to optimize the time spent in routine tasks, the software should meet the requirements NFC-WJ-04 and NFC-AF-06 in order to respond to the user on the shortest time span to reduce the time it would take to perform the task manually.

4.1.3.2 Scalability

Besides the importance of the platform performance is also important to evaluate if the platform is scalable. Since the platform will be used by several users which can access it simultaneously or not, is important to ensure that the requirements, NFC-WJ-04 and NFC-WJ-05 are fulfilled. In addition to support for multiple users at the same time is important that application performance is satisfactory in this situation, to not harm the user experience.

4.1.3.3 Security

Security issues are very important in the platform, since it contains private data, is necessary to protect the access to it. To protect the application following points will be implemented: access control to web application, intranet, and SSO authentication and use HTTPS.

Only the users with privileges to the application can access it. The access to the application is configured in the application and there are several types of accesses. Given that the WIT contains an intranet with all its platforms, the application will only be available in the company, being closed to outside access. The only way to access the application from the outside is through a VPN connection, which requires the employee's credentials.

The Single Sign-On is a way to control multiple accesses to different but related web applications. Using this property, the user performs the login only once, and after this he will have access to all systems without requiring re-authentication. The same happens on logout from the application, using Single Sign-Off, when the user exits the application, performs logout on all system applications. To integrate the platform with the SSO, there are some settings that need to be configured in Apache Tomcat.SSL protocol that allows communication in "private" avoiding Eavesdropping attacks^[33].

Besides this, the information about client session (username, password, profile) must be stored in memory only while the client has an active session. All user information must be destroyed after the session being inactive.

4.1.3.4 Robustness

A robust system is a system that can handle errors without there being a failure. This includes incorrect data, defects of the software and unexpected events.

Nowadays a system must ensure security and availability of 100%. This requires us to focus not only in performance but also in security and confidence. So becomes important to create a set of tests to analyze the server response to several kinds of failures. This way is possible to measure the dependence existing in human intervention for system recovery.

4.1.3.5 Usability

One requirement that is very important is usability, if the of the application usability is not good this will not be used. Therefore, it is important that the application is built taking into account the user to whom it is intended. Thus, the construction of the application and its design took into account usability issues, the opinions of the reviewers and human resources team and the system used currently. It is intended application is so easy to use by users and will thus simplify the task of the evaluators and human resources. During the second semester was performed a test phase where improvements were pointed out to the platform.

One of these improvements was adding a column to the table CV where the user can see other evaluations inserted without having to consult the profile.

Besides this, some improvements in UI were made, examples of this alterations are the text boxes with a dynamic size (size increases when the user clicks in, in order to display all its contents and decreases when the user clicks out of the element) and also the utilization of colors in order to facilitate the user task and highlight the important aspects.

4.1.3.6 Mockups and prototype

Before the transition to the development phase, it was important to create mockups and functional prototypes that represent one possible approach to the interface user.

The process to validate the mockups took several iterations until the final version. During this process, we obtained the opinion of various stakeholders in the process as reviewers and human resources. Additionally during this process it was still important to review the current process for the design of the application, which would simplify the task of the various stakeholders in the process taking into account what is done by each one of them today. The drawn mockups can be found in the Annex D.

After the creation of the mockups, they were sent to a designer who has perfected the look of the application and created a prototype in HTML with images of several screens.

The goals of the development of prototypes are: validate the mockups previously created and analyze the technologies to be used for developing the user interface. These mockups can also be found in Annex D.

4.2 Technologies

This section describes some of the technologies that will be used during the project development.

4.2.1 Presentation Layer

In the presentation layer was used Apache Struts ^[42] is an open-source tool that simplifies the creation of web applications web in java and is one of the tools allowed in WIT for Web development.

Besides allowing the creation of web pages using the architecture is MVC in a simple way this choice was made ponderously and more details can be found in section 4.2.4 and Annex D.

4.2.2 Business Layer

In this layer was adopted Java programming language since it is one of the most used languages in the company servers. To expose the services of this intermediate layer was used the Apache Tomcat application server used very often in the company projects.

4.2.3 Persistence Layer

The technology chosen for data storage support was MySQL. The reason for this choice was the low maintenance cost, the fact of this technology is used in other servers by the company (bug-tracker, intranet).

4.2.4 Web Frameworks

As part of this internship, since it is necessary to create a web application, it is inherent to use a web framework to reduce the overhead associated with common activities performed in Web development.

Therefore, it was decided that an assessment had to be made of the various frameworks available using the language, since this is the language used within the company.

The description of each of the frameworks and their comparison and analysis is available in Annex G. After the framework analysis it was decided to Struts framework which is also used in various projects of the company.

4.2.5 Graphic Tools

One of the main features to be developed during this internship was the creation of reports about the recruitment process, so it was necessary to analyze tools which transform information into attractive graphics.

During the mock-ups, several types of reports were defined, which would then be created in the platform and the design of these graphs was also defined. The types of graphs which can be created are: pie, column or line charts. The column charts must have clickable bars to make it practical for the user to see detailed information about the selected phase. For example, at the dashboard page, if the user so desires, he can click on the bar at any stage of the process and view more detailed information on this step. To improve usability a set of icons were also defined and that should be placed in each of the main bars of the graph for the user to have a direct perception about which phase corresponds to each bar of the graph.

After defining the chart requirements, the search for a library of graphic tools began and the following tools were analysed: Google Charts, Jfree, Pcharts, Open Flash Charts, AM Charts, Plotkit, Fusion Charts, Visifire, G, SwiftCharts, Gral, JqChart and eJSChart. A detailed analysis of each of the tools studied is available in Annex G, in this section we only present the findings obtained during this study.

After analysing the features and the limitations of each of the present tools, it was decided to use the Google Charts. This decision was taken because this tool is very well documented and it was tested and can be adapted to fill each one of the reports requirements. This tool enables the creation of several different types of graphics including all of the ones required for this project, column, pie and line charts. To create clickable charts we can use events and open a new page or change a chart via JavaScript. This API supports several types of events like “On click” which allows using a click on a bar chart to see detailed information about the click area. The possibility to interact with the chart also improves the application usability.

4.2.6 Other Technologies

This section presents some technologies used in the implementation of some features of the platform.

JExcel

JExcel is an open source java library that allows read and write excel files. This library is used to perform download of the reports and to export the candidate's information's.

Java Mail ^[44]

The JavaMail API provides a platform-independent and protocol-independent framework to build mail and messaging applications and was used to send the emails to the candidates when the process ends.

Batik ^[43]

Batik is a Java-based toolkit used to export images in the Scalable Vector Graphics (SVG) format to a png image.

Alfresco SDK ^[45]

Alfresco is a system for document management and its SDK provides support to integrate the WIT Jobs application and the web service with the Alfresco.

4.3 System Architecture

The definition of the software architecture is a very important step before the development process. A good choice allows increased flexibility and portability to develop software. This chapter describes the high level architecture of the platform to develop – WIT-jobs. More details about the System Architecture can be found in the Annex F-Architecture.

4.3.1 Representation adopted

This application belongs to the human resources department of WIT and allows the visualization and management of all the data to job applications that are inserted into the database via a web service that connects databases with the application form.

The application is composed by 3 components:

- Application Form;
- Application Form Web service;
- Platform WIT-jobs;

In the next image, the component dependencies are displayed making it easier to understand the architecture of the platform.

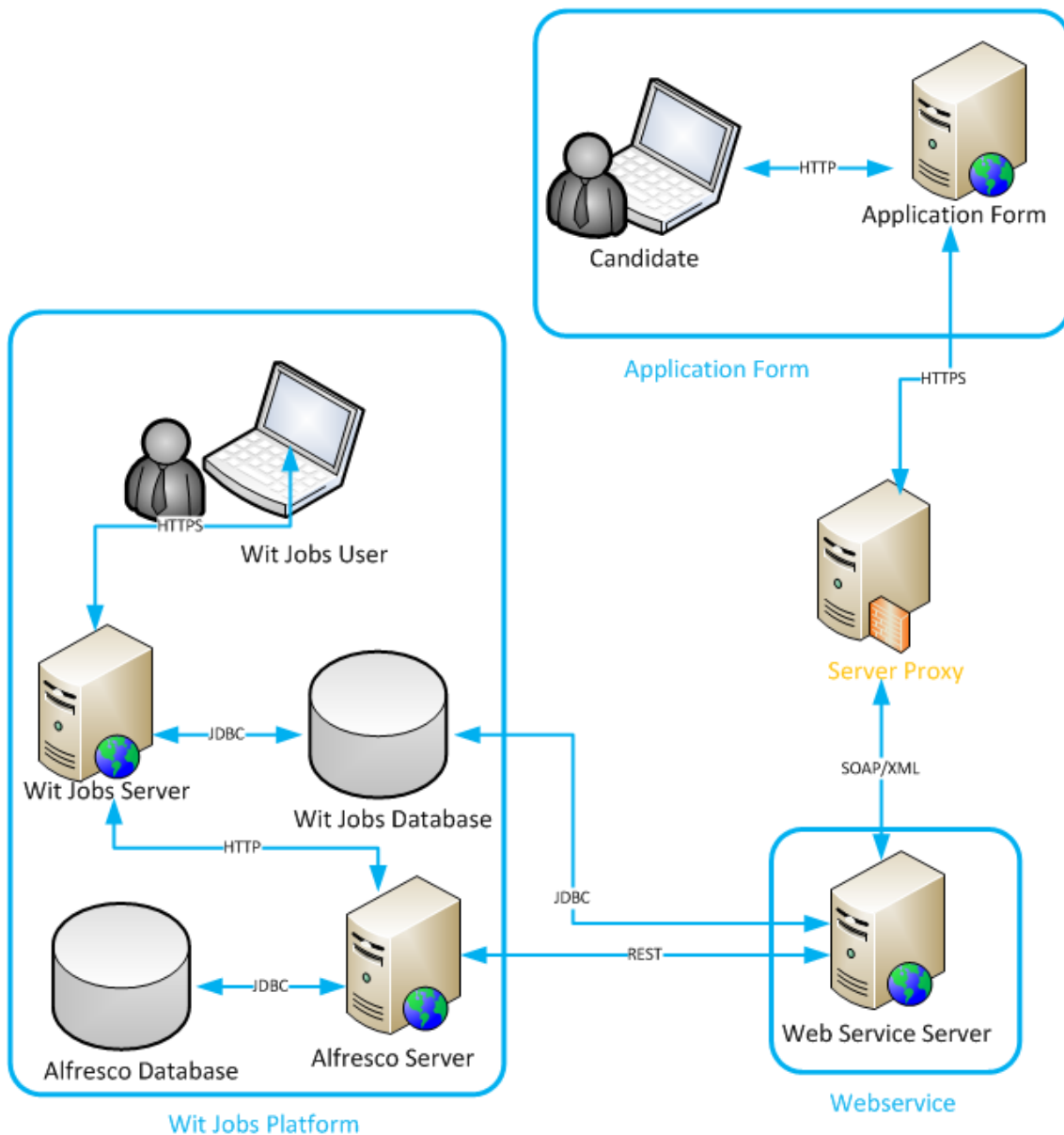


Image 6-Architecture Diagram

The Application Form is responsible for receiving all data from an application and sends it to the web service. This component is created dynamically and it needs to obtain information about the existing job calls to populate the list of job call available and its offices and skills, which change depending on the selected job call. To obtain these details the Application Form makes a request to the Web service.

The web service is responsible for sending data from applications submitted to the WIT jobs database, to send the candidates CV to the alfresco platform database and also for obtaining all the necessary information to fill the application form with information about the Job Calls.

The data obtained by the Web Service, is sent to the server using XML. Each time a user opens the Application form will be sent a request to get the data about all the open job calls. Each time a user submits an application the web service receives a request to store

data in the database and to create a connection to the Alfresco Web Service and store CV file in the Alfresco database.

The connection between the application form and the web service is done through a reverse proxy server, which is used to protect the web service from possible internet attacks (hacking) by using/requesting unknown http requests in search of possible vulnerabilities.

On the left of the diagram we have the main component: the Platform WIT-jobs. This is the central component of the project and owns its main features.

This platform main concern is to save and manage all data about the recruitment process; this data includes not only the data which comes by completing the application form but also the data inserted by multiple users throughout the process. Besides this, the platform is also responsible for generating graphs and reports about the recruitment process allowing its exportation. Through the platform is also possible to create the various job calls and their details which will be presented in application form like the job call required skills and the offices where the job call is available.

The data processing is made through a connection to the database (MYSQL), where the web service stores the data received from the application form. The platform WIT-jobs is also connected to the Alfresco since it provides the user the possibility to access the candidate's curriculums.

4.3.2 Controller module uses view

4.3.2.1 WIT Jobs

In the Image 7-WIT Jobs sub modules is possible to see the decomposition of the modules of the WIT Jobs platform.

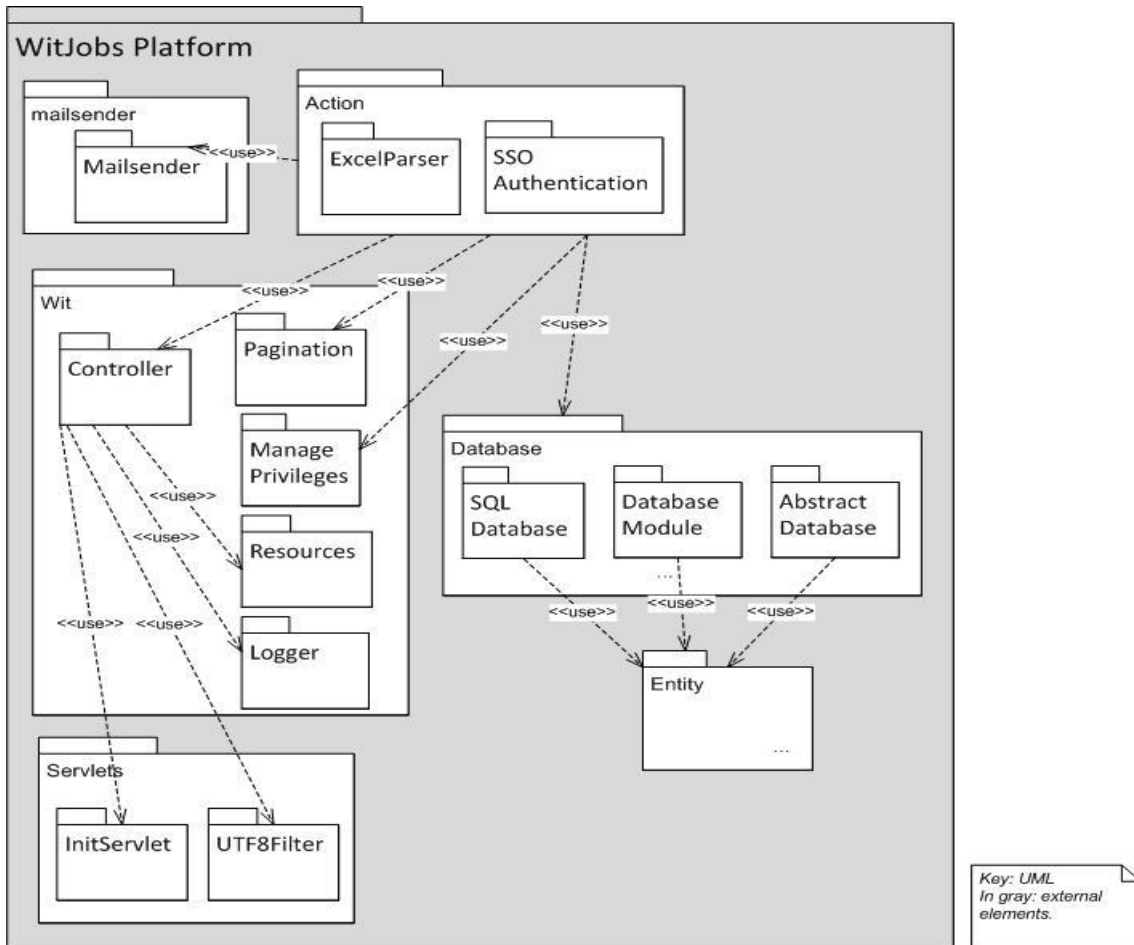


Image 7-WIT Jobs sub modules

Action

Once this project was developed with MVC architecture this module contains the Controllers for the user interface. These controllers are Java classes responsible for the event-listening triggered from the view (JSP pages) they perform the required action and send the result of an action to the view page.

Database

This package is responsible for all access to the database.

WIT

This package is responsible for initializing all server modules as well as its corresponding shutdown. Is also responsible for initialize the resources files and the server logs.

Mailender

The mail sender is a helper module responsible to send out emails using the Java Mail API.

Servlets

This package includes the init servlet, responsible to initiate the application and the UTF8 filter.

Excel Parser

The excel parser is responsible for create the excel file reports to be exported.

SSO Authentication

The SSO authentication is an action created to redirect the user to company SSO login system.

Controller

This is the Controller class for the server. It is responsible for initializing all server modules as well as its corresponding shutdown.

Pagination

Due to the large amount of data that tables may contain and in order to avoid the overhead on the front end paging is done server side. The pagination class is responsible to create the pagination of the several tables existing on the application frontend where the only data that will be show will be sent.

Manage Privileges

The manage privileges class is used to verify if the user has privileges to a determinate page.

Resources

The ResourceModule is responsible for providing the server configuration properties to the rest of the applications, such as database configurations, external web services configurations, etc.

Logger

The LoggerModule is responsible for the logs of the platform and is started on Controller creation and is used by all modules.

SQL Database

The SQL Database extends the Abstract Database and contains all the global methods to use.

Database Module

The Database module is an interface that contains all methods used in the access to the database.

Abstract Database

This class is used by SQL Database and contains all accesses to the database.

Entity

This package contains the classes that correspond in memory to the data entities required. For each data entity, there is a POJO. The POJOs are used throughout the application as data transfer objects.

Init Servlet

The init servlet is the servlet responsible to initiate the platform resources.

UTF8Filter

This servlet is used to filter the characters of the Page to UTF8.

4.3.2.2 WIT Jobs Web Service

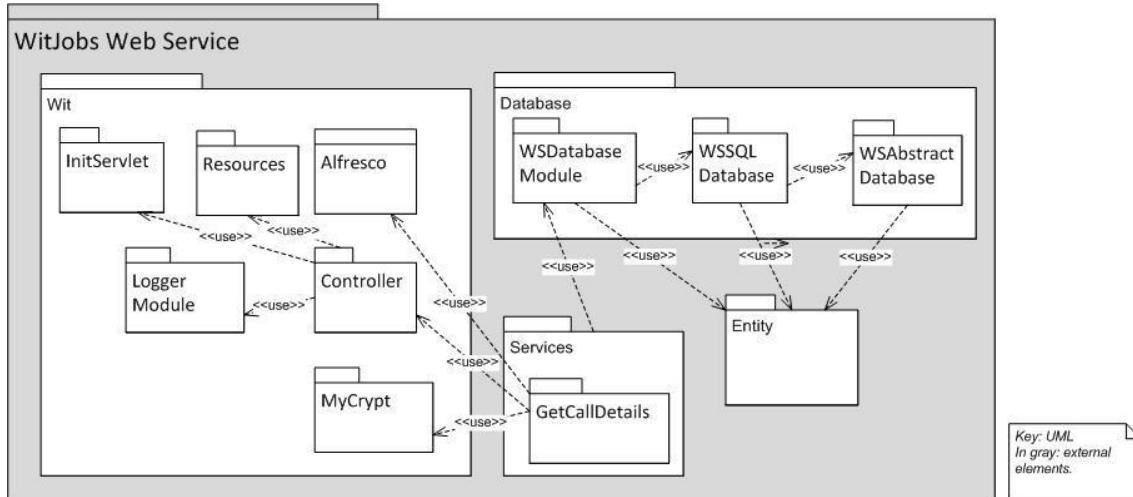


Image 8-WIT Jobs Web Service sub modules

Services

This package contains all of the methods that can be access by the web service clients

WIT

This package is is responsible for initializing all server modules as well as its corresponding shutdown. Is also responsible for initialize the resources files and the server logs.

Controller

This is the Controller class for the server. It is responsible for initializing all server modules as well as its corresponding shutdown.

Resources

The ResourceModule is responsible for providing the server configuration properties to the rest of the applications, such as database configurations, external web services configurations, etc.

Logger

The LoggerModule is responsible for the logs of the platform and is started on Controller creation and is used by all modules.

Alfresco

The Alfresco class contains all the necessary methods to save the candidate CV in the alfresco Database.

MyCrypt

Once the access to the web service methods is done authenticating the user and that these credentials are sent encrypted, it is necessary that the web service has both the methods

needed to decrypt the data on either ace keys used. The MyCrypt class contains all the methods and data necessary to make the decryption of the user authentication in order to verify if he has the required permissions to use the Web Service methods.

Database

This package is responsible for all access to the database.

WSSQL Database

The SQL Database extends the Abstract Database and contains all the global methods to use.

WSDatabase Module

The WSDatabase module is an interface that contains all methods used in the access to the database.

WSAbstract Database

This class is used by WSSQL Database and contains all access to the database.

Entity

This package contains the classes that correspond in memory to the data entities required. For each data entity, there is a POJO. The POJOs are used throughout the application as data transfer objects.

Init Servlet

The init servlet is the servlet responsible to initiate the web service resources.

4.3.2.3 Application Form

In the Image 9-Application Form sub modules is possible to see the composition of the application form.

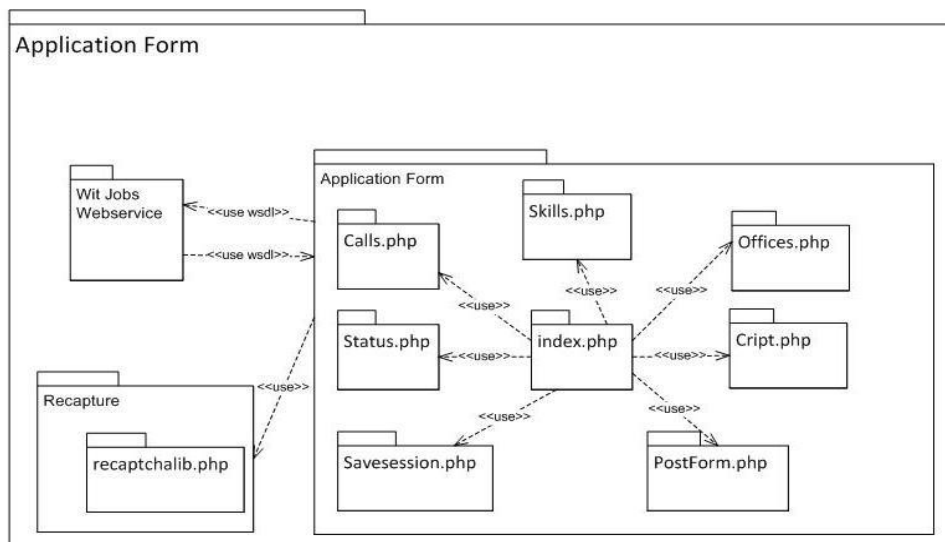


Image 9-Application Form sub modules

Application Form

This component is the main component of the application form and uses the other components to create the application form page, to make the field validation and to send the data submitted to the web service.

Recapture

The recapture package contains the library necessary to use the Recapcha in the Application form including validation of data submitted by the user.

WIT Jobs Webservice

This component is responsible for saving the submitted data and for retrieve the list of the job calls available. The list of the job calls available and its details is required in order to create the application form page.

Calls

The Calls file is responsible to access the Web service and retrieve the data about the Job Calls. After getting the data about the job calls the data is saved it in the user session and this class creates the list of the job calls available in the application form.

Skills

The Skills file is responsible to create the list of the required skills given a selected job call.

Index

The index file is responsible for creating the Application form page and for validate the form fields in the client side.

Status

The Status file is responsible to check if a job call is still available when the submission is done.

Save Session

The Save Session file is responsible to save the form fields in a session when the user changes one field.

Offices

The Skills file responsible to create the list of the offices where the job call is available given a selected job call.

MyCrypt

The MyCrypt file contains all the methods and data necessary to make the encryption of the user authentication before send a request to the web service. Remember that the authentication required to use the Web Service methods and the encryption of the user details is made for security reasons.

Post Form

The post form file is responsible to validate all the fields from the server side and to send a response to the client with the submission result. If the submission is succeeded the post form will also make the connection to the web service and send the details.

4.3.3 Client Server view

The next image presents the client server view of the application WIT Jobs.

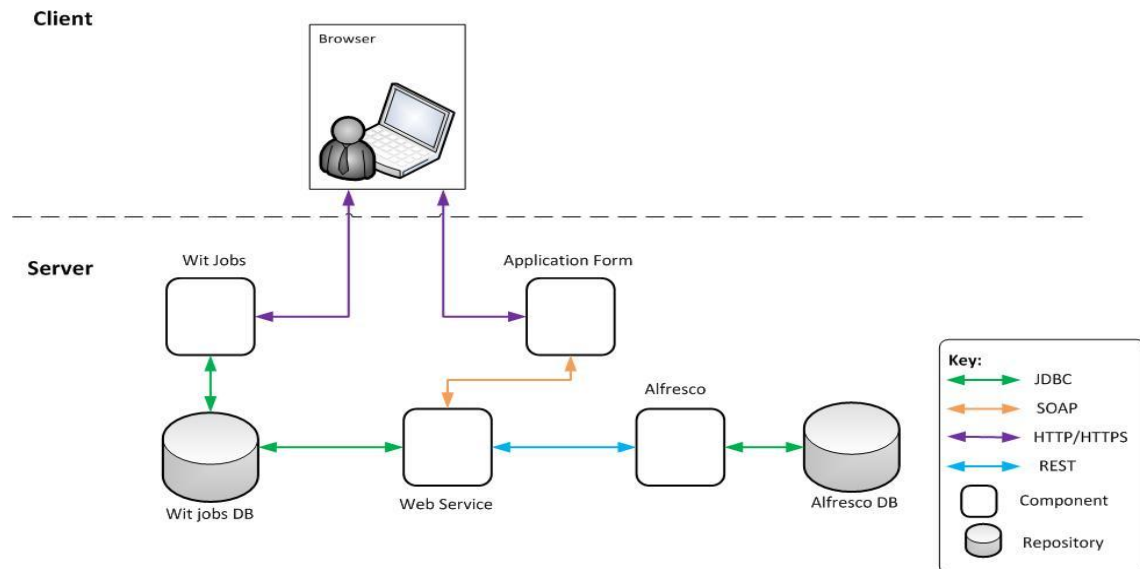


Image 10 -Client/Server view

Browser

This component represents the user interface of the application running on a web browser.

WIT Jobs

The WIT-Jobs platform is responsible for generating graphs and reports about the recruitment process and allows the management of the recruitment process data.

WIT Jobs DB

The WIT Jobs DB is responsible to save all of the data regarding the recruitment process like applications, candidates, job calls, etc.

Application Form

This component is responsible for receiving all data from an application and sending it o the Web Service.

Web Service

The WIT Jobs Web Service is responsible for saving the applications data, for saving the curriculum in Alfresco and for obtaining all the Job Calls information to fill the application form.

Alfresco

The Alfresco API is responsible for saving the documents submitted through the application form on Alfresco database and for allow the user to access to the CV direct link.

Alfresco DB

The Alfresco DB is responsible for maintain all the candidates CV files.

4.3.4 Data Model

The data model of the application can be found in the Image 11-Data Model and the description of the represented tables is in the Table 11-Data Model Description.

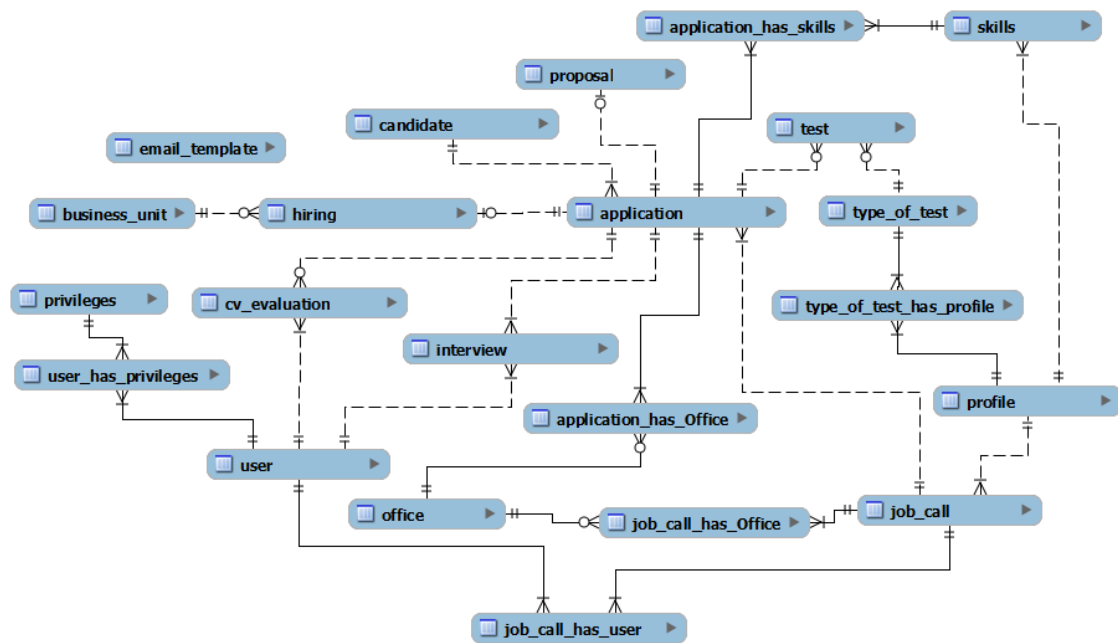


Image 11-Data Model

Table	Description
Candidate	The table contains the Candidate list and the details of each candidate.
Application	On the table application are stored the data from each of the applications received.
CV Evaluation	During the first stage of the process, several reviewers do their evaluation of a curriculum. Each of these evaluations is stored in the table CV_evaluation.
Interview	Another stage of the recruitment process is the interview, in this table are saved the data about every interview.
User	The list of the various users who have access to the application is in the table "User".
Privileges	This table has a list of the various privileges available and required to access certain menus.
User_has_privileges	Once a user can have multiple privileges and a privilege can belong to different users, it was necessary to create a weak entity. The table user_has_privileges is a weak entity and keeps the connection between the tables user and privileges.
Test	This Table contains a list of tests performed by all candidates during the recruitment process.
Type_of_test	This table is a list of the various types of tests performed during the testing phase according to the announcement.
Profile	This table contains a list of all available profiles for job calls. A profile makes the connection between a job call and the necessary tests and skills.
Type_of_test_has_profile	Once a profile of a job call may require several different tests and one test can be associated with several different profiles the Table type_of_test_has_profile was created and it is a weak entity that allows the association between the tables: type_of_test and profile.
Job_call	This table stores the list of all job calls of the company their details and status. This table also maintains the information to assign a job call to a profile.
Office	This table keeps the list of all the company locations.
Job_call_has_office	As each job call can be available in several offices there is a weak entity that relates the tables: job call and office.
Skills	This table keeps the list of all the skills and associates each one of them with a profile using the attribute profile_id.
Application_has_skills	This table keeps the data necessary to associate an application with the skills experience introduced by the candidate.
Application_has_office	This table saves the data to associate a job call with the offices where it is available.
Hiring	This table keeps the information about all contraction data of a candidate.
Proposal	This table saves the information for all data on the proposal presented to a candidate
Email_template	This table stores the contents of each of the types of emails that will be sent by the application.
Business_unit	This table has a list of all of the company business areas.
Job_call_has_user	The weak entity "Job_call_has_user" to save the association between users and the job calls they can access.

Table 11-Data Model Description

5 Tests

One of the several phases associated to the process of software engineering is the testing phase. This stage is of the most importance since it is at this stage that is validated and verified all the constituent parts of the developed system.

Thus, during this stage, and in accordance to the planning, were performed a series of tests to the platform. These tests are divided into two groups: acceptance testing and ad-hoc testing.

Regarding the acceptance testing, a set of functional tests was specified and run. The test specification and the report of the results can be found in Appendix H. Besides the tests specification, this document includes the results and the problems encountered.

Initially it was envisaged that the platform tests will be made by at least one member of the WIT's quality assurance team, similar to what is done in the WIT's projects. Usually, in the company, the testing process is initiated by the project manager, when he makes a request, for the quality assurance team, after that the team will test the software after create the specification of the software. The tests will be made for the person who created the test specification and if by other team members if necessary.

Since this project is for internal company use and the fact that the test team is busy testing other projects the only resource available to perform the tests and create the platform specification tests was the intern. However, the Scrum Master, Monica Graça also performed some tests to the platform and to the Application Form to the extent the time he had available.

The second testing phase consisted of ad-hoc tests ran on the platform to assess the viability of the platform.

After the testing phase, a meeting was held to evaluate the severity of the problems found and to decide what corrections had to be made. During the realization of the first phase of testing, 73.3% of tests passed and 23.4% failed from the 672 tests that were in the test specification. There were found 87 bugs, 28 of which have little severity, 23 with medium severity and 34 with high severity.

The main problems encountered were related to the platform UI. There were several misplaced elements, mainly in older versions of Internet Explorer. There were also some problems related to the page encoding and with the page protections. Sometimes, there were some protections missing, in other cases there were some protections that didn't allow storing the desired information. Some of the problems reported are related with the fact the application saved a "NO GO" result if the user only made a comment and the fact that there incoherent information in the reports and in the search results. Besides this, the problems found there were also found some things that needed to be changed.

It's worth mention that all the bugs with medium and high severity were fixed after the first phase of testing and only 23 of the 87 issues/problems found weren't fixed because they were related to UI problems of the platform in the internet explorer and the platform will be used internally so the only browsers where it should be available without any problem are the Google Chrome and the Safari.

During the development of the platform, several meetings were held, at the end of each sprint, in order to verify the progress of the work done. There were also several versions of the platform available for testing by some of the potential users.

After the initial period of testing, it was decided that the platform should support the browsers Google Chrome and Safari while the Application Form should be supported by: Google Chrome, Safari, Mozilla Firefox, Opera and Internet Explorer version 7.

During the internal realize, there was a problem found with the application form. The application form didn't save the application data and crashed while loading the submission result. In order to solve this problem, it was necessary to analyze the application logs and was found that the cause of this problem was related to the fact that the user tried to submit an application with an ID card too large. So, it was necessary to add a protection, to every field of the application form and to every field of the platform.

In addition to the problems found, during the testing phase, several ideas to improve the usability of the platform emerged. After the correction of the problems found and the changes suggested were implemented there was a new period of testing where there were ad-hoc tests and the T-Spec was updated. Thus, there was room for a new period of testing where there were ad-hoc testing and the new version of the t-spec, according to the alterations implemented, was run.

6 Final Product

This section introduces the final product, trying to cover each module by presenting some examples of each screen one followed by the description.

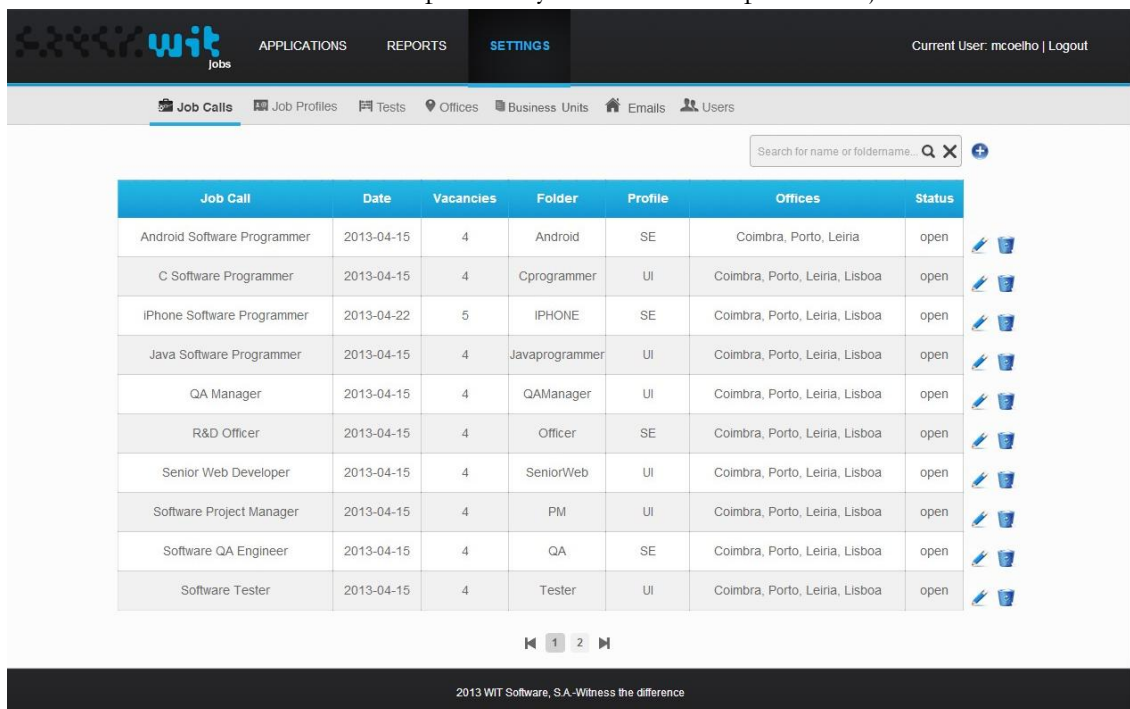
6.1 Settings Module

This section presents some screens of the application settings.

The first screen that can be seen in the Image 12-Job Calls and presents the page to create, edit and delete a Job Call. The job calls presented in the table are the ones listed in the Application Form and all of the changes made in the table will reflect in that component.

Each Job Call has associated a folder name, that corresponds to the name of the folder where the CV's will be saved in Alfresco, a profile (which the description will be present future in this section), a group of offices (which can be defined in tab "Offices" of the settings menu) and a status that can be modified in order to chose if the job call is available in the application form or not.

Other feature available is the possibility to search for a particular job call.



The screenshot shows the 'Settings' page of the WIT Jobs application. The navigation bar includes 'APPLICATIONS', 'REPORTS', and 'SETTINGS'. The 'Job Calls' tab is active. A search bar is present above the table. The table lists various job calls with columns for Job Call, Date, Vacancies, Folder, Profile, Offices, and Status. Each row includes edit and delete icons.

Job Call	Date	Vacancies	Folder	Profile	Offices	Status
Android Software Programmer	2013-04-15	4	Android	SE	Coimbra, Porto, Leiria	open
C Software Programmer	2013-04-15	4	Cprogrammer	UI	Coimbra, Porto, Leiria, Lisboa	open
IPhone Software Programmer	2013-04-22	5	IPHONE	SE	Coimbra, Porto, Leiria, Lisboa	open
Java Software Programmer	2013-04-15	4	Javaprogrammer	UI	Coimbra, Porto, Leiria, Lisboa	open
QA Manager	2013-04-15	4	QAManager	UI	Coimbra, Porto, Leiria, Lisboa	open
R&D Officer	2013-04-15	4	Officer	SE	Coimbra, Porto, Leiria, Lisboa	open
Senior Web Developer	2013-04-15	4	SeniorWeb	UI	Coimbra, Porto, Leiria, Lisboa	open
Software Project Manager	2013-04-15	4	PM	UI	Coimbra, Porto, Leiria, Lisboa	open
Software QA Engineer	2013-04-15	4	QA	SE	Coimbra, Porto, Leiria, Lisboa	open
Software Tester	2013-04-15	4	Tester	UI	Coimbra, Porto, Leiria, Lisboa	open

Image 12-Job Calls

In the Image 13-Job Profiles is the screen where is possible create, edit or delete a job profile that will be able to be associated with a particular job call. To create a profile, besides being necessary to enter the name and acronym, is necessary to introduce the tests that the candidates who apply for the job call will do and skills required for this job call.

The set of tests that can be associated with a profile can be set in the menu "Tests".

The list of skills will then make the application form and all applicants who intent to apply for the job call are required to fill out the level of fitness.

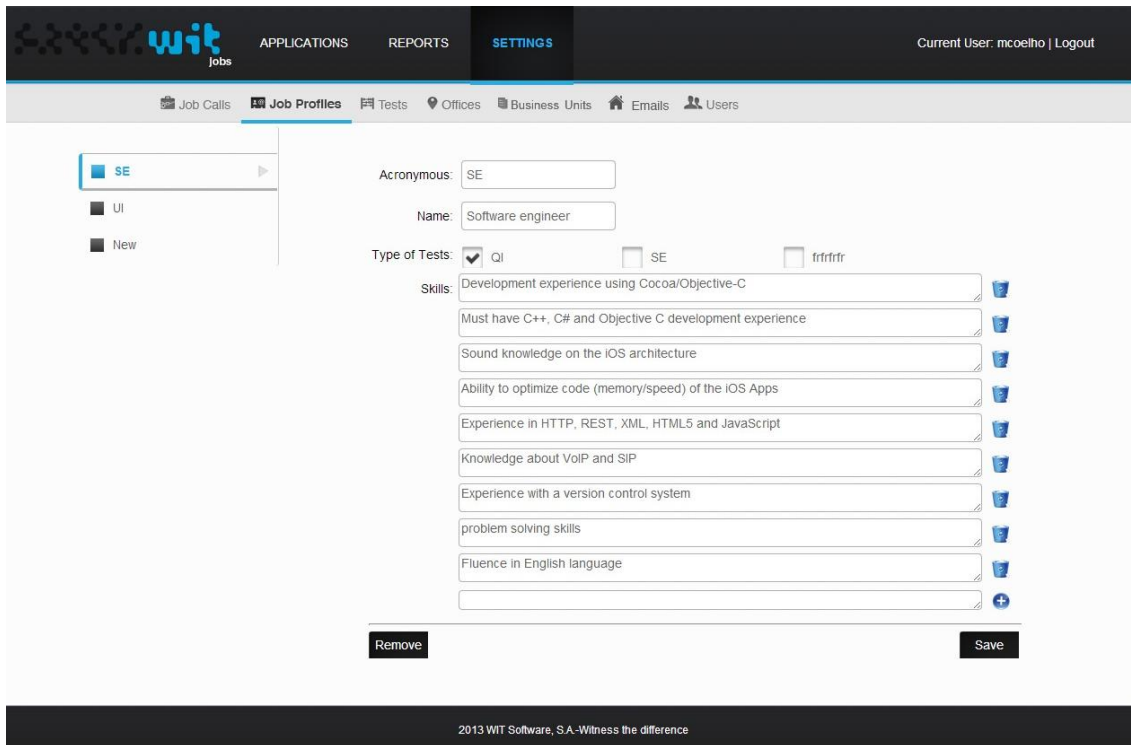


Image 13-Job Profiles

In the Image 14-Users table is the screen where it is possible to add, delete or modify privileges to users. Besides this, the page also allows searching for a user.

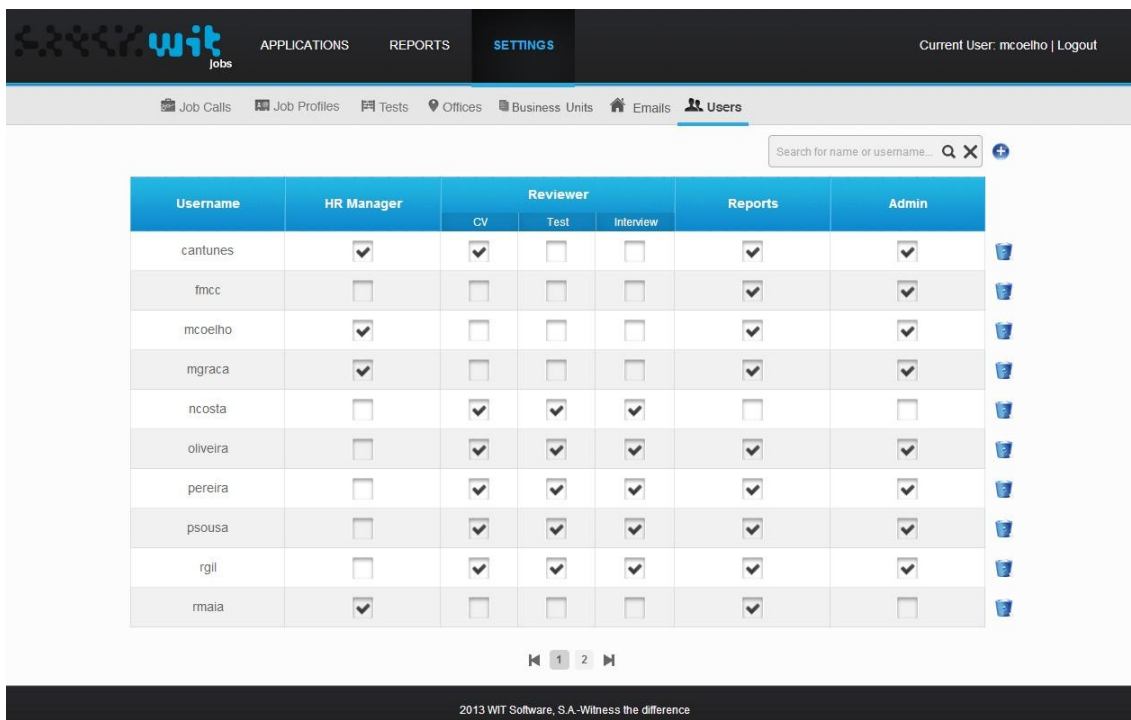


Image 14-Users table

6.2 RH Manager Module

In the image it is possible to see the table of the HR Manager. This table shows, by default, the various applications waiting to be unlocked and the applications in progress.

In the various columns of the table there are filters that can be used to select the data we pretend to see and/or sort the applications.

At the top of the table there is a search box, where the user can search by all the fields of the table and the export button that allows exporting the list of application that is being presented.

NOTE: You have 23 applications on hold, 4 to schedule test, 3 to introduce test result, 1 to introduce interview result

Status	Job Call	#CV ID	Name	Phase	Details
	QA Manager	68	Vanessa Ramos	On Hold	On Hold
	Software Project Manager	75	fsdfdsfsf fsdfdsf	On Hold	On Hold
	Android Software Programmer	3	André Sousa	Test	Schedule
	Android Software Programmer	6	Miguel Pereira	Test	Waiting Confirmation
	Telecom Solution Architect	7	Ricardo Mendes	Interview	Schedule
	Spontaneous	11	Paulo Magalhães	CV Evaluation	GO 1-0 NO GO
	Spontaneous	12	João Marcos	Test	Schedule
	Android Software Programmer	15	Daniel Valente	Test	Schedule
	Software Tester	16	Daniel Sousa	Test	Schedule
	R&D Officer	17	Vanessa Ramos	CV Evaluation	GO 0-0 NO GO

In Progress
 Go
 No Go
 On Hold

2013 WIT Software, S.A.-Witness the difference

Image 15-HR Manager Main table

6.3 Reviewer Module

In the Image 16- CV Reviewer main page it is possible to see an example of the tables available for the reviewers. In this case the table presented is the table of the CV Reviewers which displays the applications in the CV evaluation phase.

This table has several columns common with the table with applications in the testing phase and the table with applications in the interview phase. These common columns are the Job Call, CV ID and the name.

The main difference between the tables of the evaluators is that the CV Reviewer tables allows inserting CV evaluations and see the comments insert previously, the table of tests allows reviewers to see the status of the applications that are at this stage and the interviewers table allows to enter the interview comments and see comments entered by other users.

It is also important to note that the candidate CV ID, in all of the reviewer's tables has a link to the candidate's CV in Alfresco.

Similarly to the HR Manager table the reviewer's tables also allow to filter, sort and search for candidates.

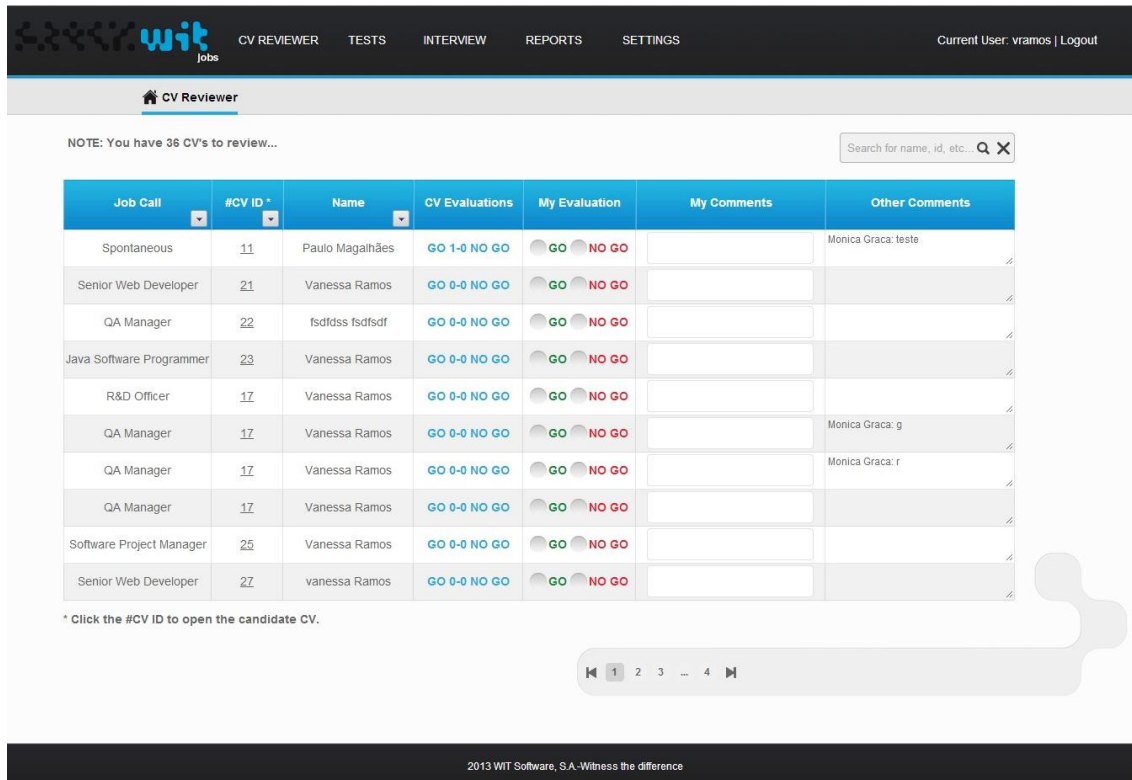


Image 16- CV Reviewer main page

6.4 Profile Module

In the Image 17-Candidate Profile (Test phase) is possible to see a candidate's profile. The profile includes several data submitted by the applicant in the application form, further data entered during the process by the various intervenient and a button with a direct link to the candidate CV.

The profile of the candidate contains a group of tabs where each one corresponds to a phase of the process. In the image it is possible that the candidate is in the testing phase and in this tab is possible to enter the scheduling of tests, the grades obtained and the final result. The remaining tabs, as this also have a section to introduce the final result. In the tab CV evaluation is possible to see a table with the track record of all evaluations. In the interview tab is possible to see comments previously entered and insert the scheduling data and comments. The hiring details tab allows saving details about the presented proposal and if the candidate accepts the proposal, the data about the job that the candidate will occupy.

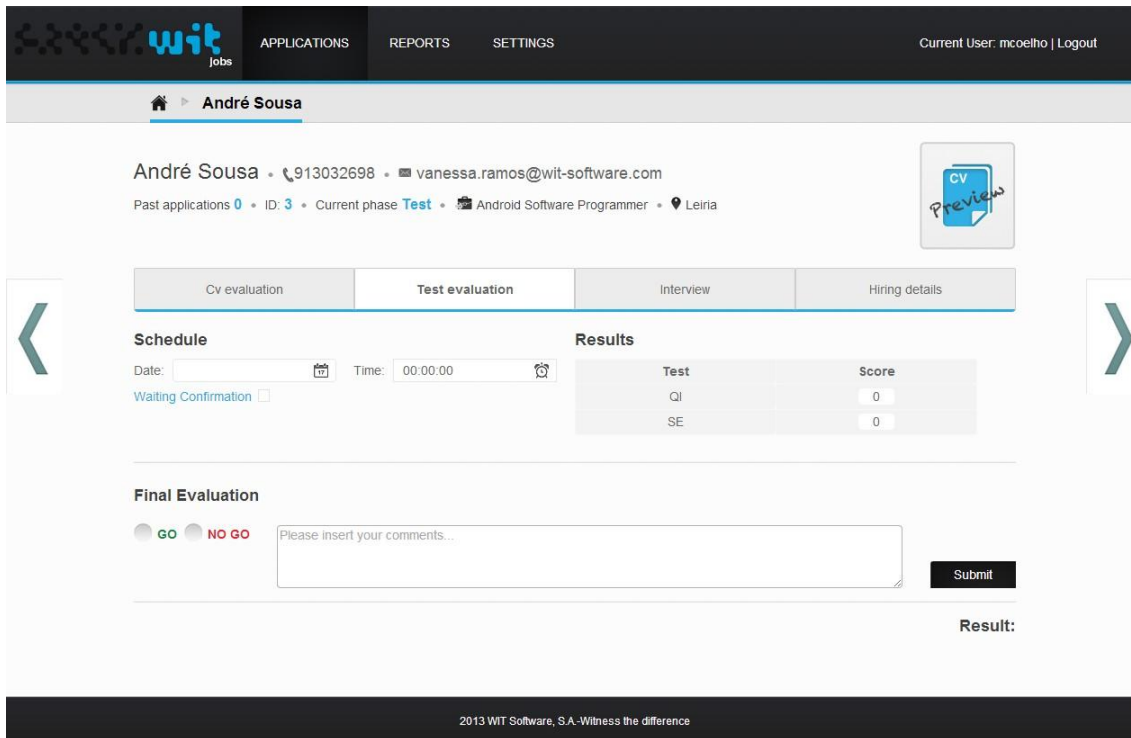


Image 17-Candidate Profile (Test phase)

6.5 Reports Module

In reports module on the application is possible to see results of the recruitment process by selecting the desired year. Within the set of reports is possible that there are the main dashboard that can be seen in the image Image 18- Reports, reports on each phase of recruitment: Application, Tests, Interview, Proposal, Hiring and data about internal statistics.

In each of these tabs it is possible to see various types of graphs with data on applications by job call, gender, and office and business unit. Besides being possible to check these charts there is also the possibility to export their image, view the data in tabular form and export it in excel format.

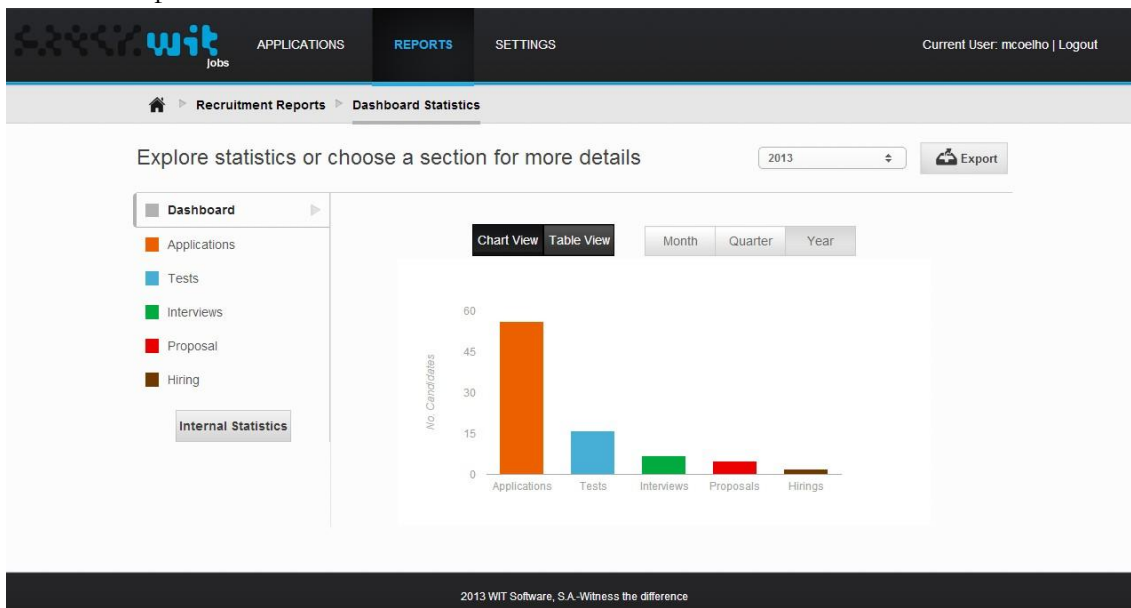


Image 18- Reports

7 Future Work and Conclusions

7.1 Future Work

The WIT Jobs Project is a Project developed with the goal to optimize the tasks of the intervenient in the recruitment process of the WIT Software. Since the development of this project is limited to the duration of this internship there were some features that couldn't be implemented but will be implemented before the platform is put into production.

This document presents a list of ideas that can add value to the platform WIT Jobs, improving the experience of the platform but for time reasons were not implemented in this initial version.

7.1.1 Features

In this section are presented some features that should be included in the platform- WIT Jobs and Application Form.

7.1.1.1 Filter applications by year of submission.

With the passage of time and in the beginning of each year, there will be the possibility that there are different applications for years. Although applications are presented in order of submission, If the head of human resources use a sort of filters, he can't reverse the order of the applications to the initial order (date of submission).

One of the utilities that may be important is to have a filter that allows the visualization of the applications that were submitted in each year with the possibility to export the list and view details about each application.

So, in accordingly with this, is useful to place a filter, similar to the select box existing in the reporting module that allows the user to choose the year of the applications he wants to watch.

7.1.1.2 Include the platform information entered by the candidate if this answers the question contained in the application form.

One of the fields of the application form is a question to which the candidate should answer is stating why he considers himself a good candidate for the particular job call. However, during the development of mockups and platform was not possible to find a place to present this information to the human resources and to the reviewers, leaving this feature for future work.

7.1.1.3 Notify a reviewer periodically.

One of the features that should be developed in the future is sending emails alerting the reviewers that they have x applications waiting for CV evaluation. Once, during this internship there were some difficulties in determining the frequency with these emails should be sent and since this was not one of the main uses of the application, it was left for future developments.

7.1.1.4 Notify a reviewer if his name or username is mentioned in a comment.

The main use of the comments in the evaluations is that they can be viewed by other users. Thus, a feature that could be useful, in this regard, is sending a notification if the username or the name of the tester is mentioned in a comment. This way the evaluators and the human resources could use the platform to notify other evaluators to see the comments introduced, since when assessing the application evaluators may not realize that his name was mentioned in the review.

7.1.1.5 Change the message that appears to HR Managers.

The message that appears to HR Manager has information relevant to the various situations in which the application is pending an action of the same. Given the several states where there may be applications, the message that appears to the user can be extensive in order to include the number of applications in each state. In this case, the message will no longer be attractive to the user, increasing the probability that will not be read.

In this situation it will be important, in the future, change the way information is presented to the user in order to improve the user experience of the WIT Jobs platform.

7.1.1.6 Include the date of birth in the Application Form.

One of the problems encountered during the test phase was the use of BI as a primary key to identify a candidate. If a candidate enters an ID that isn't his and already is in the database, the platform would admit that it was the same candidate previously entered and so would refresh the data of that candidate with the details of the new one.

Given this situation, it was necessary to find something that would allow disambiguation between two candidates with the same BI. The solution found was that the disambiguation shall be made by the human resources at the unblocking of the application.

Information that could be useful to make this disambiguation is the date of birth once the probability of a candidate to enter the same name, the same BI, the same email and the same date of birth of another candidate without dealing with the same person is greatly reduced.

7.1.2 LinkedIn Integration

Although due to time limitations as a result of problems encountered in the platform and the application form, the integration of the platform with LinkedIn was not developed, a study was done to evaluate the limitations that exist and how the functionalities would be useful to the company.

After this analysis, a meeting was held during this internship in order to identify three features to implement. These features are presented below.

7.1.2.1 Create applications platform based on information from LinkedIn

Sometimes the contact with a candidate is initiated by WIT through LinkedIn, in these situations, to avoid that the candidate has to fill the application form, will be useful to be able to create an application for a particular job cal using the information that the candidate has in his LinkedIn profile.

7.1.2.2 Get information on candidates who submitted the application using the Application form;

To gather information about a candidate is required to find his profile, for this it is necessary that the user enters his LinkedIn profile in the application form or that the human resources attempt to identify the profile of the candidate. To identify the candidate profile, there will be done a search through the functions provided by the LinkedIn API and the results will be presented with a list of options based on name, where the results are displayed by proximity and human resources can then associate the candidate's profile with the application.

7.1.2.3 Integrate the application form with the plug-in “Apply with LinkedIn”;

LinkedIn provides a Java-Script plug-in that allows the association of LinkedIn data with the application form. This plug-in can even be used as a single source of submission of the application, i.e., when the candidates press the "Apply with LinkedIn", his information is sent to the email or in an xml avoiding filling form.

In addition, this plug-in can also be used to populate the form fields with existing data from LinkedIn profile.

7.1.2.4 Advantages

These three features have the following advantages:

- Gather more information about the candidates;
- Save time entering data for candidates who are contacted by Human Resources through LinkedIn;
- See if the candidate has any connection with any WIT's employees;
- Allow candidates become "friends" to the WIT to increase the contacts network in order to reach more people.

7.1.2.5 Limitations

There are some limitations that are important to refer since they will determine the features to develop:

- The research is done by the user WIT, will only be presented results that are in network research;

- There is a unique identifier that allows uniquely identify a profile. That is, we can use any field such as the email address to uniquely identify a candidate;
- The plug-in "Apply with LinkedIn" has some limitations that must be circumvented in order to make the completion of the data but require the user to be the user to associate the job that he is applying lime.

7.2 Conclusion

The final result of this stage is certainly advantageous for WIT software. The platform developed, will be in production in the near future, when the various changes outlined in the section 7.1 are implemented and will allow optimize the recruitment process and increase the human resources team productivity.

Throughout this internship, there have been several steps and was gain a higher sensitivity to issues related to the quality process of a project. Due to the problems encountered in the final stage of the internship, was possible to identify some shortcomings in implementation of some features that will be useful, in the future, to define the quality process in order to avoid the faults indentified in the creation of test cases.

The implementation of several features required the use of technologies, increasing my competencies, in order to successfully achieve the goals set at the beginning of this internship. In addition to the technical knowledge acquired, using processes of software development in a business environment were invaluable to my enrichment technical, personal and professional.

This internship and the adaptation to the business world, forced me to have an ability to adapt the project development, accordingly with the requirements that were added and removed.

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