Joël GUEGUEN

Master 2 European Computer Science

INEAD - FEDE

2016 / 2017

N° 92717 - FEDE

Universitary tutor : M. Sami HILALA

Enterprise tutor : M. Laurent GORRY

BBS : Brest Business School

Synthesis of the professional Thesis Master 2 European Computer Science

HMI development of an intranet website for management of company internship agreements

BREST BUSINESS SCHOOL

Federation for EDucation in Europe
Fédération Européenne Des Ecoles

➢Acknowledgements

Before any development on this professional experience, it seems appropriate to begin this professional thesis with acknowledgements, to those who taught me a lot during this internship, and to those who kindly made this internship a very profitable moment.

I would therefore like to thank greatly BBS (Brest Business School) notably the director M. Luc PONTET for having welcomed me to carry out my internship, thus offering me the opportunity to acquire a very enriching professional experience.

In addition, I would like to thank M. Laurent GORRY, my internship supervisor who trained and accompanied me throughout this professional experience. He devoted me a part of his precious time, has answered all of my questions and who was good enough to validate this report before publication. He also left me with enough autonomy so that I could express some ideas during the development of project. M. Sami HILALA, my INEAD universitary tutor, for his availability, his wises advices in the conception and realization of this thesis, as well as interactions and exchanges that we have had during the internship. On another hand, I would like to thank likewise M. Erwan LANCHEC, the responsible of Information Systems Direction (ISD) of the company for its support, relief and explanations in the work.

Finally, I would like to thank all the teachers of the training for their teachings, the entire pedagogical team of INEAD as well as all the employees of the BBS Company for their advices they were able to give me during this internship.

➢ Abstract

I completed my internship in Master 2 European Computer Science at BBS company (Brest Business School).

I was in charge of the HMI development of an intranet website for the management of internship agreements of the company. To do this, a document of specifications had been elaborated by my tutor of internship concerning the different needs of application. Indeed, the company wanted to digitize all business processes related to the operation of company, by automating them from their website.

Digitization or digital transformation has become important to bring a better productivity and optimization in business processes within companies. Objective of this internship was to develop interfaces of application in order to pursue migration of the old version to the new version of the intranet website.

The internship project was divided into three parts. First, there is the theoretical analysis of situation, then development of interfaces for the website and finally, project management. The different steps of design, implementation and production of a web application will also be addressed, to get a preview of the interface development project of intranet website.

This professional experience enabled me to discover new tools and new working methods during realization of this project. Therefore, I was able to improve at the same time, skills in IT Project management but also in research and development.

Keywords : Development, HMI, business processes, intranet website, digitization, digital transformation, web application

Summary :

Introduction :

Digitization is today a must for companies or any type of organizations. Indeed, it applies to all domains and ensures optimization of time and money by automating processes more and more complex. It can even become a competitive advantage in areas where digital transformation has not been fully done by companies.

Digitization is the process that transforms an object, a tool, a process or a work into a computer program in order to replace it and make it more efficient, more performing. The digital transformation started from the beginnings of the internet, couriers have been replaced by emails, events and conferences by web forums, shops by e-commerce websites. Now, companies are experiencing a wider and more efficient digitalization, which has become a natural phenomenon combining the appearance of Internet and the daily advances in computing.

The necessity for companies to comply with digital transformation is becoming more and more evident. Much more than a trend, this phenomenon must now be an important component in the center of any business strategy of companies. Digital transformation is a concept that is interfering even in the economic model of societies. The companies depend on it, as digital enhances the customer experience and optimizes productivity.

The digital transformation turns out to be more a sociological than a technological subject, because with the arrival of digital, these ones are in fact led to rethink their processes, their modes of operation, their managerial practices, and finally the company values.

Some guidelines had been defined from the beginning to lead properly this professional thesis. Thus, in order to respond at best to the problematic of thesis, it was necessary to get some informations about the global context of internship and environment of the company. By documenting through books, reviews, websites or even reports to retrieve information on this problematic. This collection of informations also offered a specific analysis on some strategic improvements in the development of IT projects, business processes and organization of companies.

The main source of elaboration of the thesis was the different teachings established during the daily practice of activities to which I was assigned, as well as the few interviews I had with the employees of the different services of the company.

The objective of the project was to do the HMI development to automate the management of internship agreements on the intranet website of students and employees of the BBS Company. Moreover, data management was important in the use of intranet website because most of the information, representing the work context of the company, was directly related to the database. More widely, I was so interested in web application design together with research and development.

This thesis will first address an analysis on the study of art by demonstrating the main objectives and needs of the web application, from the former existing intranet website permitting to migrate to the new version of the website, as well as explanations on the principle of digitization in companies. Before continuing the description of the different performed activities notably as the development interfaces of the intranet website, by taking into consideration of the digital transformation within companies. Finally, I will conclude on the structuring and implementation of project management to monitor the progress of the project development. I will specify too the many contributions that I have had as much on the personal as professional domain.

Problematic :

Administrative staff and the business relations services have to deal with many internship agreements and there is a need for the entire automation of the process in order to be able to manage more rapidly internship agreements.

« Automate the process of internship agreements management»

Presentation of BBS Company :

Brest Business School, formerly "ESC Brittany Brest" is a great French school created in 1962. It offers seven professional and international training programs in the field of management and trade. It is under the co-tutelage of Chamber of Commerce and Industry of Brest as well as Chamber of Commerce and regional Industry of Brittany.

In a constant evolution world, Brest Business School has constantly innovated and proceeded to the necessary adaptations to offer the training programs suitable to the needs of the companies and the desires of students. It is a member of the Conference of Great Schools and hosts nearly 800 students on its Brest campus.

Spacious, the Brest campus is endowed of modern pedagogical infrastructures and spaces dedicated to students like co-working spaces. It has become also a meeting place for entrepreneurs since the campus integrates an incubator, the headquarters of "Product in Brittany" and has recently had as partner the CESI, "center of training in all the sectors of activity" which also resides in their campus of Brest.

Because the economy and society are globalized, but also to respond to the major challenges of the planet, their programs integrate economic, societal and technological cultures with the dimensions of creativity, innovation and entrepreneurship. These programs are diffused through a modern pedagogy adapted to the native digital public, using all Medias supports and all places of knowledge.

Brest Business School designs and proposes adapted programs that prepare students to become responsible managers and entrepreneurs in a globalized environment. In complement and support of its program portfolio, Brest Business School affects socially and economically the actors of its territory through its applied research activities.

The operational implementation of their mission translates into:

- the provision to the populations of a higher education institution of management, quality and resolutely international, preparing new generations of managers to relieve the complex challenges of the planet and to create the necessary economic and social value
- the improvement of the knowledge and managerial practices of students, companies and institutions

- the development of innovative teaching practices transposable in companies
- the contribution to the development of territorial organizations :
- by the provision of multicultural human resources,
- by assistance and national and international provision of services,
- by works, studies, advices and research,
- the support for start-ups and companies creation.

BBS has also several international partners for the diversity of exchanges in the service of relations with the companies.

Chapter I : The subject of internship

1.1 Evolution of digitization and digital transformation of the companies

Faced at the disruption caused by digital, the digital transformation has become a major subject of preoccupation and a strategic stake for all organizations. Thus, new objectives have to be redefined, to allow further operational performance, to seize all growth opportunities and to guarantee the durability and security of operations. As Companies must remain competitive, they must take into account the digital transformation that is taking place within society. It is indeed a mode of culture to appropriate, not only within companies but also in daily life. Customer experience, enterprise reinvention, operational optimization, compliance and security are as many areas as advantages proposed by digital transformation.

Currently, the omnipresence of technologies in daily means that more and more people are appropriate them so much that they have become unavoidable. Administrations and companies are thus confronted with new uses linked to the democratization of technologies generating new expectations but also new prospects and opportunities. Digital has also changed the way of consumption. Companies must reinvent themselves on new, more opened, collaborative and responsible business models. It would also be preferable for the productivity of a company, to associate users to innovation processes, and move from a centralized strategy to an open innovation practice, based on user experience.

Developments concerning the security and protection of personal data are equally important, within an ecosystem where users share more and more data. For a better profitability, the companies must not only optimize processes, but also reinvent them according to new sectors of activities. Digital transformation has taken place on the market from the unmet needs of the customer. Permitting also to solve them thanks to the ergonomics of the different internet platforms. The digitization method often consists to experiment, measure and improve the products and services, by taking into consideration the feedback of users. Thus the customers nourish the renewal of the offer thanks to an unprecedented interactivity and to the exploitation of their data.

1.2 Presentation and working environment

Visit of the locals of BBS with the responsible of the ISD, M. Erwan LANCHEC and M. Laurent GORRY, my internship tutor and the BBS Computer Engineer. Therefore, I met several people including the director of BBS, M. Luc PONTET and the people with whom I will eventually be led to work during the development of the website application.

Some employees still use the former version of the intranet website, as they have habit to work on this ERP[1] since some time. However, with new demands in terms of functionalities and ergonomics, BBS will soon have new hardware with one of these digital partners. Thus the former version of the application will no longer be available. All users will then have to use the new application which will be developed except if some important elements according to the functions of each employee are only on the former version until the total and complete migration is made.

The company also has an internet website : http://brest-bs.com/ and an intranet website for BBS students : http://student.brest-bs.com/

Indeed, a recast and migration of the former version of the BBS intranet website : http://intra/default.aspx will be carried out towards the new version of the website : http://h2o.brest-bs.com/

And it was on this new version of the website that the development of the "**Enterprise**" part for the internships, with the creation of new rubrics in the Enterprise part of the application should be done : manage the companies, manage the contacts, manage the learning tax, manage the offers, manage the groups, **manage the internships**, manage the apprentices

[1] ERP : Enterprise Resource Planning

Then the creation of new rubrics in the part to **manage the internships** :

- Validate a convention request

- Validate an internship

- Edit an internship agreement

- Management of internships

When it was necessary to do the ERP, the application was already developed with **ASP.NET Webforms** framework technologies. Then the responsible of the DSI preferred so to continue the development of the application in **ASP.NET**.
Even if he had thought to do the development in **JAVA / J2EE** for portability[2], it would have taken much longer because we had to redo the whole application.

ASP.NET (Active Server Pages) is a technique to generate on demand dynamic web pages and used to enforce web applications. An ASP.NET page is composed of two parts : one side of the **HTML[3]** code, and the other of the program instructions. The ASP.NET engine is a filter plugged into the Internet Information Services (**IIS[4]**) web server. It is distributed with the .**NET framework**. ASP.NET can be used with any programming language for the .NET platform.

The ASP.NET **MVC** framework is more and more used in comparison with the ASP.NET **Webforms** framework because it offers a complete management of the HTML generated by the web application, which simplifies the use of libraries like **Bootstrap** or **JQuery**.

Moreover, **Visual Studio .NET**, the **IDE[5]** used to create applications using ASP.NET includes a debugger, a web page editor and a text editor with syntax highlighting,

[2] Computer portability : Portability refers to the ability of a computer program to adapt more or less easily to function in different execution environments. Differences can affect the hardware environment (processor) as well as the software environment (operating system).
[3] HTML : HyperText Markup Language
[4] IIS : It is a web server of different Windows operating systems. It supports several web techniques including ASP.NET for the development of web applications.
[5] IDE : Integrated Development Environment is a set of tools to improve the productivity of developers who develop software.

Auto-completion (named IntelliSense technology), and a syntax check, which further simplifies programming work.

ASP.NET is, according to Microsoft, supposed to have better performance than other scripted technologies because server-side code is compiled into a few simple **DLL**[6] on the web server. During development, when the source code is finalized, the solution is precompiled before being placed on the hosting server (publication). ASP.NET enables developers to a more fluid passageway from the classic development of Windows applications to the development of Web applications.

[6] DLL : Dynamic Link Library

1.3 Presentation of the internship subject

The internship subject of the BBS Company is to organize the migration and the recast of an intranet portal for the students and the employees (users). With parts also concerning the drafting of specifications and **HMI**[7] development, web design for technical and functional aspects, as well as on the ergonomics and responsive design interfaces of the application.

Another interest of migration from the former ERP to the new application is also the accompaniment of the employees during the development of the application.

That is why, it was necessary to have several discussions and exchanges with the persons concerned. For example, to know if it corresponded to their needs or if they had opinions about the design of the application. Therefore, these students and employees can use an user-friendly, functional and ergonomic application.

Most of the employees are ravished about the new application being developed. Because they think the use of this application is simpler. Indeed, the proposed interfaces have been simplified and have been divided into parts for a better use.

[7] HMI : Human-Machine Interface

1.4 State of the art – situation theory

During the migration and development of the new application, several projects were developed. Concerning my part on the development of the application, there were three main projects :

The *Admin* project, which regroups all the components, functionalities and interfaces of the application used by all BBS employees.

The *Student* project, which regroups all the components, functionalities and interfaces of the application used by the students. (**Responsive Design** of the application).

Moreover, the *Utilities* project, which regroups the functionalities most often used by users. Such as for example, the sending and the receiving mails, creation of a new account, data from an Excel, **XML**[8] or **JSON**[9] file extraction, print creation of a PDF file, or again a display contents of one of the tables into the database.

It was in the *Admin* project that principally consisted the part on the development of the application. And precisely in the creation of a new "Enterprise" rubric.

Concerning access and authorizations, they differ according to the type of user. For example, the administrator is the one who has the most rights on the content of the application. Then, each of the employees has a specific interface according to their function, needs and therefore does not have access to all the details and all the content of the application. In addition, students only have access to information about them on the application.

[8] XML : eXtensible Markup Language
[9] JSON : JavaScript Object Notation

Here is how the application works :

For the intranet website of students :

Students connect with their login[10] and password[11] provided by BBS. Then they access directly to an interface that contains all the information that concern them.

For the intranet website of employees :

Users (employees) connect with their login and password provided by BBS.

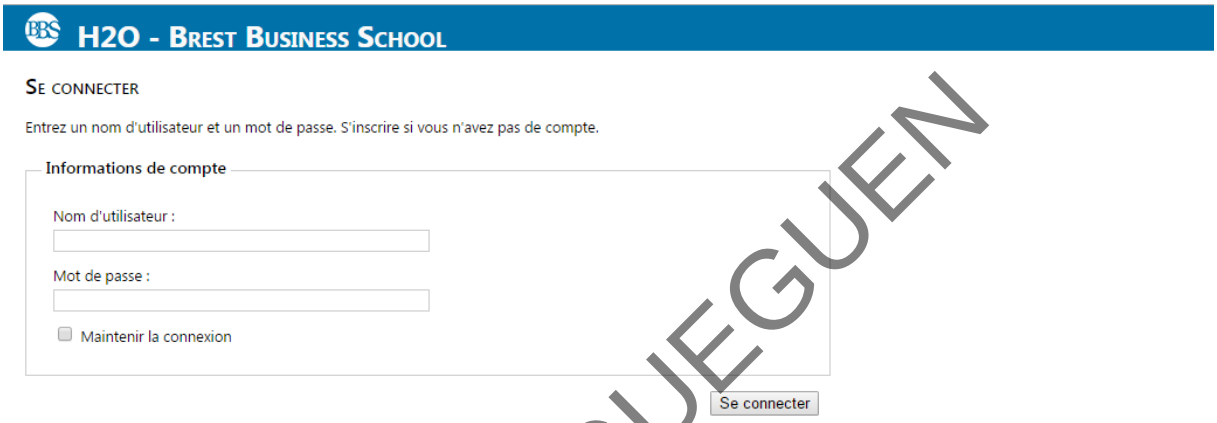


Figure 1 : Connection interface to the intranet website

Then depending on the type of user, they access to an interface that contains all the informations that concern them.

[10] Login : refers to the username or to an identifier as well as an authentication to verify the identity of the person who connects to a computer system.

[11] Password : Password, used during an authentication to access a resource or service.

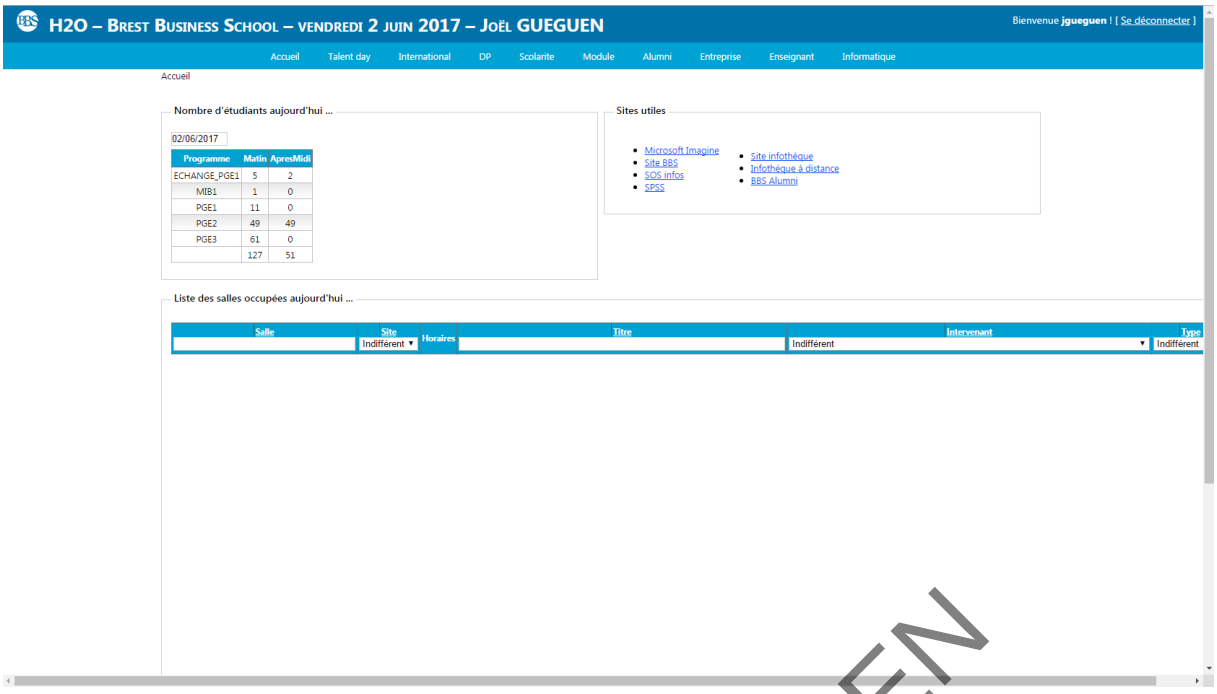


Figure 2 : Home interface for *Admin* user type

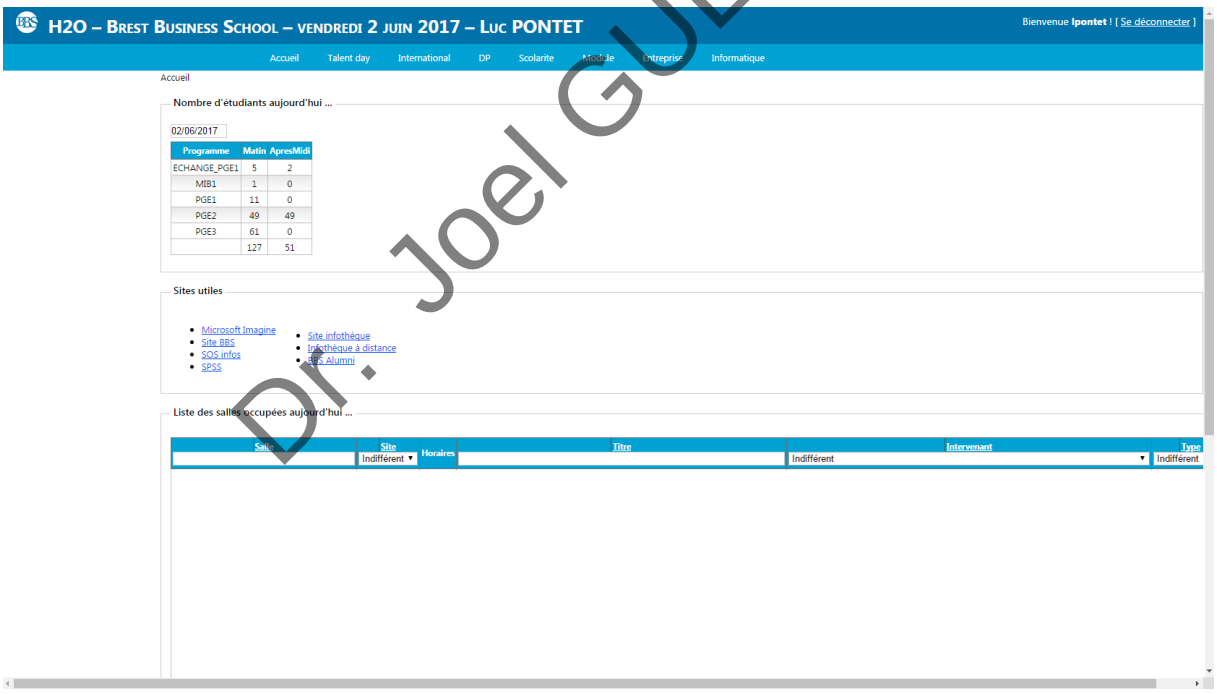


Figure 3 : Home interface for *administrative personnel* user type

The global development of the intranet web application :

For the intranet website development, it was also necessary to respect the **graphic charter**. For this, a main page for each of the interfaces proposed by the application had been set up. It therefore contained ASP.NET development with **AJAX**[12], **XHTML**[13], HTML and **CSS**[14] for the interface menus design.

Thereby, when a new web page was created, it had to be linked each time to the main page.

The home page is the common page for each different user type, only the rubrics and menus and their contents are different to the display. Notably, it was requisite to use several packages necessary for the development of the intranet web application. For example, AJAX, Bootstrap, JQuery or Entity Framework.

Concerning the **database**, in order to be able to create queries with the tables created in **SQL Server**, it is necessary to create an **UML** diagram containing the tables concerned. This is done with the Entity Framework.

The **Entity Framework**, considered as an ORM (Object Relational Mapping), is a set of .NET Framework technologies that support the development of data-driven software applications.

[12] AJAX : the Asynchronous Javascript And Xml computer architecture allows to build web applications and dynamic interactive websites on the client workstation using different technologies added to different web browsers.

[13] XHTML : eXtensible HyperText Markup Language, is a markup language used to write web pages, such as HTML, but with a syntax defined by XML.

[14] CSS : Cascading Style Sheets, to describe the presentation, the design of HTML and XML documents.

The following diagram illustrates the Entity Framework architecture for data access :

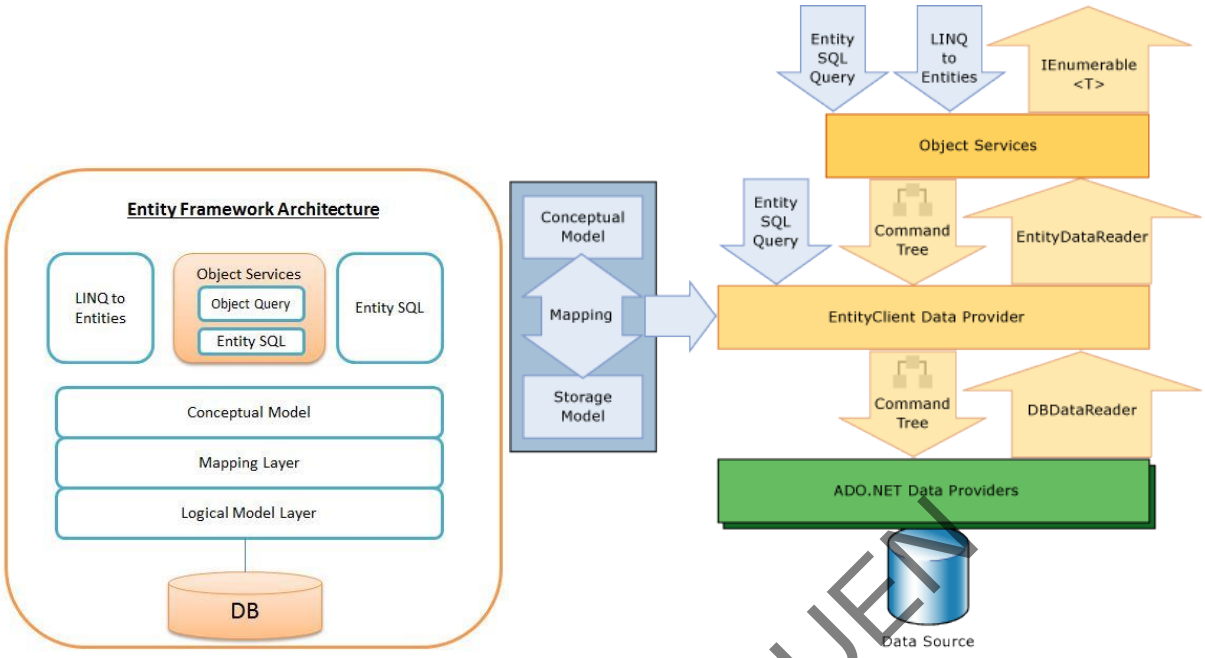


Figure 4 : Entity Framework Architecture

The application is very large in its entirety (more than 500 data tables) and has many Entity Frameworks in connection with the tables in the database.

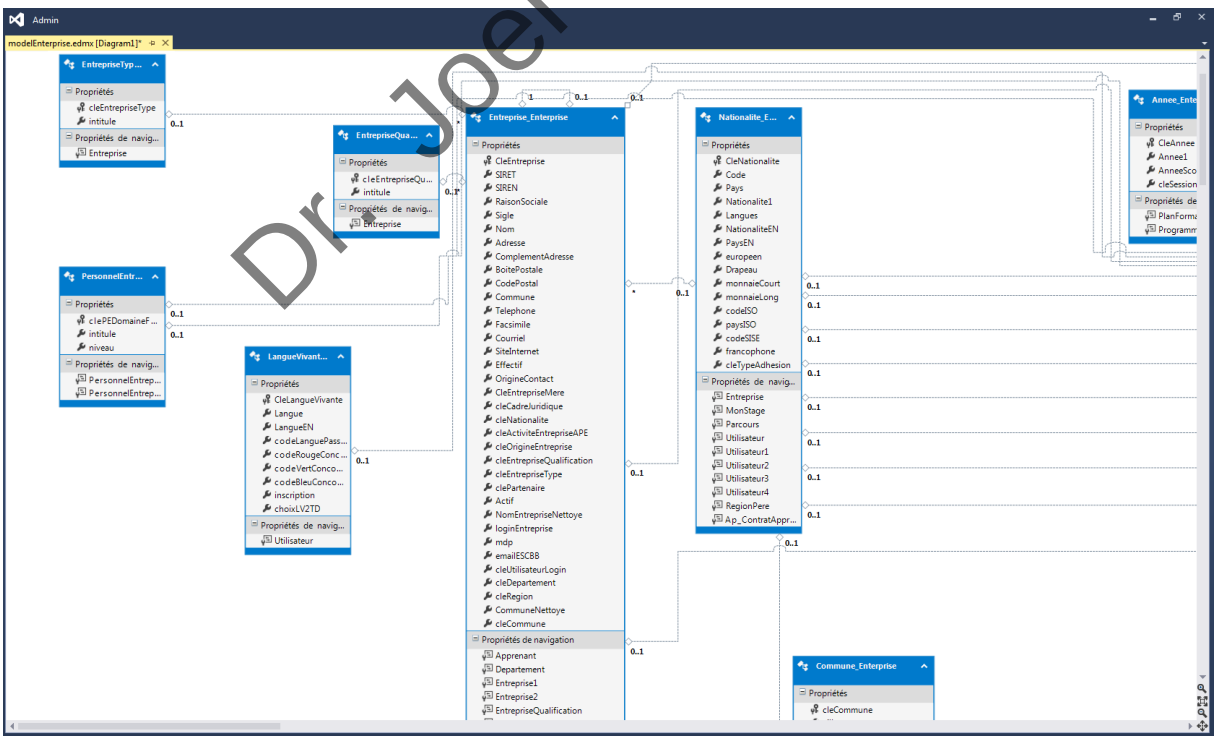


Figure 5 : Preview of an Entity Framework model of the application

SQL (Structured Query Language) queries were done with LINQ (Language Integrated Query). **LINQ** is a component of the Microsoft .NET framework that allows making queries on data to .NET languages by using syntax similar to that of SQL.

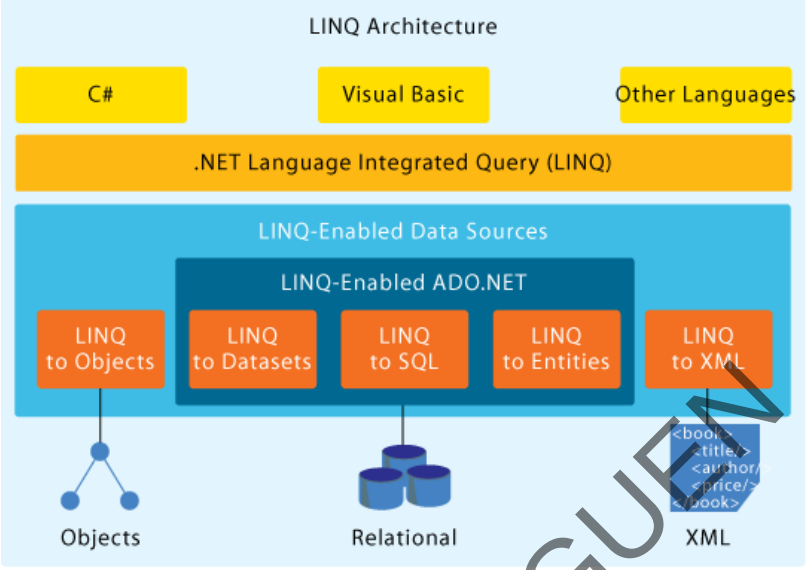


Figure 6 : LINQ Architecture

For each web page creation, two pages are presented for the development of the application. The source page and the design page of the application containing a graphical preview of the page on the website.

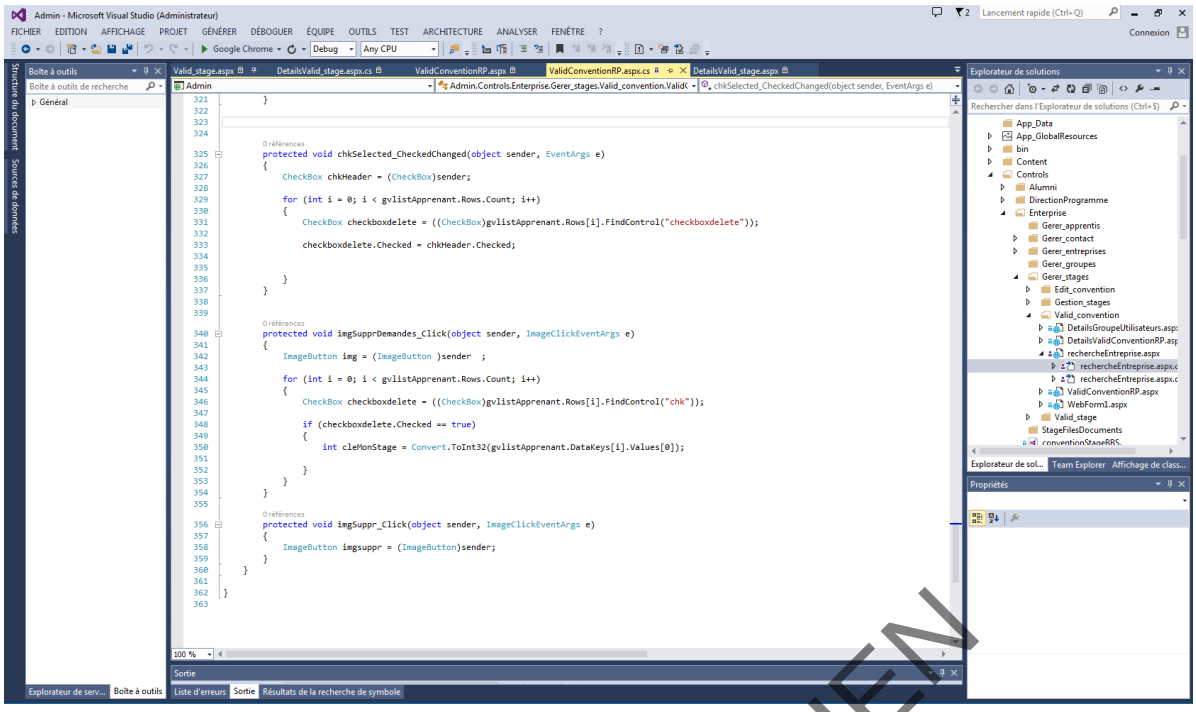


Figure 7 : Example of a source page in the application

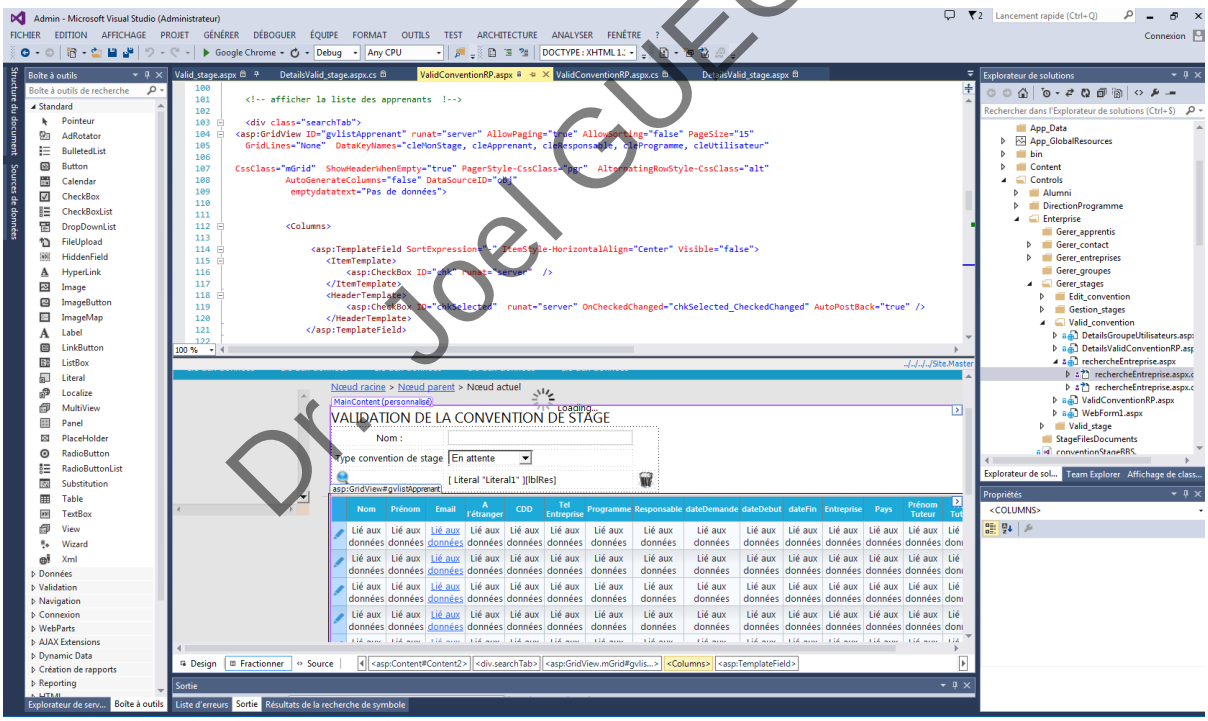
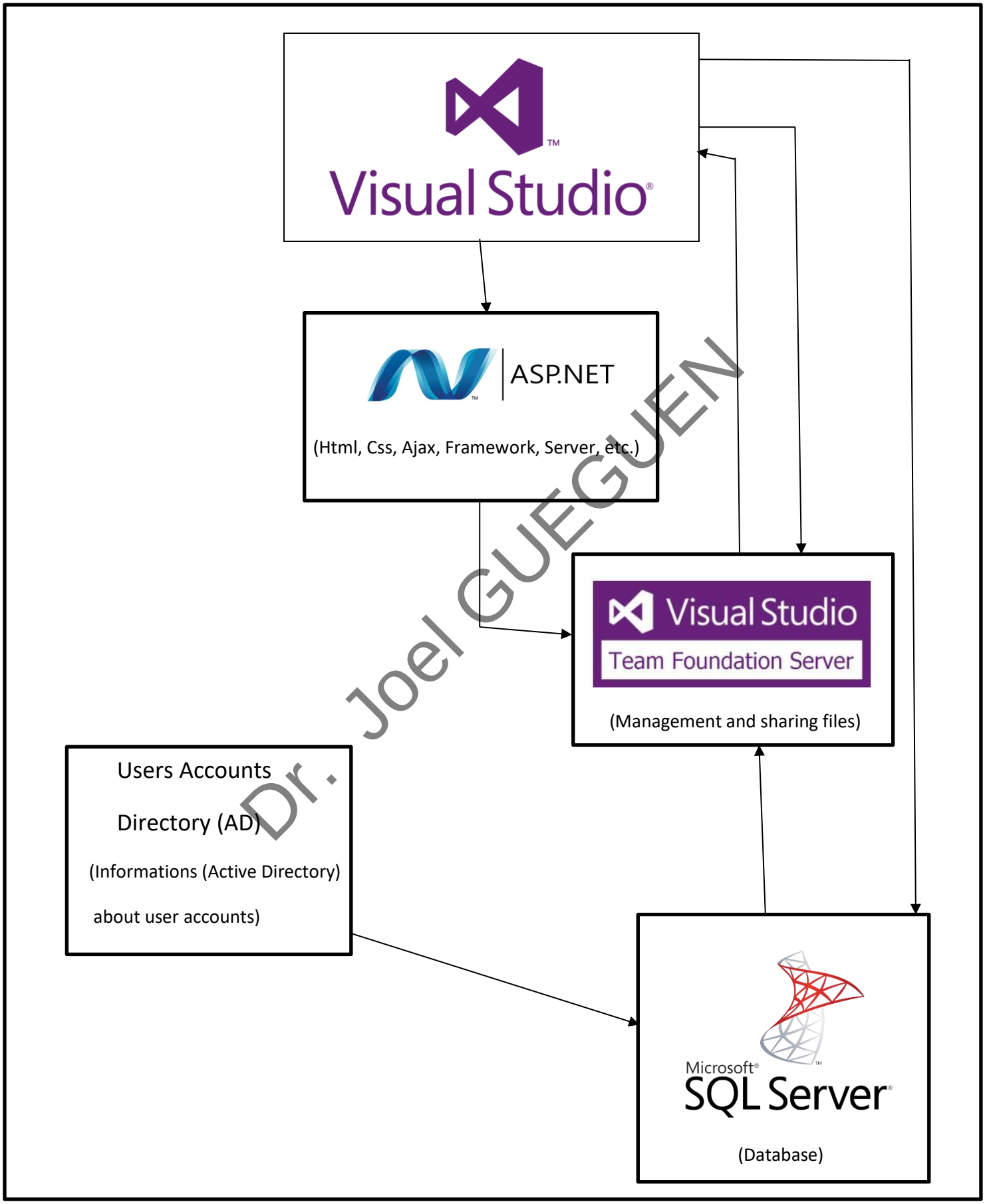


Figure 8 : Example of a design page (with graphic preview) in the application

At each new creation of interface, it was necessary to secure the informations of the users and to give rights on the use of the contents of the application.

1.5 Software application architecture



1.6 The reasons and context of software development

Design, user interface (**UI**[15]), user experience (**UX**[16]) and ergonomics :
a created interface could serve from a person to a group of people in a given service. Thereby, the interface had to be functional and user-friendly for all the people concerned by this one. This depended on the **business processes** of each company staff but also on the specific use of interfaces.

Concerning the needs of the application, there were two main BBS services for which I had to make interfaces. :

- The **Program Responsible service** (**RP**)

The staff responsible of the different programs

- The **Enterprises Relations service** (**RE**)

The staffs who are in contact with enterprises

The company often preferred that the functional part and the graphic part be done simultaneously, but sometimes it was more interesting to do first the functional part and then the graphic part. Because the real need resides in the functional part for the development of an application.

The intranet website has been developed with the **ASP.NET Webforms** framework. Moreover, even if the **ASP.NET MVC**[17] framework is the most recent and most used, the development of the website in ASP.NET Webforms suits the different employees of the company. Thus, as it is about migration from a former intranet website based on the ASP.NET Webforms, it was preferable to use this framework.

[15] UI : User Interface
[16] UX : User eXperience
[17] MVC : Model – View – Controller

Chapter II : Description of the realized work

2.1 Role and contributions in the company

The main final objectives defined for this internship were to create the HMI development of the intranet website of the company. More precisely, to create the internships menu in the "Enterprise" rubric of the application. Then there was also the identification of the functional specifications, and the detailed design of the interface development parts of the application. Therefore, at the beginning of the internship, I had done a planning of the work according to the time that was granted, but also to obtain more productivity and efficiency in the organization. On the one hand, there was the part consecrated to the HMI development of the ERP, and on the other hand, the part consecrated to the search of relevant information on several fields for the development of the application but also of the company.

During the project management, it was necessary to take into account the different phases related to the development of the application. In addition to the use of new web tools and technologies, the user experience / user interface was a very important criterion in the development of ERP interfaces :

- Force of proposition in web design,
- R&D on the application responsive design,
- Production,
- Finalization of the project,
- Supports and application maintenance for users,

Before publication of an interface on the server of the website, it was necessary to make deployments locally for each of the interfaces of the ERP. Thus, some settings and configurations may be necessary.

The software architecture of the application permitted to apprehend and analyze the different structures that composed the website. Furthermore, its conception also depended on certain specificities, for example :

- The explanations on the functioning of the former version of intranet website,
- The functioning of the ISD for the company,
- The functioning of the company through the intranet website,
- The global functioning of an ERP,
- The business processes of the company

I was also requested to train and help the other trainees, as well as to do supplementary works to improve the design of the application. In addition, the conduct of the development project, which included a research and development part, was very useful to dispose of time permitting to respond to the expectations and needs of the company.

As far as, discussions and interviews with company staffs were very enriching for the different needs to conceive on the intranet website.

2.1.1 The tools and technologies used

In computer science, it is often asserted that the documentation part is just as important as the programming part and that the debugging tool permits to solve many problems. Thus, I found so very useful to produce documentation, comments, to use the "debugging", the breakpoint, the internal and external procedure for the methods when developing web pages for the intranet website.

Concerning the working environment, the tools and technologies used to develop the application are as follows :

IDE : Visual Studio.

Visual Studio is an IDE developed by Microsoft. It provides a complete set of tools for the development of applications based on the .NET framework, in different programming languages. It allows so to develop web applications or software.

Development of the web application : Ajax, HTML/CSS, JQuery, ASP.NET, C#, Web services.

The database Management : LINQ, Entity Framework, SQL Server.

SQL Server is a SQL database management system (DBMS) incorporating, among others, a relational DBMS (RDBMS) for visualization of data tables, developed and commercialized by Microsoft.

These technologies will be detailed as and when that they have been used during the development of the web application.

2.1.2 Development and functionalities of the intranet website (ERP)

Each person using the application and each person defined in the application are users. Moreover, each **user** is listed in a **user group**. As a result, all employees using the web application are users, but they must only have access to information about them on the application. To do this, it was necessary to set up rights on the use of the application so that the menus and interfaces of the application are displayed according to the user concerned.

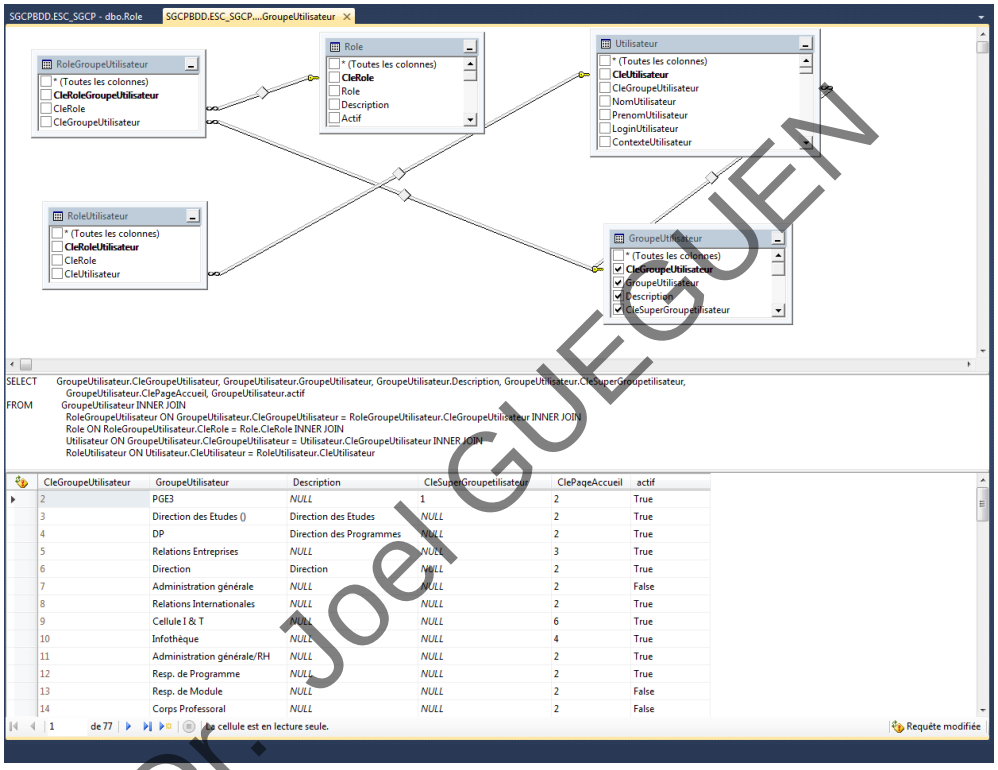


Figure 9 : GroupeUtilisateur table in SQL Server

ERP is an information system that permits to manage and follow up on a daily basis all the information and operational services of a company.

The basic methodology of an ERP implementation project involves the following main phases :

General design (business needs collection, definition of information system processes and identification of ranges with the standard product).

Detailed design (definition of functionalities used by processes and management rules).

Implementation (setting, technical design and specific developments).

Integration tests (systems tests permitting to the integrator to ensure that the solution complies with the general design and detailed design).

Recipes (business tests, a chosen future user population simulates flows corresponding to the operational activity of the company).

Production, ERP **support and maintenance**.

Several designs and deployments are often necessary to take into account and identify the differences between the business needs of the company and the services proposed on the website.

Autocomplete is a computer-based feature that allows the user to limit the amount of information he enters to the keyboard by being proposed a complement that might be appropriate for what he is looking for information. Autocomplete imposes to the software to forecast the informations that the user is likely to look for, before this one has fully seizure it, for example in the search engine of a computer system. It is therefore available in cases where it is possible to predict the different strings of characters that will be seizures, for example from the informations that are stored in a database.

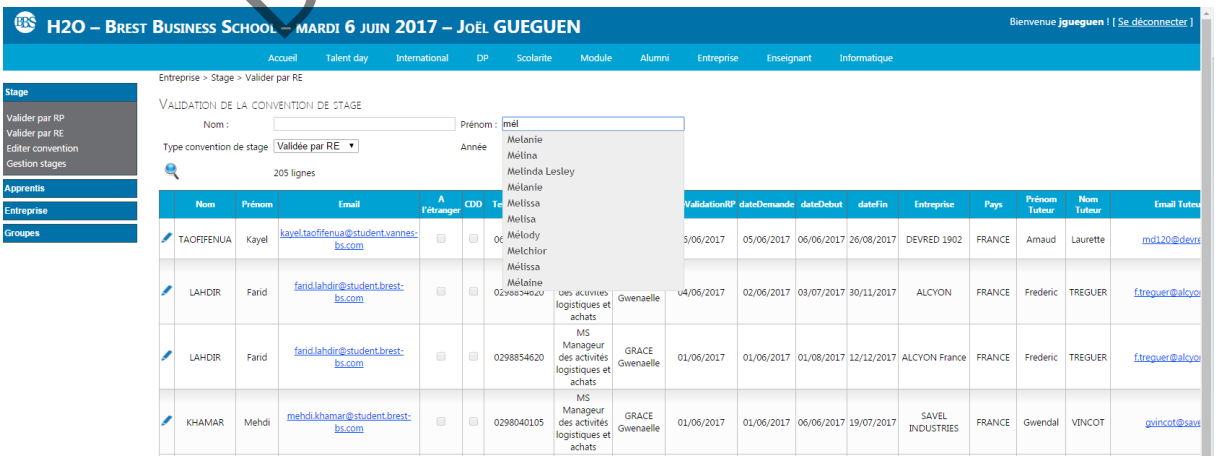


Figure 10 : Interface with autocomplete search of the first name of the person

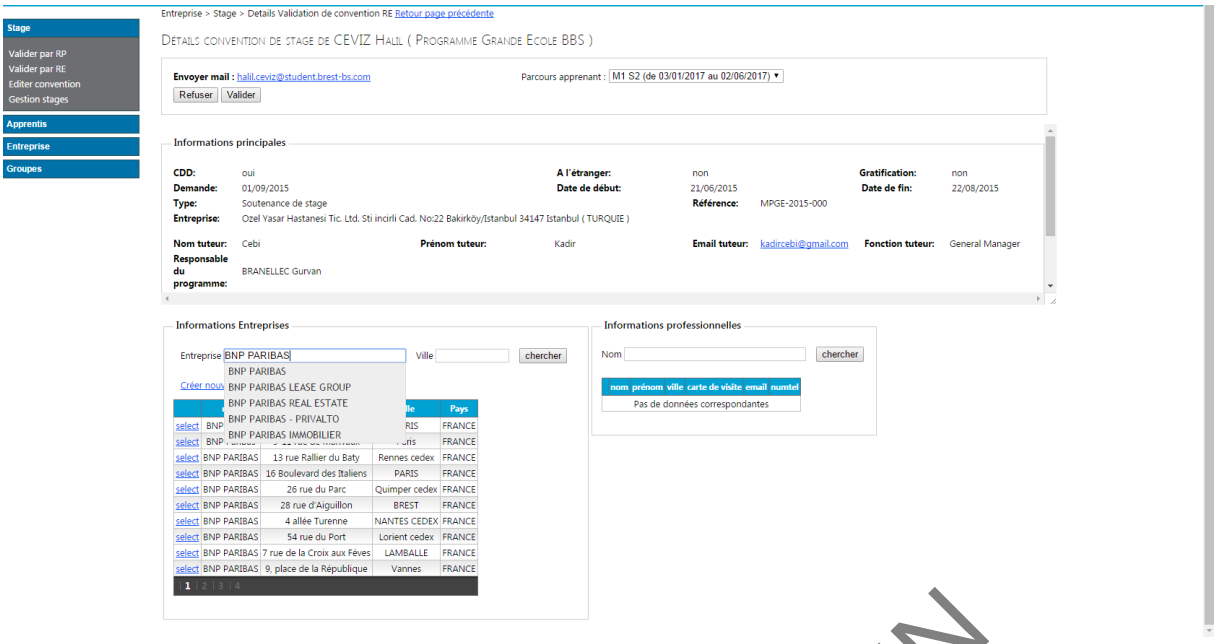


Figure 11 : Interface with autocomplete search of company name

For several web pages, checks had to be made to have better usage management and to have only useful information in the SQL Server database. Indeed, it was necessary to do some checks so that the user does not enter any information in the database. The informations had to be correct before making any manipulation with the database. For example, it is necessary to respect the fact that there are mandatory fields to fill before making the records in the database.

And sometimes, to simplify the use end-users, pre-recorded data that concerned the informations that he had to provide were already displayed in text input fields or others. Of course, this still could be alterable, but users appreciate when existing informations and corresponding to them are automatically displayed in the application.

The interest was therefore that everything in connection with the database (updates, insertions, deletions, records, etc.) should be checked in such a way that these informations are correct and therefore useful for the staffs of the company. Thus, there is no need to make several deletions directly in the database.

The opinion change of the employees of the company using the web application, made that there was a lot of **design** on the interfaces to simplify the use of the

website. For example, as and when the interfaces were used, some search parameters were not used, so they had to be deleted, or to replace other parameters that were requested. For some parts of the application, it was preferable to **optimize** the informations displayed on the website. This meant that users could use less clickable pages with hyperlinks and page returns for navigation, but rather a page containing all the informations requested on one and same interface. This type of interface is very often named "**Single One Page Application**".

The fact that an interface worked, was only a part of what was requested to the company. The **graphic** part was equally important mainly for the **comfort** of the user but also for that the website to be more **user-friendly** and therefore appreciated by all users.

The website itself contains many web pages and different contents depending on the user. However, some functionalities are common in most of the web pages :

- To take the informations from a data table in another project of the application and display them on a web page.
- To make **filters** (alphabetical order, by type of request, etc.)
- Sending and receiving mail, **mailto**[18] links at disposition.
- Hyperlinks to open new pages.
- Returns button, navigation between pages.
- Update, add and remove data button.
- The display of the different data tables information.

The internship tutor and the ISD responsible thought that they will be very busy afterwards even if they were available. Therefore, they asked me to look at the functional specifications document concerning two other trainees so that they could be trained and helped if needed. This mainly concerned parts of the main menu of the application : to manage contacts of companies as well as companies.

[18] Mailto : this is a Uniform Resource Identifier (URI) scheme, permitting to create a hyperlink towards an e-mail address. Used often in a web page in HTML, to allow the user to send a message and contact a person more rapidly with predefined informations.

In the part concerning the management of companies, there had to be a hyperlink on this interface for the creation of a new company, and it was one of the interfaces I had made that was used.

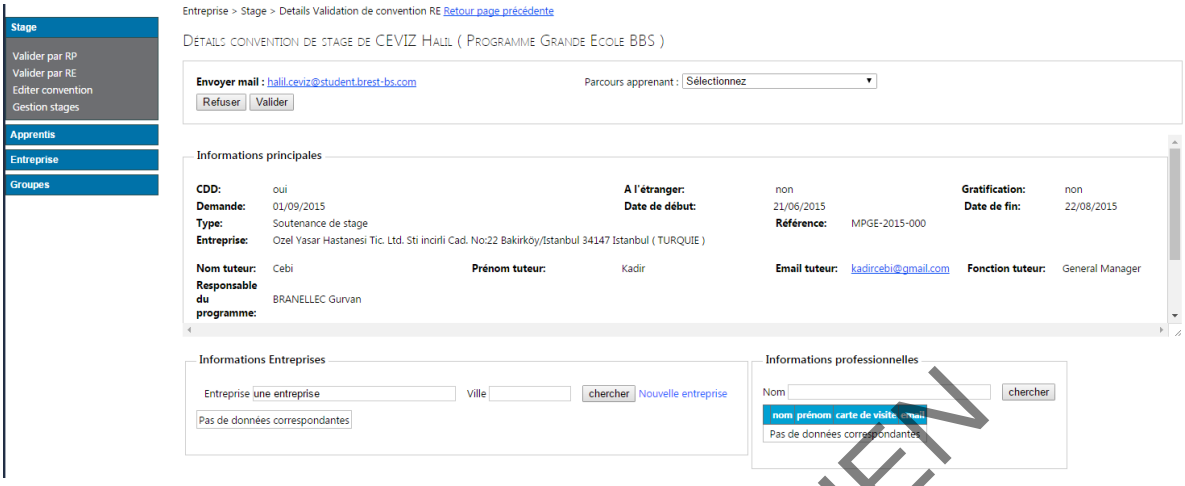


Figure 12 : Interface of the details of the web page for an internship agreement with a company

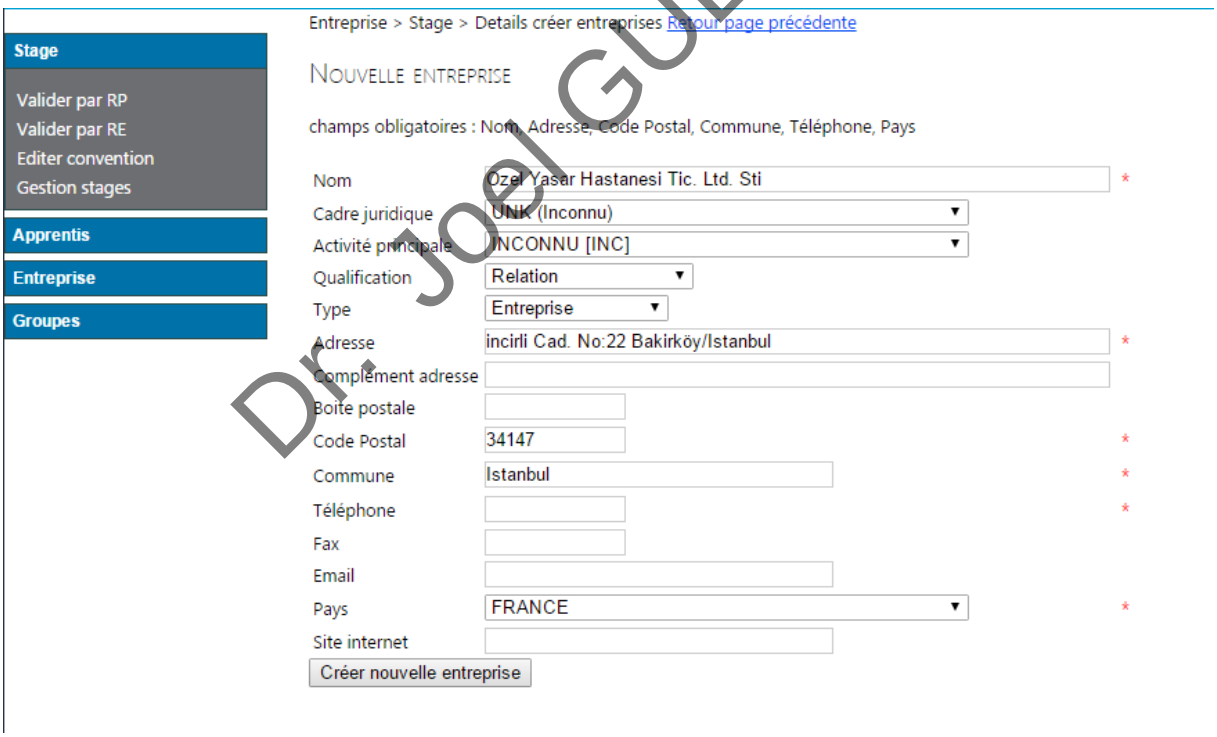


Figure 13 : Web page interface to create a new company

I wanted to know more about the **responsive web design** in ASP.NET and I then asked the internship tutor if I could at a given moment inform me about the **concept** with the Bootstrap framework and use it on the web application of students and thereafter, of the staff of company.

The responsive web design is a website whose design aims, thanks to different principles and techniques, to offer a comfortable consultation even for different supports. The user can thus consult the same website through various peripherals (TV, tablets, mobiles, PC, etc.) with the same visual and ergonomic comfort permitting to optimize the user experience. This means designing a single and same interface that is auto-adaptable to all the supports.

What was also interesting is that everything was asked to me was directly related to different functions of the company. Because most of the time, it can be a part of the eventual works or something that being done separately that is requested and which does not directly concern the needs of the company. Nevertheless, with what had been entrusted to me during this internship, I saw directly to whom it was going to serve and the different uses made by the staffs of the company.

2.1.3 Development of the « Enterprise » part for internships management

2.1.3.1 Registration and internship agreement for learners

A **sequence diagram** was chosen to illustrate the functioning of the application with the main **users**. The sequence diagram is the graphical representation of the interactions between **actors** and the **system** according to a chronological order in the *Unified Modeling Language* (UML) formulation. The interest being to describe how the actions take place between the actors or objects. The vertical dimension of the sequence diagram represents time, allowing to visualize the sequence of actions according to the time and to specify the nature of the objects used.

Ent : Enterprise, RE : Enterprises Relations, RP : Program Responsible, H2o : intranet/ERP

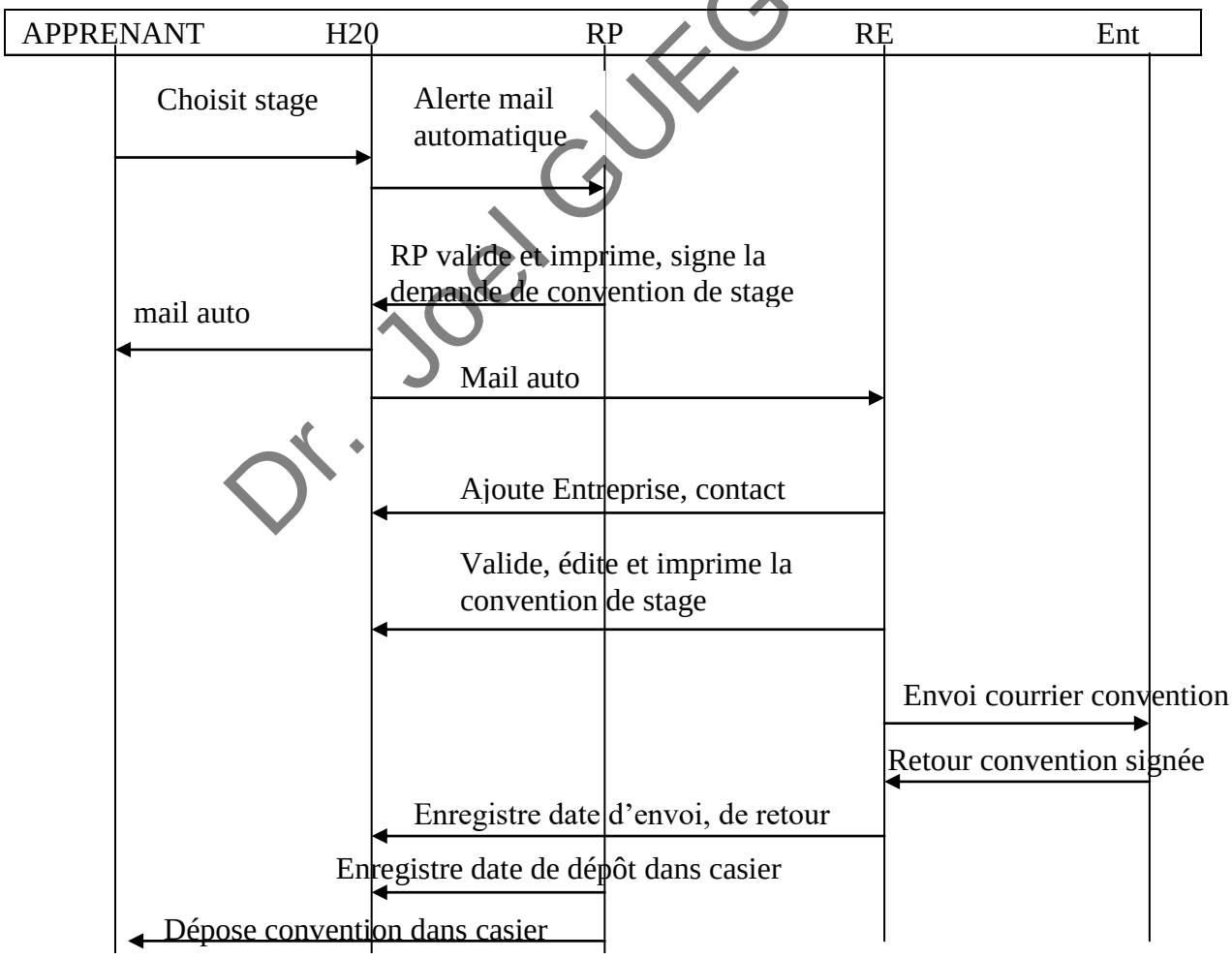


Figure 14 : The sequence diagram

The main data tables are represented in the **CDM**[19] of the functional specification document but several others tables have been added to the MCD because they permitted to make the link between the main data tables. In addition, to use items that were only available in some data tables.

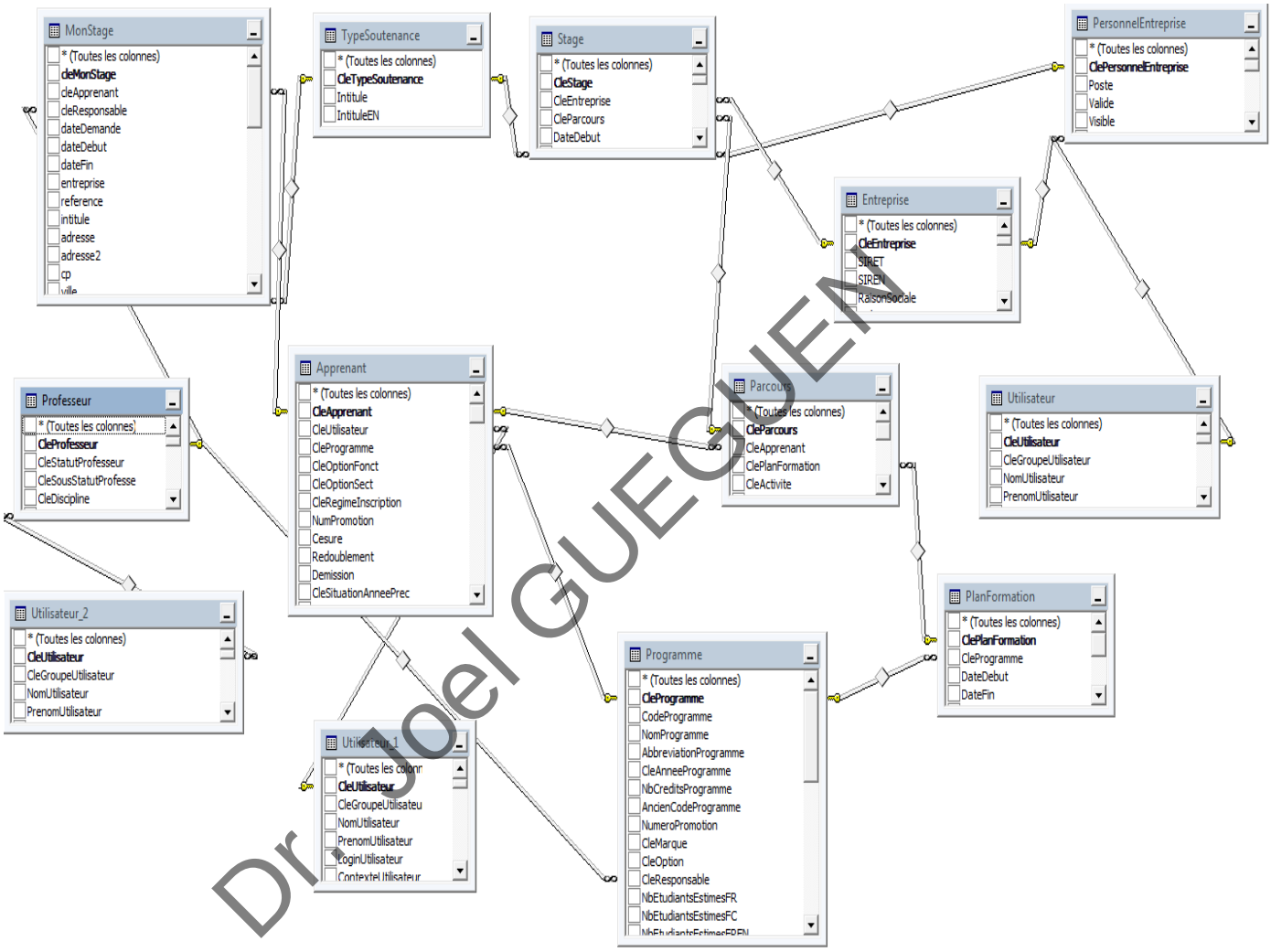


Figure 15 : A part of the conceptual data model

[19] CDM : Conceptual Data Model

2.1.3.2 Internship request by the learner

This application is located in the *Student* project which regroups all the components, functionalities and interfaces of the web application used by the students. It was therefore necessary to look how the interfaces had been produced and then to retrieve all the informations that was stored in the database.

In addition, in the *Admin* project, on one of the pages of the web application used by the employees of the company, all data were retrieved for each of the internship agreements of the learners.

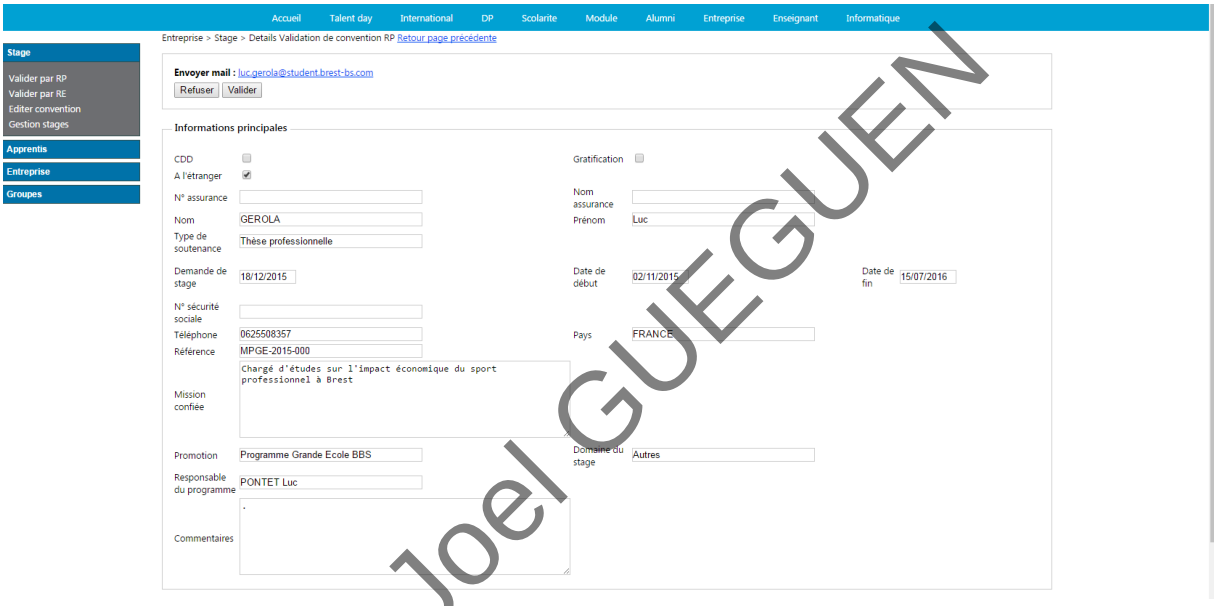


Figure 16 : (beginning interface) informations about the internship agreement of a learner

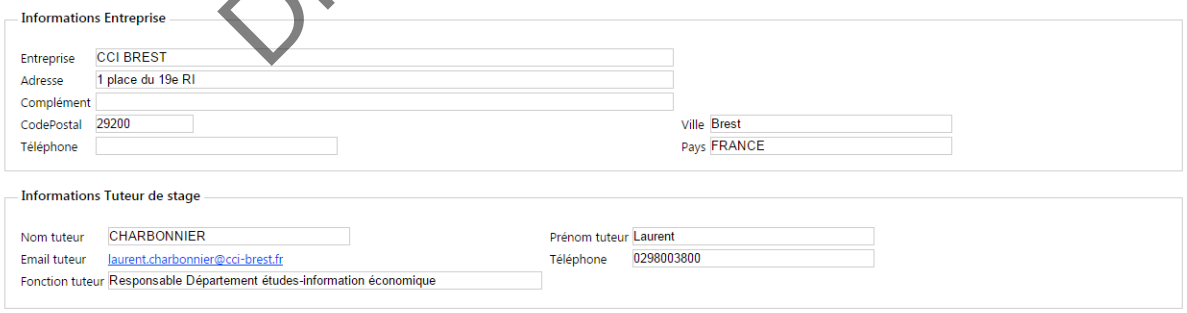


Figure 17 : (suite interface) informations about the internship agreement of a learner

In order to display the internship agreement informations of a learner on the application of validation of internship by the program responsible.

2.1.3.3 Validation by the program responsible

For the application interface :

Search parameters used : the Name of the learner and the type of internship agreement.

Display of the internship list of the learners with some informations. Then by clicking on a button, display **details** of the internship agreement for each learner.

Mailto type emails had been requested because clicking directly on the link, it was simpler to contact the learner or his internship tutor. The courier service software set up was then displayed and what all the persons had to do was to write the message and send it to the different people.

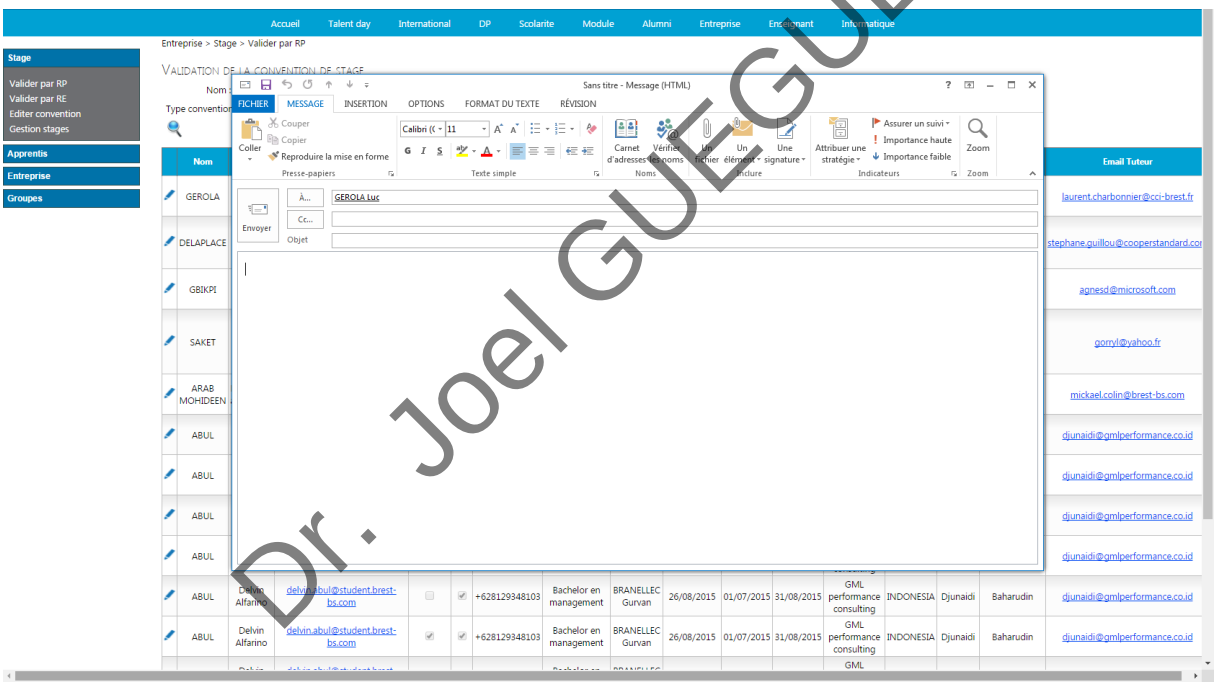


Figure 18 : Interface with courier service software for sending an email

In some parts, the mailto link displayed informations that are more complete. For example, with predefined events, by clicking on a mailto link, when the courier service software was displayed, the following informations were already pre-filled : the recipient(s), the cc(s) (congruent copy), the object, the message with clickable links in the body of text and a layout.

When RP service staff clicks on the reject button for the internship agreement, an automatic mail is sent to the learner to prevent him to modify some information about the internship agreement.

Then, as far as when the RP service staff clicks on the validate button for the internship agreement, an automatic mail is sent to the RE service, to prevent them that the RP service has validated the internship agreement, as well as the learner. As a result, the RE service will have access to informations of the internship agreement of the learner available for their functions.

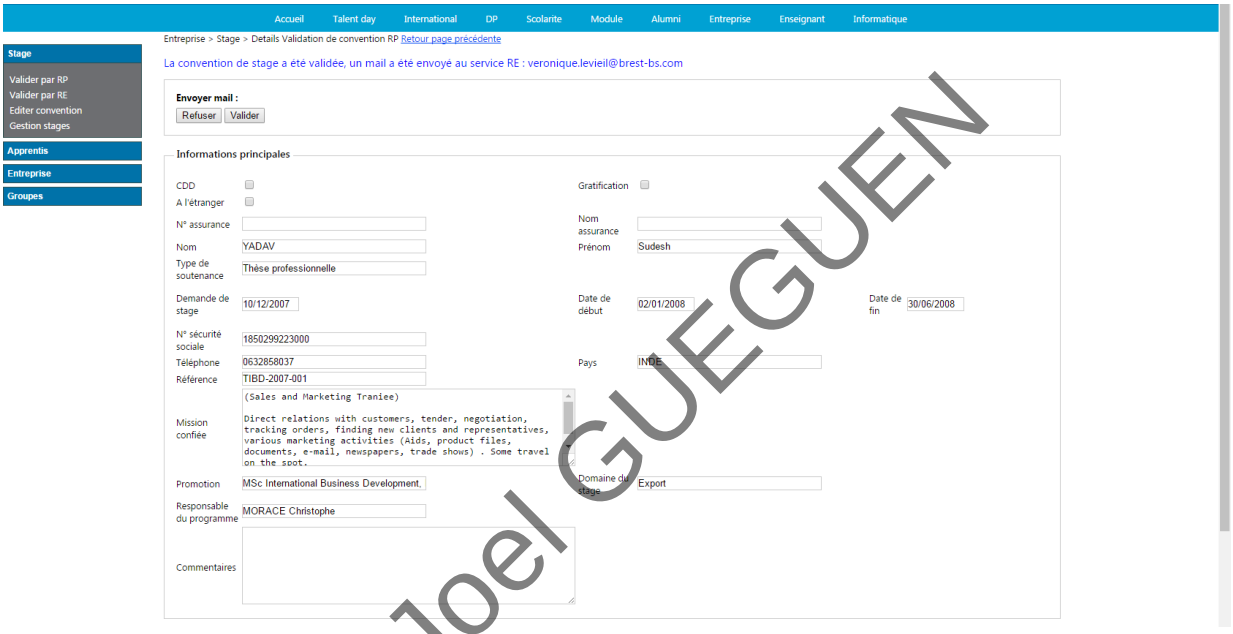
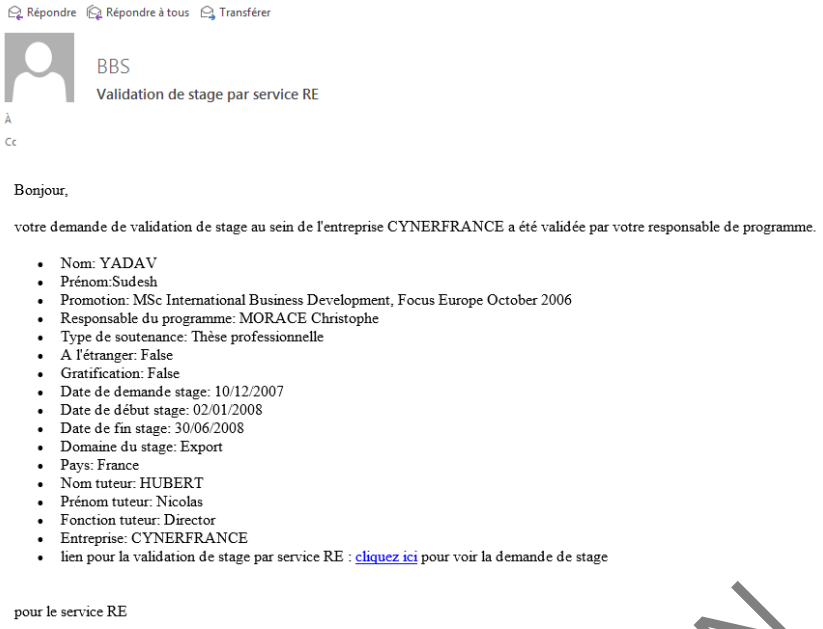


Figure 19 : Interface for the sending mail of validation of the internship agreement



Répondre Répondre à tous Transférer

BBS

Validation de stage par service RE

À

Cc

Bonjour,

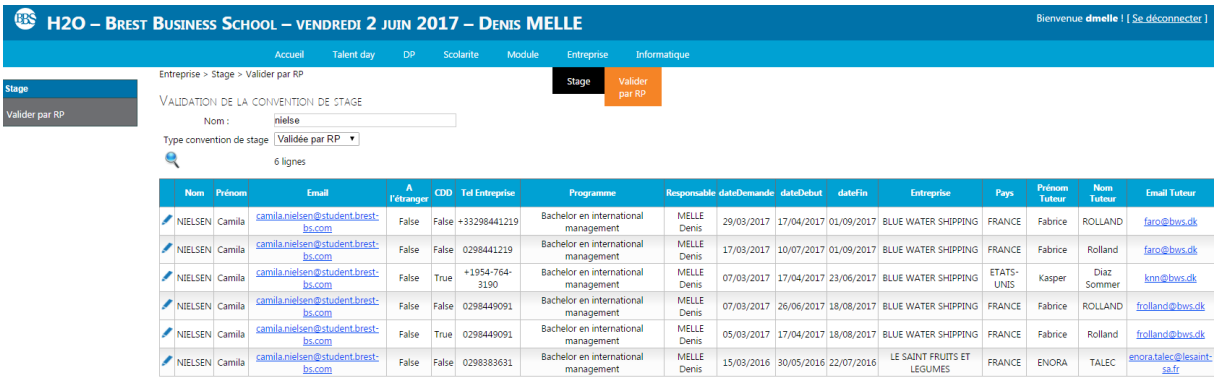
votre demande de validation de stage au sein de l'entreprise CYNERFRANCE a été validée par votre responsable de programme.

- Nom: YADAV
- Prénom:Sudesh
- Promotion: MSc International Business Development, Focus Europe October 2006
- Responsable du programme: MORACE Christophe
- Type de soutenance: Thèse professionnelle
- A l'étranger: False
- Gratification: False
- Date de demande stage: 10/12/2007
- Date de début stage: 02/01/2008
- Date de fin stage: 30/06/2008
- Domaine du stage: Export
- Pays: France
- Nom tuteur: HUBERT
- Prénom tuteur: Nicolas
- Fonction tuteur: Director
- Entreprise: CYNERFRANCE
- lien pour la validation de stage par service RE : cliquez ici pour voir la demande de stage

pour le service RE

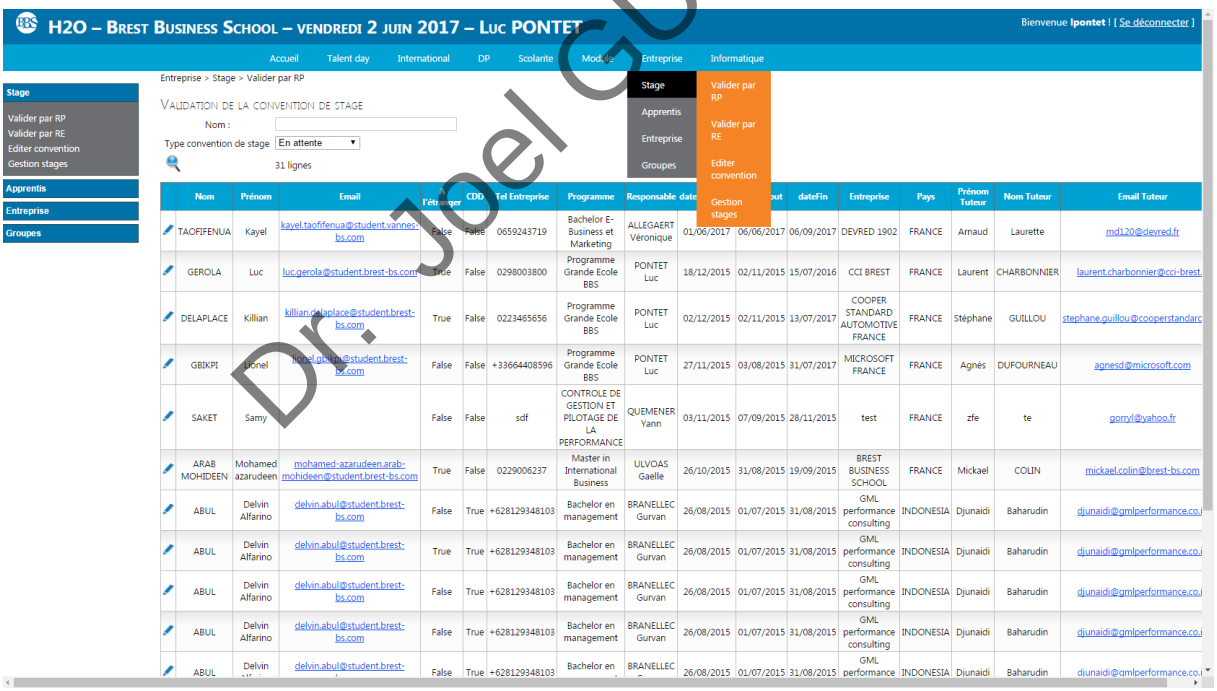
Figure 20 : Email validation of the internship agreement sent to a learner

The management of access rights for different users was notably important, because each program responsible had to consult only the internship requests that concerned them. For example, when different staffs of the company being program responsible, connect to the ERP, the proposed interfaces will not be the same according to the user.



	Nom	Prénom	Email	A l'étranger	CDD	Tel Entreprise	Programme	Responsable	dateDemande	dateDebut	dateFin	Entreprise	Pays	Prénom Tuteur	Nom Tuteur	Email Tuteur
	NIELSEN	Camila	camila.nielsen@student.brest-bs.com	False	False	+33298441219	Bachelor en international management	MELLE Denis	29/03/2017	17/04/2017	01/09/2017	BLUE WATER SHIPPING	FRANCE	Fabrice	ROLLAND	faro@bws.dk
	NIELSEN	Camila	camila.nielsen@student.brest-bs.com	False	False	0298441219	Bachelor en international management	MELLE Denis	17/03/2017	10/07/2017	01/09/2017	BLUE WATER SHIPPING	FRANCE	Fabrice	Rolland	faro@bws.dk
	NIELSEN	Camila	camila.nielsen@student.brest-bs.com	False	True	+1954-764-3190	Bachelor en international management	MELLE Denis	07/03/2017	17/04/2017	23/06/2017	BLUE WATER SHIPPING	ETATS-UNIS	Kasper	Diaz Sommer	knn@bws.dk
	NIELSEN	Camila	camila.nielsen@student.brest-bs.com	False	False	0298449091	Bachelor en international management	MELLE Denis	07/03/2017	26/06/2017	18/08/2017	BLUE WATER SHIPPING	FRANCE	Fabrice	ROLLAND	frolland@bws.dk
	NIELSEN	Camila	camila.nielsen@student.brest-bs.com	False	True	0298449091	Bachelor en international management	MELLE Denis	05/03/2017	17/04/2017	18/08/2017	BLUE WATER SHIPPING	FRANCE	Fabrice	Rolland	frolland@bws.dk
	NIELSEN	Camila	camila.nielsen@student.brest-bs.com	False	False	0298383631	Bachelor en international management	MELLE Denis	15/03/2016	30/05/2016	22/07/2016	LE SAINT FRUITS ET LEGUMES	FRANCE	ENORA	TALEC	enora.talec@lesaint-sa.fr

Figure 21 : Interface with the menus of the « Enterprise » rubric with a staff of the company



	Nom	Prénom	Email	A l'étranger	CDD	Tel Entreprise	Programme	Responsable	dateDebut	dateFin	Entreprise	Pays	Prénom Tuteur	Nom Tuteur	Email Tuteur
	TAOFIFENUA	Kayel	kayel.taofifenua@student.vannes-bs.com	False	False	0659243719	Bachelor E-Business et Marketing	ALLEGAERT Véronique	06/06/2017	06/09/2017	DEVRED 1902	FRANCE	Arnaud	Laurette	md120@devred.fr
	GEROLA	Luc	luc.gerola@student.brest-bs.com	True	False	0298003800	Programme Grande Ecole BBS	PONTET Luc	02/11/2015	15/07/2016	CCI BREST	FRANCE	Laurent	CHARBONNIER	laurent.charbonnier@cci-brest
	DELAPLACE	Killian	killian.delaplace@student.brest-bs.com	True	False	0223465656	Programme Grande Ecole BBS	PONTET Luc	02/11/2015	13/07/2017	COOPER STANDARD AUTOMOTIVE FRANCE	FRANCE	Stéphane	GUILLOU	stephane.guillou@cooperstandard
	GBIKPI	Lionel	lionel.gbikpi@student.brest-bs.com	False	False	+33664408596	Programme Grande Ecole BBS	PONTET Luc	03/08/2015	31/07/2017	MICROSOFT FRANCE	FRANCE	Agnès	DUFOURNEAU	agnesd@microsoft.com
	SAKET	Samy		False	False	sdf	CONTROLE DE GESTION ET PILOTAGE DE LA PERFORMANCE	QUEMENER Yann	07/09/2015	28/11/2015	test	FRANCE	zfe	te	gorryl@yahoo.fr
	ARAB MOHIDEEN	Mohamed azarudeen	mohamed-azarudeen.arab-mohideen@student.brest-bs.com	True	False	0229006237	Master in International Business	ULVOAS Gaelle	31/08/2015	19/09/2015	BREST BUSINESS SCHOOL	FRANCE	Mickael	COLIN	mickael.colin@brest-bs.com
	ABUL	Delvin Alfarino	delvin.abul@student.brest-bs.com	False	True	+628129348103	Bachelor en management	BRANELLEC Gurvan	01/07/2015	31/08/2015	GML performance consulting	INDONESIA	Djunaidi	Baharudin	djunaidi@gmlperformance.co.i
	ABUL	Delvin Alfarino	delvin.abul@student.brest-bs.com	True	True	+628129348103	Bachelor en management	BRANELLEC Gurvan	01/07/2015	31/08/2015	GML performance consulting	INDONESIA	Djunaidi	Baharudin	djunaidi@gmlperformance.co.i
	ABUL	Delvin Alfarino	delvin.abul@student.brest-bs.com	False	True	+628129348103	Bachelor en management	BRANELLEC Gurvan	01/07/2015	31/08/2015	GML performance consulting	INDONESIA	Djunaidi	Baharudin	djunaidi@gmlperformance.co.i
	ABUL	Delvin Alfarino	delvin.abul@student.brest-bs.com	False	True	+628129348103	Bachelor en management	BRANELLEC Gurvan	01/07/2015	31/08/2015	GML performance consulting	INDONESIA	Djunaidi	Baharudin	djunaidi@gmlperformance.co.i
	ABUL	Delvin	delvin.abul@student.brest-	False	True	+628129348103	Bachelor en	BRANELLEC	01/07/2015	31/08/2015	GML performance	INDONESIA	Djunaidi	Baharudin	djunaidi@gmlperformance.co.i

Figure 22 : Interface with the menus of the « Enterprise » rubric with another staff of the company

2.1.3.4 Validation by the RE service

For the application interface :

Search parameters used : the Name, the first name of the learner and the type of internship agreement.
Display of the internships list of the leaners with some information required for the RE service.
Then by clicking on a button, there is the possibility to display the **details** of the internship agreement for each learner, to make internship registration in the course of the learner, then the creation and registrations of companies and contacts of companies in the database.

The RE service should be able to obtain some information about the internship agreement of the learner. This means to see, the selection of the different companies in the database and being able to create a new company if it did not exist in this database. Equally, for the contacts of the company, it had to be possible to see, selecting the different contacts of the company and creating a new contact if it did not exist in the database.

When the RE service staff clicks on the reject button for the internship agreement, an automatic mail is sent to the learner to warn him to make another internship agreement or to modify some information about the internship agreement.

Then, as far as when the RE service staff clicks on the validate button for the internship agreement, an automatic mail is sent to the learner and to the program responsible. Thus, the convention button is therefore available on the interface to allow the edit of the internship agreement.

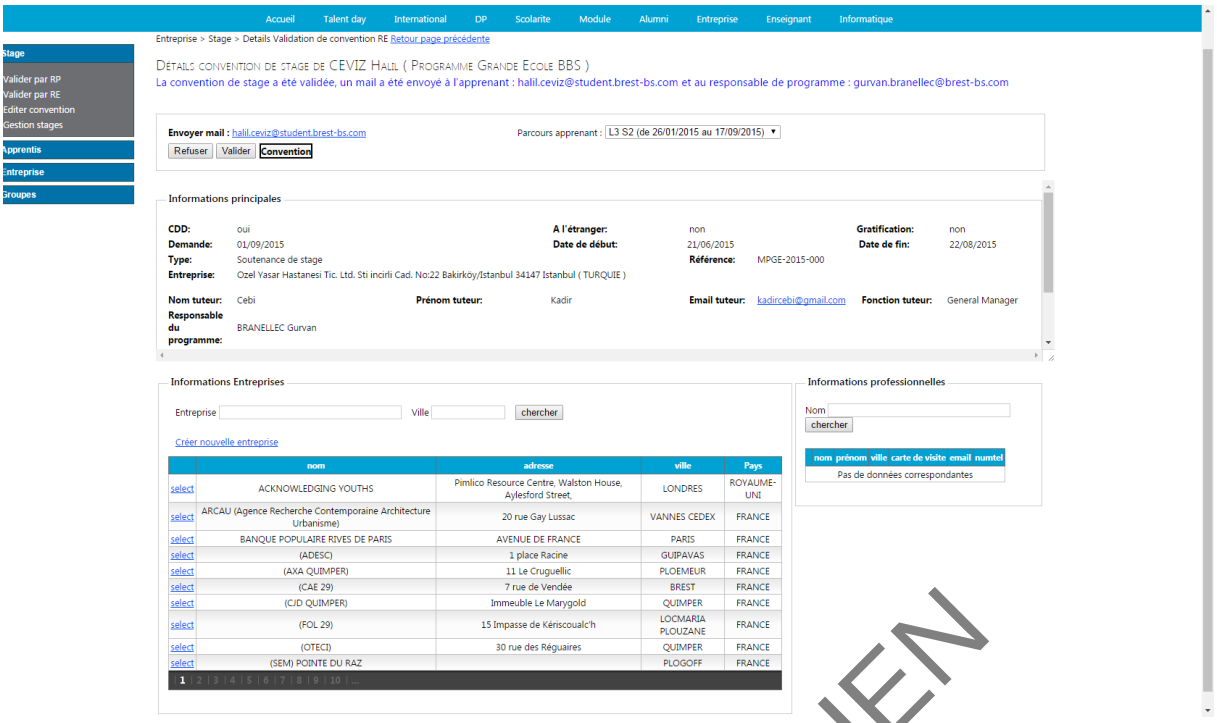


Figure 23 : Interface for the sending mail of validation of the internship agreement

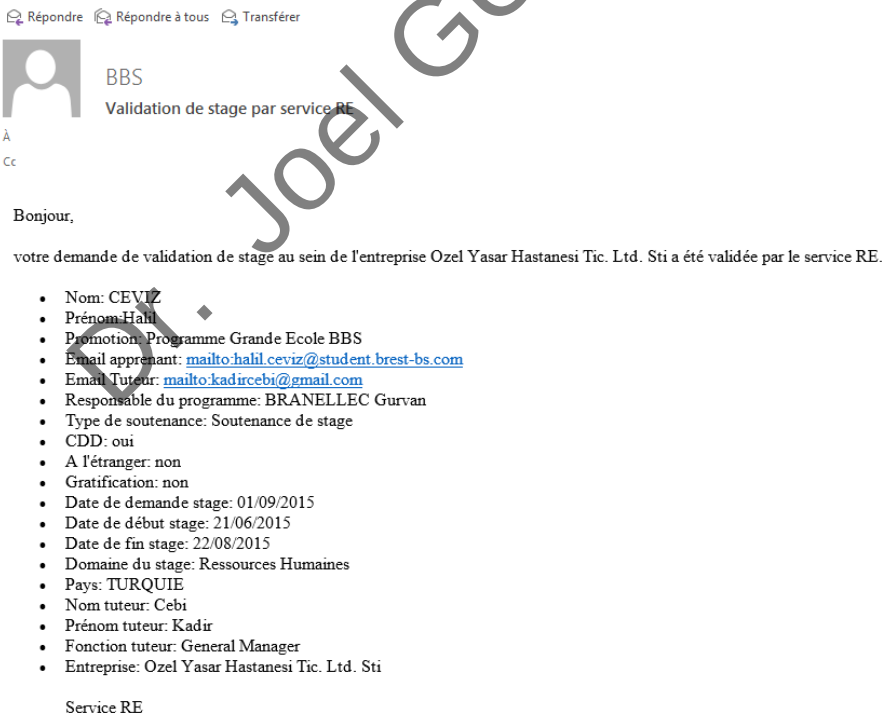


Figure 24 : Email validation of the internship agreement sent to a learner and his program responsible

The convention button permits to download in Word or PDF formats, the BBS internship agreement of the learner with all the updated informations.

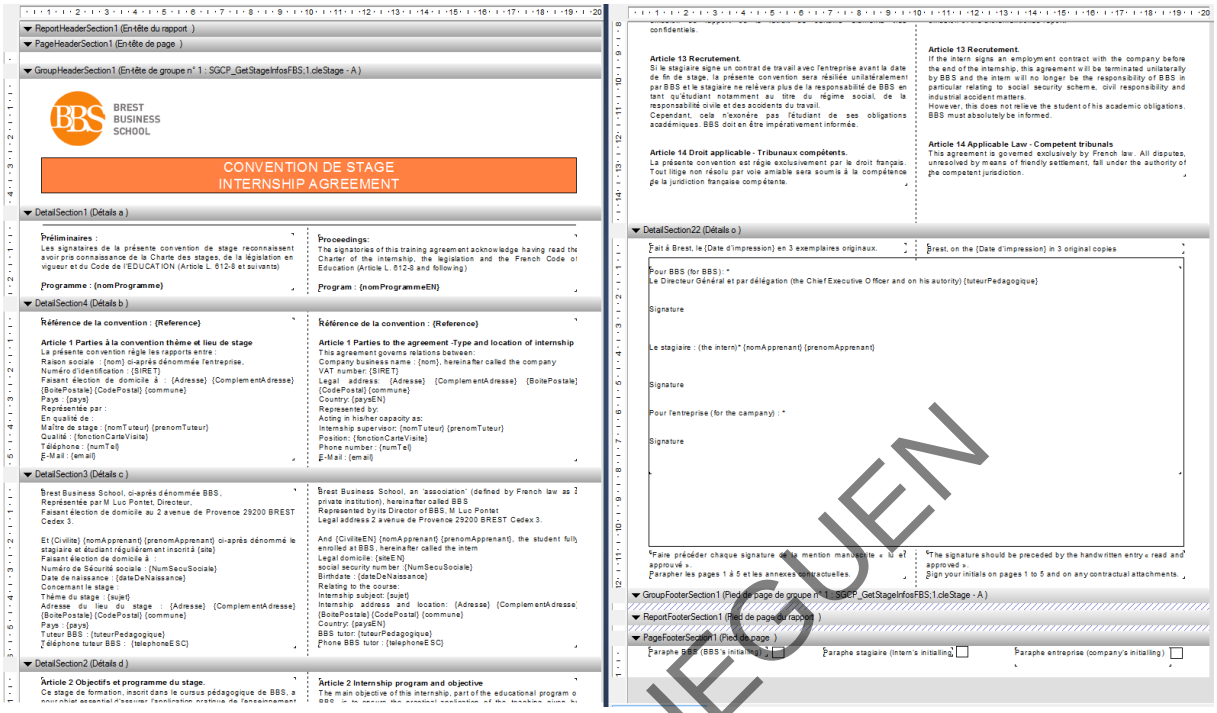


Figure 25 : A part of the BBS internship agreement in ".rpt" format with Crystal Reports in Visual Studio

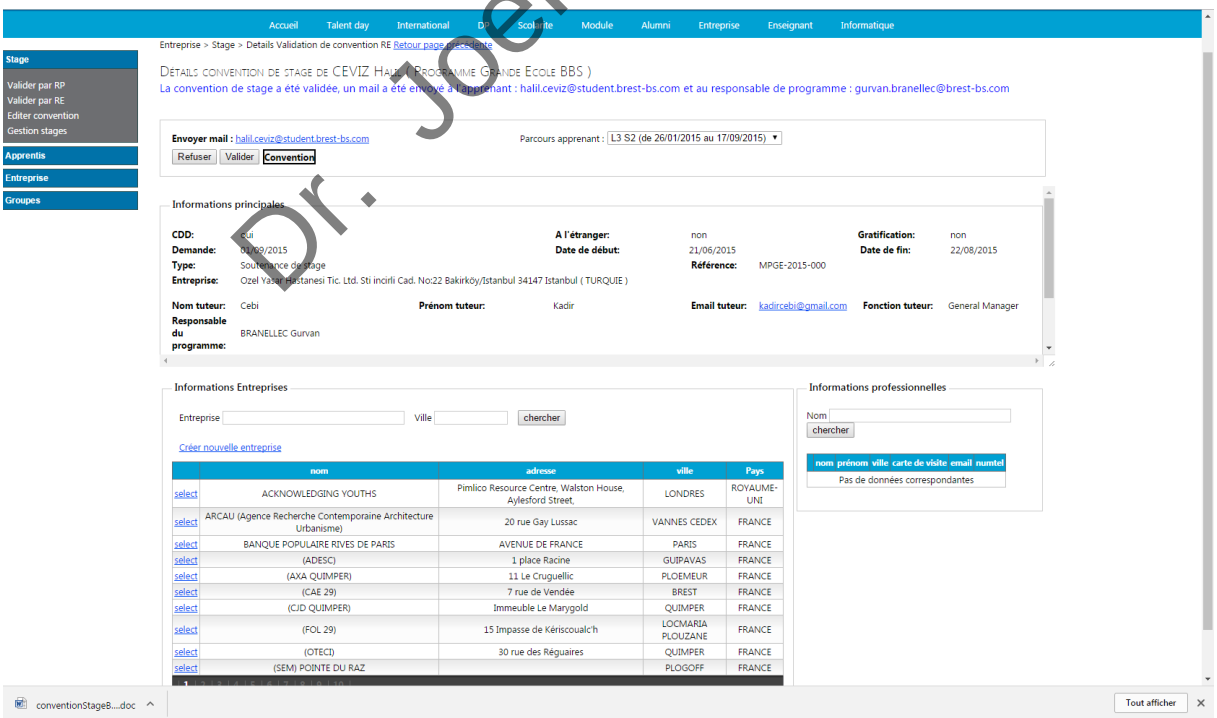


Figure 26 : Interface with the file downloaded in Word format for the internship agreement of a learner

2.1.3.5 Internship agreement edition / Management of the learners

The interface for convention edition permits from the historical of the internship agreements validated by the RE service, to select an internship and to edit all the informations about the internship agreement.

In addition, the interface for the management of the learners permits to display all the learners, to consult and delete informations about the internship agreements of the learners.

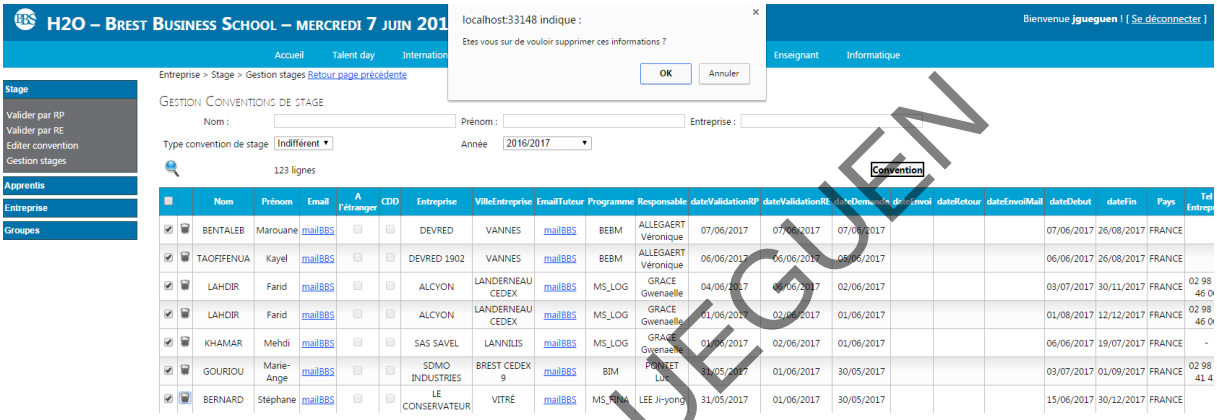


Figure 27 : Interface with warning to delete the informations of the learner(s)

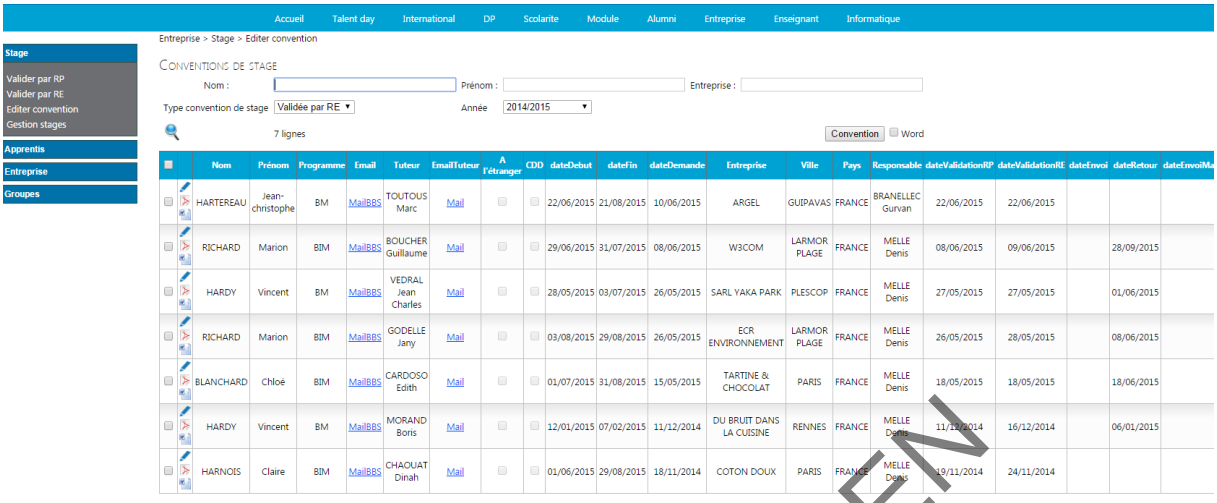
In the edition of the internship agreement :

For the application interface :

Search parameters used : the Name, the first name of the learner, the type of internship agreement, the date and the company.

Display of the list of learners whose internship agreements have been validated by the RE service. Then there was the possibility to select a person before editing or printing her internship agreement. By selecting one or some learners, clicking on the different buttons provided for this purpose, served to download their internship agreement(s) in Word or PDF format. The download was done in the Word format if the agreement of the learner had not yet been made. Therefore, in PDF format if the internship agreement of the learner already existed in the application.

Otherwise, on the interface it is also possible to use a check box to choose directly between the Word or PDF format before to click on the convention button to make the download of an internship agreement.



Nom	Prénom	Programme	Email	Tuteur	EmailTuteur	A l'étranger	CDD	dateDebut	dateFin	dateDemande	Entreprise	Ville	Pays	Responsable	dateValidationRP	dateValidationRE	dateEnvoi	dateRetour	dateEnvoiMa
HARTEREAU	Jean-christophe	BM	MailBBS	TOUTOUS Marc	Mail			22/06/2015	21/08/2015	10/06/2015	ARGEL	GUIPAVAS	FRANCE	BRANELLEC Gurvan	22/06/2015	22/06/2015			
RICHARD	Marion	BIM	MailBBS	BOUCHER Guillaume	Mail			29/06/2015	31/07/2015	08/06/2015	W3COM	LARMOR PLAGE	FRANCE	MELLE Denis	08/06/2015	09/06/2015		28/09/2015	
HARDY	Vincent	BM	MailBBS	VEDRAL Jean Charles	Mail			28/05/2015	03/07/2015	26/05/2015	SARL YAKA PARK	PLESCOP	FRANCE	MELLE Denis	27/05/2015	27/05/2015		01/06/2015	
RICHARD	Marion	BIM	MailBBS	GODELLE Jany	Mail			03/08/2015	29/08/2015	26/05/2015	ECR ENVIRONNEMENT	LARMOR PLAGE	FRANCE	MELLE Denis	26/05/2015	28/05/2015		08/06/2015	
BLANCHARD	Chloé	BIM	MailBBS	CARDOSO Edith	Mail			01/07/2015	31/08/2015	15/05/2015	TARTINE & CHOCOLAT	PARIS	FRANCE	MELLE Denis	18/05/2015	18/05/2015		18/06/2015	
HARDY	Vincent	BM	MailBBS	MORAND Boris	Mail			12/01/2015	07/02/2015	11/12/2014	DU BRUIT DANS LA CUISINE	RENNES	FRANCE	MELLE Denis	11/12/2014	16/12/2014		06/01/2015	
HARNOIS	Claire	BIM	MailBBS	CHAOUAT Dinah	Mail			01/06/2015	29/08/2015	18/11/2014	COTON DOUX	PARIS	FRANCE	MELLE Denis	19/11/2014	24/11/2014			

Figure 28 : Interface to edit conventions with list of the learners

A new page is displayed, by clicking on the button permitting to display the **details** to edit informations about the internship agreements. It is possible to send a semi-automatic mail (hyperlink "*envoyer mail"* on the interface) or an automatic mail (button "*envoyer mail"* on the interface), to notify the learner that the internship agreement has been deposited by the BBS Company.

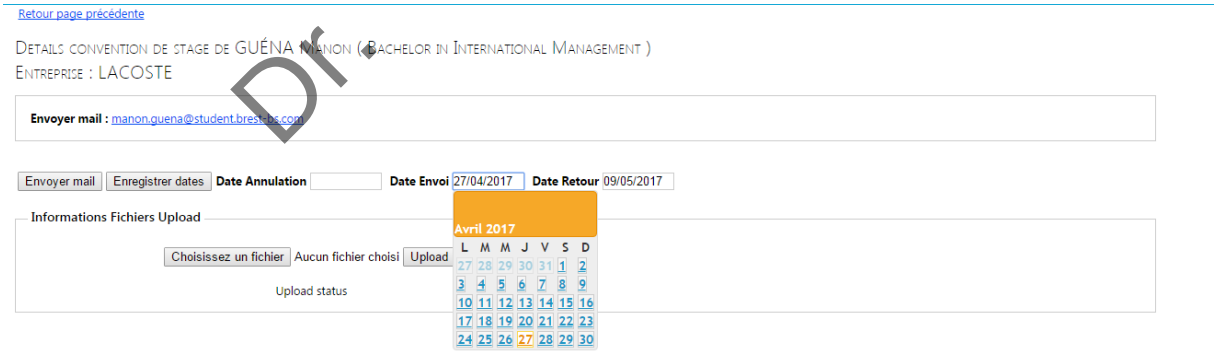


Figure 29 : Interface with the sending date update of an internship agreement

Each button on this interface concerns recordings in the database. Then permitting to update the informations of the internship agreement.

Concerning the download of the internship agreements of the learners, it is necessary first to select the learner or learners before to click on the convention button, to update the informations about the internship agreement of the learner(s). Then, the convention button will make the download of the BBS internship agreement in PDF version in the case of the agreement had not yet been made or in Word version if the agreement already existed with new updated informations for the internship agreement.

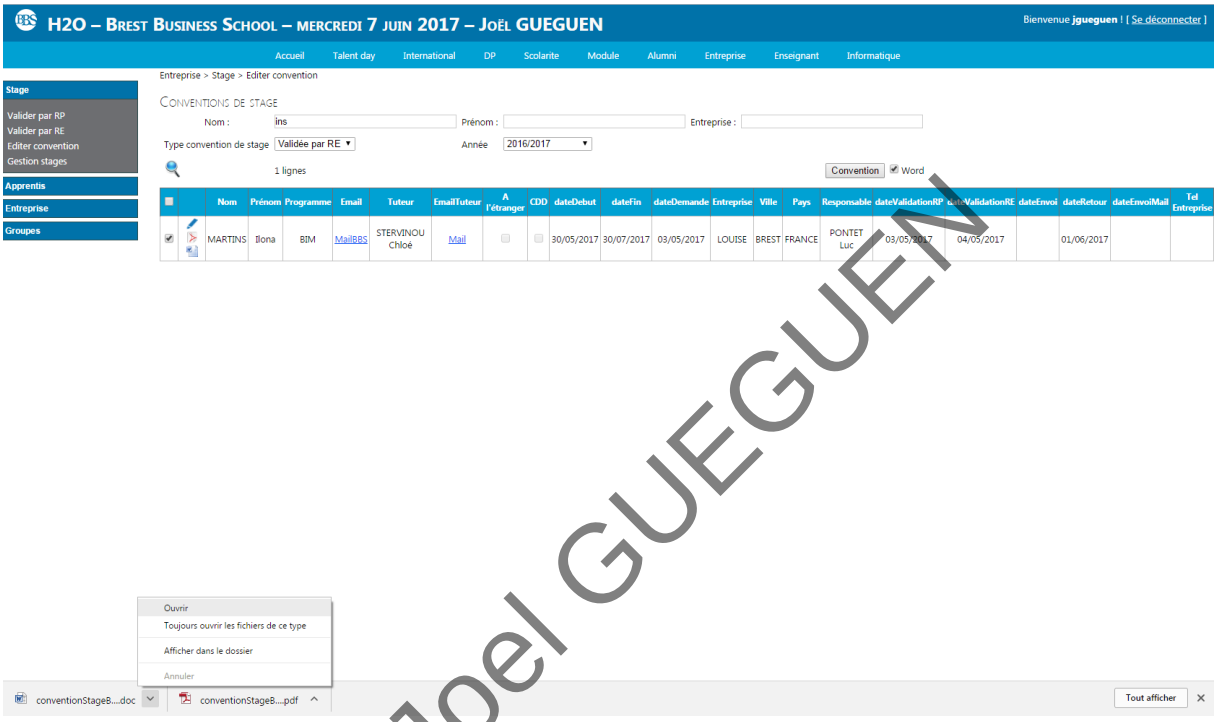


Figure 30 : Interface with opening of the downloaded file in PDF and Word format of the internship agreement of a learner

Then it was to be done only if there was enough time and if needed. As precised in the functional specifications, it was not mandatory but after some discussions, the internship tutor had requested that it possible to upload documents in a table with the display of informations according to the users. Because he had said that uploading of documents was much requested and very used within companies. In addition, that to see its functioning would be interesting.

The interest for the RE service, is that it would be possible to directly upload documents and files concerning a learner on the website and so to be able to find more simply any type of file related to the learners in the application.

I had also set up the possibility to open the files, to download them or to delete them according to the needs of the user. The user can therefore choose a file and upload it directly from the web page of the application.

The uploaded file appears on the web page and it is possible to open, download or delete it. The files are not set locally but on the server. So no matter on which system the web page is displayed, several checks have been made so that the files are displayed concerning the learner requested by the user (RE service staff).

Thus, if the user wants to access to the web page with different systems, the path is checked at each time. If it already exists then it can upload the file on the web page. In case of it does not exist, the new path will be first created automatically, and then it can upload the file on the web page.

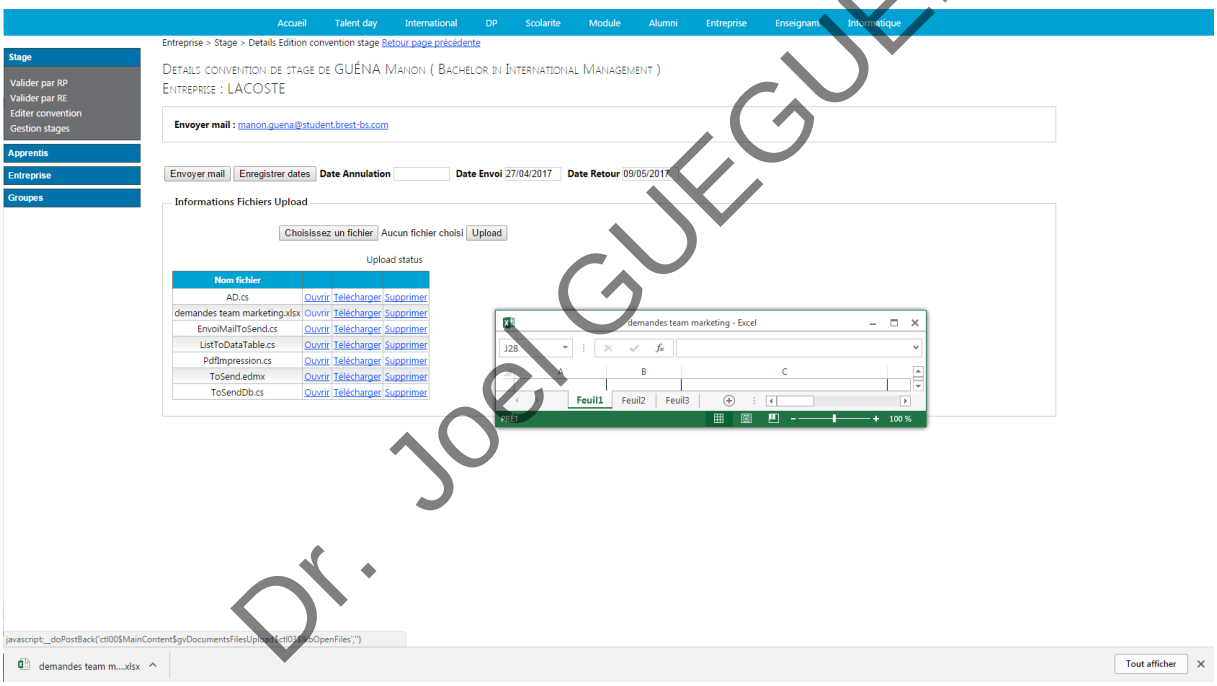


Figure 31 : Interface to open an uploaded file on the web page

The uploaded files are placed in a folder named "*StageFilesDocuments*" in the application, which contains folders with as name each Id retrieved for each of the learners, containing the informations of the files uploaded by user (RE service staff).

Depending on the people chosen by the user on the application web page, there are thus different informations.

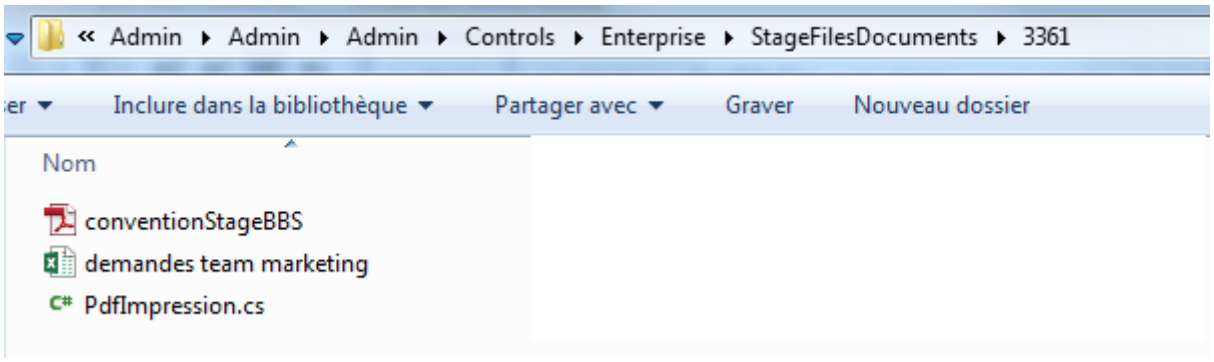


Figure 32 : The uploaded files linked to a learner in the "StageFilesDocuments" folder

Figure 33 : Interface with the same files uploaded for a learner by the company staff

The informations contained in each folder of "*StageFilesDocuments*" are exactly the same as those which are displayed for a learner on the web page. It is thus possible to interact on the folder or on the web page. For example, if there was an adding or files deletion in the folder of a learner, this will be done automatically on the web page of the application.

2.2 Analysis and interpretations

2.2.1 The Research & Development part

Digitization in the broad sense of the word allows to develop opportunities in all sectors and this, through different points :

- The notion of distance no longer exists, information can circulate instantaneously and is not constrained by a geographical area.
- Information and dematerialized content can reach more people and without real limit.
- Collaboration between people, the contents that can be shared and modified in real time by all, permit to work more simply on the same project.
- The automation of repetitive activities permits also a better productivity and optimization of work time within the company.
- Digitization also permits to limit malfunctions, by detecting them more rapidly with updates and functional checks in the system.

At a time where digital has found its place in every aspect of our everyday life, the evolution of needs and habits of consumers have become more closely linked to digital innovations. The digitization of an activity or a company must be accompanied by a good digital strategy, if this strategy is well defined, the digitization of the company will bring undeniable advantages. However, these advantages are different according to the point of view.

From the ***point of view of the company***, digitization will improve different aspects :

- Optimization of process time.
- A faster and simplified communication between different businesses within the same company.
- Improved working conditions for employees.
- A more precise optimization of expenditures and therefore an increase of the profitability.

- Be able to collect a large amount of data about the customers to refine the target of the company.
- Less expensive communication costs thanks to a sharper focus.
- Through new tools, **CRM**[20] (Customer Relationship Management), **ESN** (Enterprise Social Network), processes automation, automatic data processing, it is now possible to achieve high levels of performance.

From the ***point of view of the customer***, it will be rather others advantages that will emerge :

- Being more modern, the company will have a better image for the customers.
- A better communication with the company and therefore a loyalty more important.
- To get a more personalized and relevant offer according to their needs.
- Customer satisfaction is greater, and further improved for investments and to attract new customers.

As a result, digital has become a major asset for any company that wishes to remain leader in its market in a society in full **uberisation**[21]. But more than a strategical model, engaged digital transformation also changes the relationship between the company and its customers. It simply no longer delivers services to their customers, but performs them with the customers, notably by taking account of their opinion, continuously in the construction of this service. The realization of an offer as personalized and customizable as possible becomes the main objective into the culture of the company. Moreover, the digitization of a company can only really take place and accelerate if all employees are also involved within the organization. Thus, understanding the mechanisms and stakes of digital transformation is necessary for all companies that wish to develop their activities.

[20] CRM : (Customer Relationship Management), is the set of tools and techniques used to detect, process and analyse the informations about customers and prospects, in the interest of a loyalty by providing them better services.

[21] Uberisation : it is a recent phenomenon in the field of the economy consisting in the use of services enabling professionals and customers to get in touch directly, almost instantaneously, through the use of new technologies.

Digitization challenges the business model by offering new opportunities in enterprises processes such as open innovation, collaborative intelligence and agility. Occasioning equally, the fact that digital technologies are fully integrated into all of their activities. Thus, by taking into account the innovation that is one of the foundations of the organization, companies must benefit from the digital as a growth lever and competitiveness in several sectors of activity.

Indeed, many companies have estimated preferable to replace a disparate and non-homogeneous set of software by ERP at the cutting edge of technology rather than to make rectifications of existing or older programs.

Some large ERP offer to their users an extensive functional coverage. However, no ERP can claim to fit perfectly at all businesses or activities. ERP struggle to offer certain functions and it is for this reason that to create his own ERP becomes more advantageous for certain areas of a company. Market or regulations requirements are constantly renewed and the main editors of ERP must continuously strive to integrate or update newly required functionalities such as customer relationship management, risk management or digital responsibility (Green IT).

Thus, an ERP can prove to be indispensable for the management of a company or its resources according to the situations. There is the possibility to use free or proprietary software packages available on the market, according to the budget and needs of the company, or to create his own ERP software. Those are tools permitting to centralize all the informations within the same interface in order to optimize the productivity of the employees in the business processes of an organization.

BBS Company had preferred to create their own ERP because the market-based software packages did not really match with their business needs. In addition, it was more efficient to modify or add new functionalities in the configurations of the application. The interest was that all data would be instantly accessible for all persons in a company.

Chapter III : Project management structuration

3.1 The interest of project management

In order to be able to finalize in time the project concerning the HMI development of the intranet website of the company, it was necessary to use some methods related to the conduct of a project. Because the project management permits to have a global vision but also on the long term. The problematics are already defined in advance and it is thus more efficient to manage them by taking into account of the time granted which is important.

Project management could be globally summarized this way :

- **The framing phase :** it is the entire analysis part, formalization and planning. This is the beginning of the process with taking into account the request and the calibration of the project as a whole.
- **The design :** This is the phase of definition and preparation of the works to come. (requirements, planning implementation, resources definition, etc.).
- **The implementation :** It is therefore the implementation of what has been planned previously with an interest to capitalize on the experience in the framework of continuous improvement in project management. (meetings with the stakeholders, audits, checks and validations, communication of informations, compliance of needs, etc.).

Project management is a set of techniques used to identify, plan and manage a project. However, the actual evolution has sparked the managerial aspect in order to have a greater benefit during the conducting of a project. Because it does not reproduce a model but creates new ones, project management is seen as a tool permitting to develop the productivity of the employees and the diversity of the businesses of the company. More than an organizational method, project management represents a new transversal and cultural approach for companies.

3.2 The different phases of project management

Once objectives are determined, an analysis phase consists to analyse the existing management processes, to determinate which ones are affected by the project, to optimize the existing processes and eventually to define new processes (management rules).

These analyses are formalized in different documents. The functional specifications require a deep analysis of management processes of the company, constraints and needs. The implementation of an ERP is often an opportunity to talk again about the management rules of the company, to seek sources of savings, to optimize the management rules. During migration from in-house software to an ERP or ERP to another ERP, correspondences between data areas must be found. The definition of interfaces will permit to developers to be rapidly operational. This fact is often named **data mapping** or data transcodification. They will know exactly the type of data and the format of the data to process as well as their correspondence between the former and the new system.

Describing interfaces consists of explaining the correspondence between the data of the existing Information System and those of the ERP to implement. The description of the interfaces is included in the detailed design document. Once the specification documents completed and validated, the preparation phase of the IT recipes will be presented.

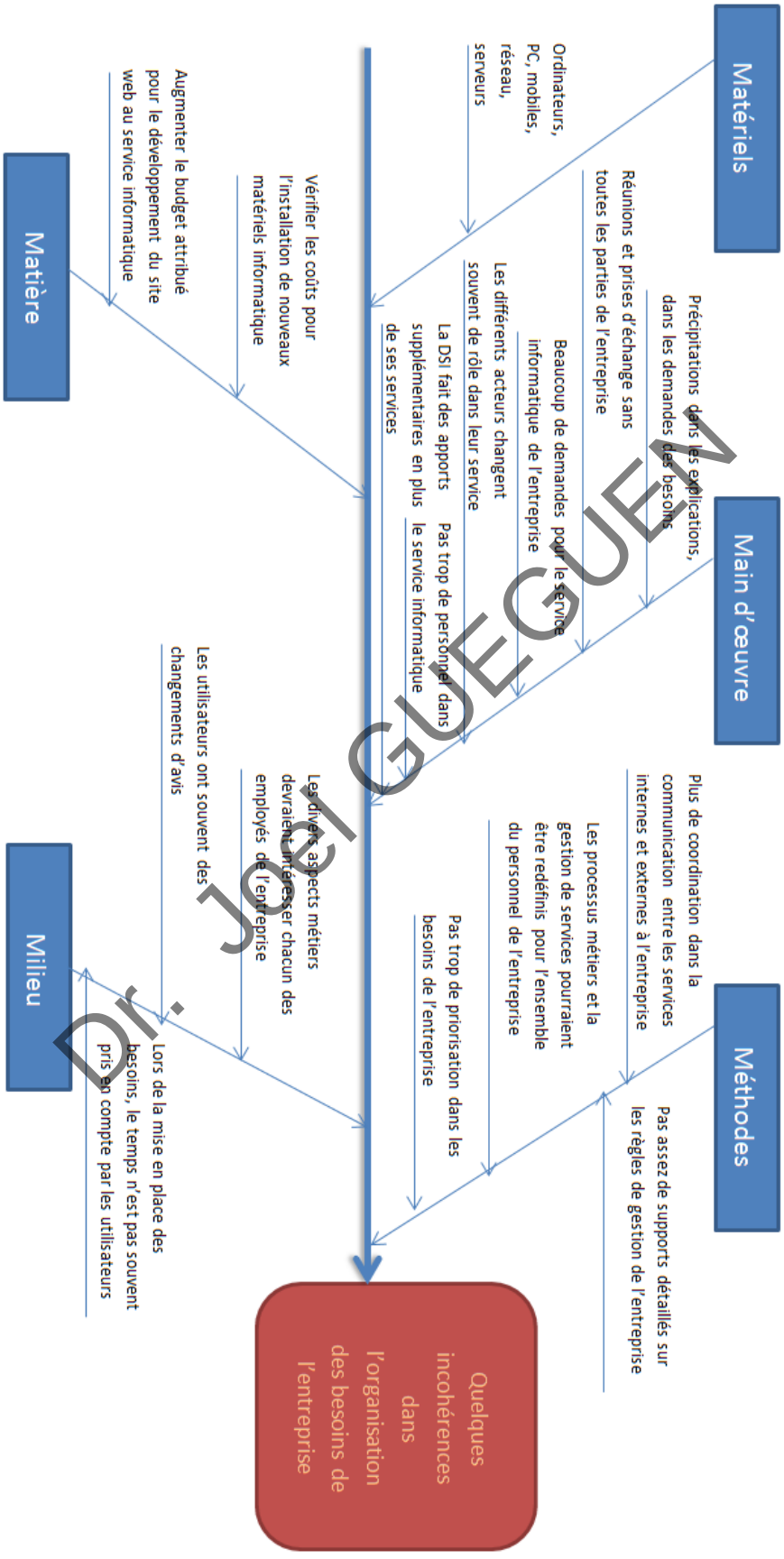
A matrix of functions is then prepared. It is about therefore to represent in a table the major processes impacted by the software package. For each function, test cases are prepared. Moreover, for each test case, test games are designed. It is about to test the correct functioning of all the management processes of the company. A possible method is to use a function matrix that lists all the major functions of the software package related to management processes. For each function, it is necessary to match test cases, and to each case of tests, data games. Softwares are available to this end, to manage test cases and to monitor and manage the recipe phase.

The migration phase is the final phase of ERP production. It is about therefore to make the migration from a former website (commonly designated to be used only for one or a few services of the company with a limited number of users) to a new improved version comprising totality of different services of the company.

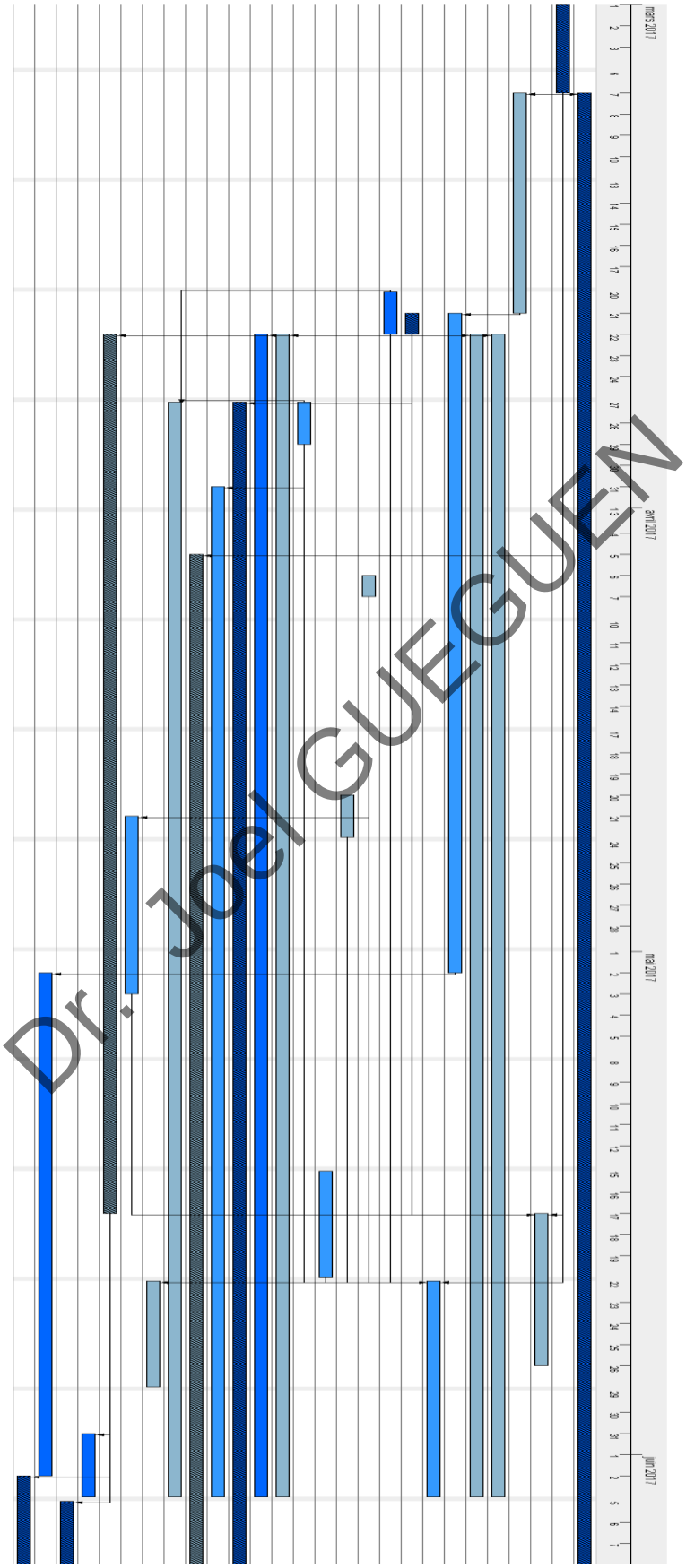
To this end, **checks** are made on both the MOE (project management) and the MOA (project development) sides, their methods of verification and analysis being different. The often-established findings are that the **deployment** of an ERP promotes productivity within a company. The software package and its functionalities give a global vision of the activity of the company. ERP aims to improve the **organization** of a company to reduce its costs. Companies using an ERP solution optimize rapidly their daily and improve their organization. Thus, companies optimize data processing, hardware resources and its processes.

Several diagrams have been elaborated to provide a better global vision of the whole project. This also permitted to define and prioritize the important phases of the development of the application. It was about the causes and effects diagram, the PERT diagram and the GANTT diagram for conduct of the development project. Indeed, the causes and effects diagram demonstrate graphically the causes leading to an effect and was used as a synthetic visualization tool and the communication of causes identified during the implementation of the project. Then the PERT diagram defined the means and practices to describe, represent, analyse and monitor the different activities of the project. Finally, the GANTT diagram provided a scheduling, allowing to visualize in time the different activities of the project. Thus, in this way, I established an optimal planning permitting to determine the project completion dates, to identify the existing margins on some activities and to visualize the progress of the work of the project development.

3.3 The causes and effects diagram



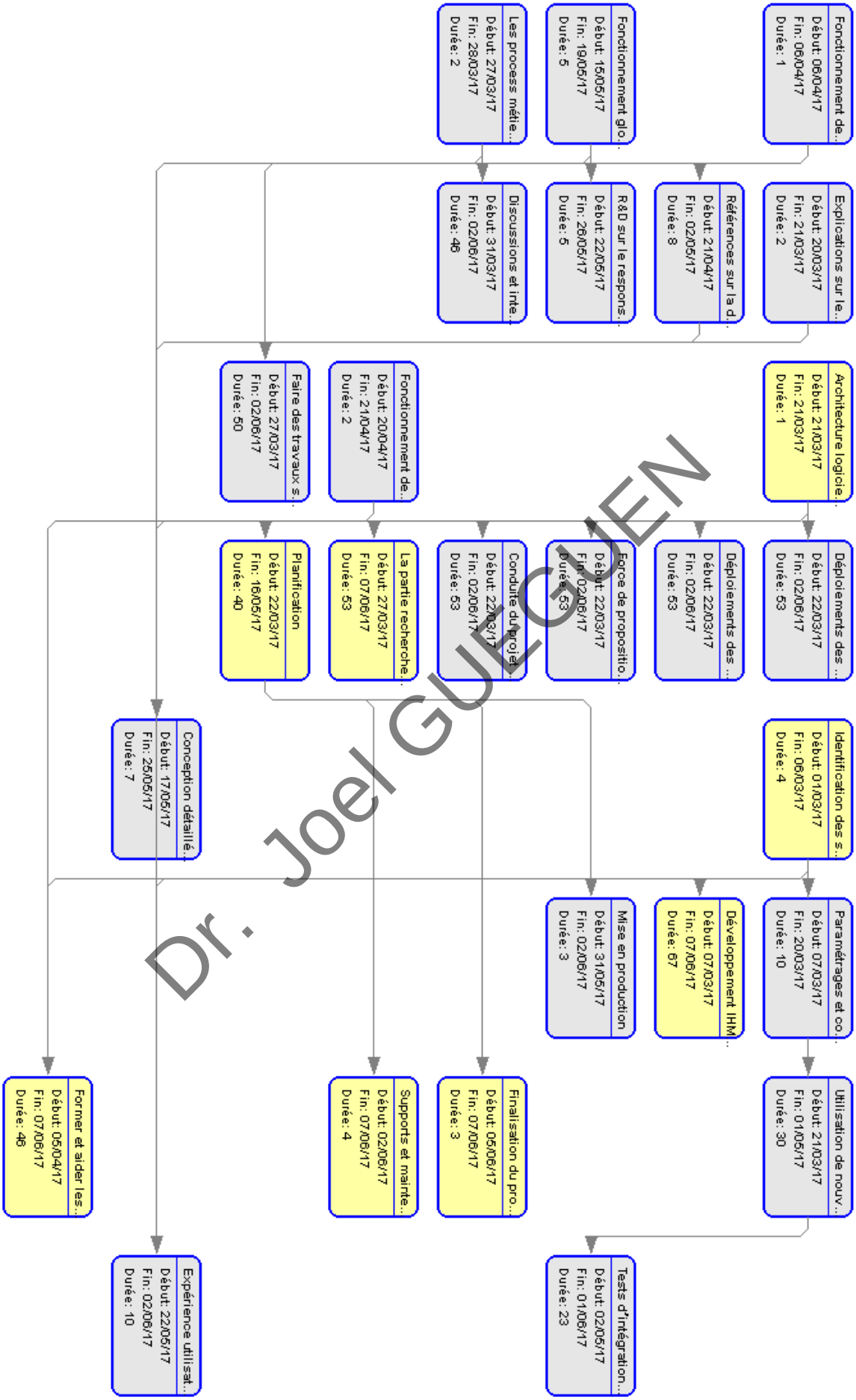
3.4 The GANTT diagram



3.5 The PERT diagram

The list of activities of the development project :

Nom	Date de début	Date de fin
Développement IHM du site web	07/03/17	07/06/17
Identification des spécifications fonction...	01/03/17	06/03/17
Conception détaillée des parties de dével...	17/05/17	25/05/17
Paramétrages et configurations de l'appli...	07/03/17	20/03/17
Déploiements des parties de l'application ...	22/03/17	02/06/17
Déploiements des parties de l'application ...	22/03/17	02/06/17
Utilisation de nouveaux outils et technolo...	21/03/17	01/05/17
Expérience utilisateur/Interfaces utilisateur	22/05/17	02/06/17
Architecture logicielle de l'application	21/03/17	21/03/17
Explications sur le fonctionnement de l'a...	20/03/17	21/03/17
Fonctionnement de la DSI pour l'entreprise	06/04/17	06/04/17
Fonctionnement des services de l'entrepri...	20/04/17	21/04/17
Fonctionnement global d'un ERP	15/05/17	19/05/17
Les process métier de l'entreprise	27/03/17	28/03/17
Force de proposition dans la conception ...	22/03/17	02/06/17
Conduite du projet de développement	22/03/17	02/06/17
La partie recherche et développement	27/03/17	07/06/17
Discussions et interviews avec les person...	31/03/17	02/06/17
Former et aider les autres stagiaires	05/04/17	07/06/17
Faire des travaux supplémentaires pour a...	27/03/17	02/06/17
R&D sur le responsive Design de l'applica...	22/05/17	26/05/17
Références sur la digitalisation au sein de ...	21/04/17	02/05/17
Planification	22/03/17	16/05/17
Mise en production	31/05/17	02/06/17
Finalisation du projet	05/06/17	07/06/17
Tests d'intégration et conformité des bes...	02/05/17	01/06/17
Supports et maintenance de l'application ...	02/06/17	07/06/17



3.6 Finalization of the development project

During the finalization phase, and even throughout the development of the project, it was useful to make an analysis of the **metric code**.

To do this, in the Visual Studio **IDE**, there is an "Analyse" button in the menus, permitting to choose the following action : "Calculate the metric code for the selected projects".

Metric code is a set of software measurements that provides to developers more details about the code they develop. By using code metrics, developers can understand which methods need to be reworked or tested in more depth. Development teams can identify potential risks, understand the current status of a project and monitor progress during software development.

The values of the metric code permit to give the dimensions of the software. The following list displays the metric results of the code interpreted by the Visual Studio IDE :

- **Maintainability index :** Calculates the percentage of index that represents the simplicity of use in the maintenance of code. A high value means a better efficacy of the maintenance. It is possible to use colour assessments to identify rapidly important or problematic aspects in the code. A red coloration indicates that the code has a maintenance complexity. A yellow coloration indicates that the code presents a beginning of complexity in maintenance. Finally, a green coloration indicates that the code has a good simplicity in maintenance.

- **Cyclomatic complexity :** Measures the structural complexity of the code created by calculating the number of paths to different codes, in the program flow. A program, whose monitoring flow is complex, requires supplementary tests to reach good code coverage and is more complex to manage for maintenance.

- **Depth of heritage :** Indicates the number of class definitions that extend to the root of the classes hierarchy. More hierarchy is deep, more it can be complex to see where are located, specific methods and particular fields having been defined and/or redefined.

- **Class coupling :** Measures coupling with unique classes via parameters, local variables, return types, method calls, generics or model instantiations, attributed classes, interface implementations, fields defined on external types, and an attribute decoration. A good software design implies that the types and methods have high cohesion and low coupling. High coupling indicates a complex design to reuse and manage because of its many interdependencies from others types.

- **Lines of code :** Indicates the approximate number of lines in the code. The Count is based on the IL code (Intermediate Language) and therefore does not match the exact number of lines in the source code file. A very high count may indicate that a type or method is spread and used in too many parts of the program and must be thus fractioned. It can also indicate that the type or method is complex to manage for functioning of a part of the application.

For example, I have done metric code analyses for *Student* and *Admin* projects in the application.

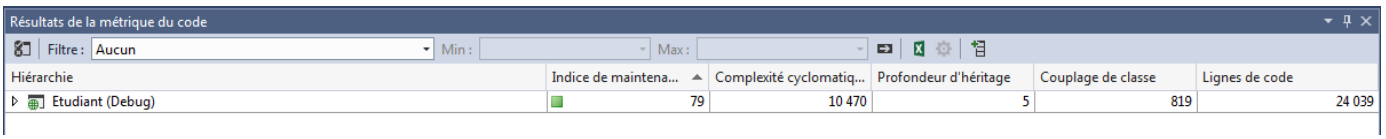


Figure 34 : Metric code analysis for the *Student* project

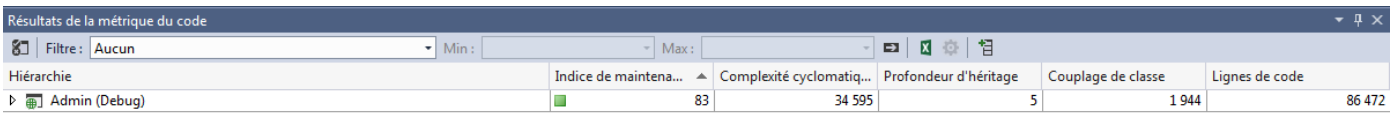


Figure 35 : Metric code analysis for the *Admin* project

With a better planning, the teamwork is better organized and the material needs better identified from the beginning of the project. For example, the expected time for an activity could be reduced during the development of the interfaces of the website, and then this gave an advancement in the project. Moreover, with a project-monitoring tool, it was interesting to view the different activities that had been done or had to be done for the finalization of the project. That is very useful in case of supplementary requests from users or important needs in the moment to which it was necessary to add them in the development project. Project management also permits to facilitate a proactive communication to further improve the exchanges of information. Furthermore, the fact that all the important data are centralized to find them more simply is also efficient, because the tools and methods are already known and could be reused in another project.

Acclaimed by more and more companies, project management is required in any type of structure as a particularly efficient organization. It is also a useful tool to improve the organization of the company.

Conclusion :

The HMI development of intranet website of the BBS Company was an innovative project and improvement of the existing. Because even if there was a former existing website for the development of the new intranet website, the project was equally innovative because it had to respond to new demands and its implementation included the use of many and new technologies in the field of the web to satisfy better the different needs. This internship at BBS was very instructive. I was able to acquire new skills in the design and development of web applications. Learned to simplify, understand the user and therefore adapt to his needs.

In a professional context, during this internship, I had to discuss with people who were not necessarily in the same field of my work. It had been enriching to meet and work with a multi-job team. A real and concrete cohesion teamwork with only one and same objective. The peculiarity of being a force of proposition is to be able to express its point of view on certain things, but it gave me above all the opportunity to discuss on interesting subjects.

The complete development part of the menu to manage the internship agreements in the "Enterprise" rubric has therefore been finalized as well as all the supplementary works that had been requested. There was the former version of the website as model to redefine the interfaces and features to conceive on the new version of the website. To do this, it was necessary to appropriate the functioning of the global architecture of the application and of the database. Analyzing the information before organizing the development of interfaces allowed me to improve productivity in the conduct of the development project. This was demonstrated notably with the importance of discussions and exchanges with the different personal of the company. Equally with the responsible of the ISD and the tutor of internship concerning the needs of the web application.

Digitization has become unavoidable and important within companies. All business processes and work context must be redefined in order to have a better optimization in data management as well as a more efficient productivity for employees of the company.

The database is the central element for the HMI development of the website because it gathers all the informations relating to the different services of the company. Having already had the opportunity to develop some applications in "heavy client", this internship also allowed me to discover more globally the functioning of applications in "thin client". In other words, websites.

I also appreciated the rapid feedback from the users, moreover that the discussions with some teachers of trainings were interesting. I was also able to learn more about the actions taken by an IT service of a company, their role, ranging from website maintenance to elaboration of new tools to respond to the needs of users.

To carry out this project, the MVC was useful for configuring or developing some features of the web application. Even if the development of the interfaces of the application was finalized, the accompaniment of the users being important, it was necessary to set up the support and the maintenance of the application. In such a way, the users dispose of all the necessary informations in relation to the contents of the website.

It was therefore a very enriching experience, from the theoretical analysis of the situation to the design of the interfaces for intranet website. This gives a preview of the different and main activities that could be entrusted to the IT service of an organization, with the effect of digitization within companies.

Glossary :

HMI :	**Human-Machine Interface**
ERP :	**Enterprise Resource Planning**
ISD :	**Information Systems Direction**
ASP.NET :	**Active Server Pages with .NET framework**
UI :	**User Interface**
UX :	**User eXperience**
XML :	**eXtensible Markup Language**
JSON :	**JavaScript Object Notation**
DLL :	**Dynamic Link Library**
AJAX :	**Asynchronous Javascript And Xml**
XHTML :	**eXtensible HyperText Markup Language**
HTML :	**HyperText Markup Language**
CSS :	**Cascading Style Sheets**
JQUERY :	**JavaScript framework**
JAVASCRIPT :	**Scripting language for interactive web pages**
UML :	**Unified Modeling Language**
SQL :	**Structured Query Langage**
LINQ :	**Language Integrated Query**
FRAMEWORK :	**A set of structural software components**
HTTP :	**HyperText Transfer Protocol**
ASP.NET WEBFORMS :	**Framework with event programming**
ASP.NET MVC :	**Framework based on design pattern**
WEB SERVICES :	**Communication of applications via Internet**
SEO :	**Search Engine Optimization**
ORM :	**Object Relational Mapping**
IMSP :	**Integrated Management Software Package**
DBMS :	**Database Management System**

Tables of figures :

Bibliographic references :

Books and reviews :

BABINET, Gilles. *Transformation digitale : l'avènement des plateformes.* Le passeur, 2016. 154 p.

CALO, Emmanuel. *IT Management and Transformation Numérique : Le IT Management à l'heure de la Transformation Numérique.* Independently Published, 2017. 146 p.

CHAFFER, Jonathan ; SWEDBERG, Karl. *JQuery : Simplifiez et enrichissez vos développements JavaScript*. Pearson, 2014. 395 p.

COUPEZ, Christophe. *Penser Autrement L'Intranet, La Digitalisation Et Les Réseaux Sociaux D'Entreprise : une approche différente et pragmatique pour tout public !*. Books on Demand Editions, 2015. 312 p.

DELORME, Pascal ; DJELLALIL, Jilani. *La transformation digitale : Saisir les opportunités du numérique pour l'entreprise.* DUNOD, 2015. 224 p. (Stratégies et management)

DUCREY, Vincent ; VIVIER, Emmanuel. *Le guide de la transformation digitale*. Editions EYROLLES, 2016. 327 p. (Hub management)

MARCOTTE, Ethan. *Responsive design patterns.* Editions EYROLLES, 2016. 173 p.

MUNDUBELTZ, STÉPHANIE. *"La transformation digitale n'est pas une question d'outil mais d'état d'esprit, étude OpinionWay"* [online], 2017, http://www.usine-digitale.fr/editorial/la-transformation-digitale-n-est-pas-une-question-d-outil-mais-d-etat-d-esprit-opinionway-les-big-boss.N551073 (consulted the "date")

PILIU, FABIEN. *"La transformation numérique, un sujet pour les entreprises "*[online], 2016, http://www.latribune.fr/economie/france/transformation-numerique-les-entreprises-a-la-peine-617373.html (consulted the "date")

Websites :

c-sharpcorner.com. *Bind Crystal Report In ASP.NET Application And Export In PDF And Excel Format* [online]. http://www.c-sharpcorner.com/UploadFile/ansh06031982/bind-crystal-report-in-Asp-Net-application-and-export-pdf-a/ (consulted the "date") ; *Upload File Show in Grid View, Store Database And Download Using ASP.NET And C#* [online]. http://www.c-

sharpcorner.com/blogs/upload-file-show-in-grid-view-store-database-and-download-using-asp-net-and-c-sharp (consulted the “date”) ; *Gridview with image and FileUpload in ASP.NET* [online]. http://www.c-sharpcorner.com/UploadFile/261736/gridview-with-image-and-fileupload-controls-in-Asp-Net/ (consulted the “date”)

sellandsign.com. *Ne dématérialisez plus : digitalisez !* [online]. https://www.sellandsign.com/fr/dematerialisation-vs-digitalisation/ (consulted the “date”)

clic2buy.com. *La digitalisation des entreprises !* [online]. https://www.clic2buy.com/fr/digitalisation-entreprises-atout-lavenir/ (consulted the “date”) ; *Responsive web design, le procédé incontournable.* [online]. https://www.clic2buy.com/fr/responsive-web-design-procede-devenu-immanquable/ (consulted the “date”)

alphalives.com. *Définition de la digitalisation, ses avantages et ses outils.* [online]. https://www.alphalives.com/digitalisation/ (consulted the “date”)

zdnet.fr/blogs/. *Les entreprises françaises et leur transformation digitale : l’étude OpinionWay* [online]. http://www.zdnet.fr/blogs/marketing-reseaux-sociaux/les-entreprises-francaises-et-leur-transformation-digitale-que-retenir-de-l-etude-opinionway-39853814.html (consulted the “date”)

www2.deloitte.com. *Les défis de la transformation digitale* [online]. https://www2.deloitte.com/fr/fr/pages/technology-fast-50/articles/les-defis-de-la-transformation-digitale.html (consulted the “date”)

journalducm.com. *qu’est-ce que la transformation digitale ou numérique* [online]. https://www.journalducm.com/dictionnaire-marketing/transformation-digitale-numerique/ (consulted the “date”)

communication-web.net. *La transformation digitale de l’entreprise* [online]. http://www.communication-web.net/2015/03/04/reussir-la-transformation-digitale-de-lentreprise/ (consulted the “date”)

markentive.fr/blog/. *Transformation digitale* [online]. https://www.markentive.fr/blog/transformation-digitale-de-quoi-parle-t-on-vraiment/ (consulted the “date”)

webmarketing-com.com. *Comprendre la transformation digitale* [online]. https://www.webmarketing-com.com/2017/07/11/60861-10-chiffres-comprendre-transformation-digitale (consulted the “date”)

corp.hubinstitute.com. *Le guide de la transformation digitale* [online]. https://corp.hubinstitute.com/guide-de-la-transformation-digitale/ (consulted the “date”)

lesaffaires.com. *L'ère de la transformation numérique* [online]. http://www.lesaffaires.com/evenements/conferences/sommet-marketing-a-l-ere-de-la-transformation-numerique/590240 (consulted the "date")

gbogs.cisco.com. *Transformation numérique* [online]. https://gblogs.cisco.com/fr/transformation-numerique/ (consulted the "date")

cxp.fr. *TRANSFORMATION NUMÉRIQUE – Les entreprises digitales* [online]. http://www.cxp.fr/content/news/transformation-numerique-lentreprise-de-demain-sera-digitale (consulted the "date")

aspsnippets.com. *Different ways to create mailto: link – ASP.NET* [online]. https://www.aspsnippets.com/Articles/Different-ways-to-create-mailto-link---ASP.Net.aspx (consulted the "date") ; *Display files saved in Database Table in ASP.NET* [online]. https://www.aspsnippets.com/Articles/Display-Files-saved-in-Database-Table-in-ASPNet-GridView-with-Download-button.aspx (consulted the "date")

msdn.microsoft.com. *Uploading Files in ASP.NET* [online]. https://msdn.microsoft.com/en-us/library/aa479405.aspx (consulted the "date") ; *Vue d'ensemble d'Entity Framework* [online]. https://msdn.microsoft.com/fr-fr/library/bb399567(v=vs.110).aspx (consulted the "date")

entityframeworktutorial.net. *Entity Framework Tutorial* [online]. http://www.entityframeworktutorial.net/Articles/entityframework-articles.aspx (consulted the "date")

docs.microsoft.com. *LINQ queries* [online]. https://docs.microsoft.com/fr-fr/dotnet/csharp/programming-guide/concepts/linq/introduction-to-linq-queries (consulted the "date")

dotnet-france.com. *Simplifiez et améliorez vos développements JavaScript avec JQuery* [online]. http://www.dotnet-france.com/articles/JQuery (consulted the "date")

social.technet.microsoft.com. *Autocomplete with JQuery on website* [online]. https://social.technet.microsoft.com/fr-fr/library/hh127437.aspx (consulted the "date")

labo-microsoft.org. *Les technologies ASP.NET* [online]. https://labo-.microsoft.org/news/technologies/asp.net (consulted the "date")

support.office.org. *Visual studio et SQL Server* [online]. https://support.office.com/fr-FR/article/VS-avec-SQL-Server (consulted the "date")

supportduweb.com. *les Framework ASP.NET* [online]. http://www.supportduweb.com/framework-asp.net.html (consulted the "date")