



INTERNATIONAL
HELLENIC
UNIVERSITY

Dissertation Title:

**“Analysis, Design and
Implementation of an Intelligent
Maintenance Management System
for Hotels.”**

EVANGELIA VAGENA

SID: 3301120015

SCHOOL OF SCIENCE & TECHNOLOGY

A thesis submitted for the degree of

Master of Science (MSc) in Information and Communication Systems

DECEMBER 2013

THESSALONIKI – GREECE



INTERNATIONAL
HELLENIC
UNIVERSITY

Dissertation Title

**“Analysis, Design and Implementation of an
Intelligent Maintenance Management System
for Hotels.”**

EVANGELIA VAGENA

SID: 3301120015

Supervisor:

Prof. Ioannis Vlahavas

Supervising Committee Members:

Assoc. Prof.

Assist. Prof.

SCHOOL OF SCIENCE & TECHNOLOGY

A thesis submitted for the degree of

Master of Science (MSc) in Information and Communication Systems

DECEMBER 2013

THESSALONIKI – GREECE

Abstract

This dissertation was written as a part of the MSc in ICT Systems at the International Hellenic University. The objective of the thesis is first to study an innovative technology of organizing data, and secondly to examine and develop a system for stating malfunctions employing by hotel industry.

More specifically, throughout this dissertation it is described in detail the ontology technology as well as the advantages and benefits that this ground-breaking technology offers. Furthermore, the stages and phases of developing a system are also presented both as general concept and for the developed system, in particular. At the second part of the dissertation a web-based software developed by the author of the dissertation is presenting, mentioning in detail the way that the author developed the in question system, each difficulty encountered, and finally the way in which the system might offer more advanced features and services.

EVANGELIA VAGENA

18-12-2013

Acknowledgments

With the completion of this dissertation, which was implemented at International Hellenic University, I would like to thank the people who helped me in completing this work.

To begin with, I would like to thank my supervisor from International Hellenic University, Prof Ioannis Vlahavas who supported me throughout the course of the dissertation. I would also like to thank Dr Christos Berberidis who provided me with any clarifications regarding the dissertation process. Special thanks to Mr Efstratios Kontopoulos for his valuable assistance provided and for the unwavering support in accomplishing this dissertation. Finally, I thank my family, friends and all those who were with me throughout this effort by providing unlimited understanding and psychological support.

Contents

Abstract.....	III
Acknowledgments	IV
Contents	V
Figure Contents	VII
Introduction	1
Chapter 1	4
1.1 System	4
1.2 Definition of the Term System	4
1.3 Ontology Concept.....	6
1.4 Definition of the Term Ontology	6
1.5 Benefits	8
1.6 Relational Database	9
1.7 Ways of Classification	11
1.8 Similar Existing Systems	14
1.8.1 FacilityONE	14
1.8.2 Hotel Hero	16
1.8.3 Maintenance Connection	20
1.9 Conclusion of the Chapter.....	22
Chapter 2	23
2.1 Aim	23
2.2 Analysis	23
2.3 Management Information Systems (MIS).....	26
2.4 Strategies for Determining Information Requirements.....	29
2.5 Design	30
2.6 Implementation	31
2.7 Implementation and Maintenance	32
2.8 Conclusion of the Chapter.....	32
CHAPTER 3	34

3.1	Porto Carras Grand Resort	35
3.2	Plan Definition	36
3.3	Information Systems Strategic Planning As a Model for Hotel Industry Management	37
3.4	Computer Technology and Information Systems for the Management of Hotel Industry	39
3.5	Analysis for Porto Carras	40
3.6	Design	41
3.7	Implementation	49
3.7.1	Creating the Repository	50
3.7.2	Uploading the Repository	55
3.7.3	Code Implementation	56
3.7.4	SPARQL Definition	69
3.7.5	SPARQL Query Structure	69
3.7.6	SPARQL Queries	70
3.8	Innovative Part	71
3.9	Conclusion of the Chapter	71
	Overall Conclusions	72
	Appendix I	81
	Appendix II	82
	Appendix III	83
	Appendix IV	84

Figure Contents

FIGURE 1.1: ACCOUNT TABLE	10
FIGURE 1.2: ADDRESS TABLE	10
FIGURE 1.3: EMPLOYMENT TABLE	10
FIGURE 1.4: FACILITYONE-COMPANY'S LOGO	14
FIGURE 1.5: HOTEL HERO -COMPANY'S LOGO	16
FIGURE 1.6: MAINTENANCE CONNECTION -COMPANY'S LOGO	20
FIGURE 2.1: STEPS IN SYSTEMS DESIGN	30
FIGURE 3.1: PORTO CARRAS GRAND RESORT	35
FIGURE 3.2: INFORMATION SYSTEM DEPLOYMENT PLAN	38
FIGURE 3.3: USE CASES	42
FIGURE 3.5: CREATING A NEW OWL ONTOLOGY_1	51
FIGURE 3.6: CREATING A NEW OWL ONTOLOGY_2	51
FIGURE 3.7: INSERTING COMMENTS	52
FIGURE 3.8: topDataProperty IN PROTÉGÉ	53
FIGURE 3.9: topObjectProperty IN PROTÉGÉ	54
FIGURE 3.10: INSERTING COMMENTS IN PROTÉGÉ	54
FIGURE 3.11: INSERTING COMMENTS TO INSTANCES IN PROTÉGÉ	55
FIGURE 3.12: UPLOADING THE REPOSITORY IN WORKBENCH PLATFORM	56
FIGURE 3.13: CSS CODE FOR THE SOFTWARE APPLICATION	57
FIGURE 3.14: PHP CODE FOR THE USER REGISTER	58
FIGURE 3.15: CODE FOR THE USER REGISTER ACTION	58
FIGURE 3.16: PHP CODE FOR THE USER LOGOUT	59

FIGURE 3.17: CODE FOR THE USER LOGIN	59
FIGURE 3.18: CODE FOR HEADER TEMPLATE	60
FIGURE 3.19: CODE FOR FOOTER TEMPLATE	61
FIGURE 3.20: CODE FOR BROWSE BREAKDOWN LIST	62
FIGURE 3.21: PAGINATION FUNCTION	63
FIGURE 3.22: CODE FOR INSERT BREAKDOWN	64
FIGURE 3.23: INSERT BREAKDOWN INTERFECE	65
FIGURE 4.24: CODE FOR HELP DESK	66
FIGURE 4.25: HELP DESK INTERFECE	66
FIGURE 4.26: CODE FOR THE SmS NOTIFICATION	67
FIGURE 4.27: SmS NOTIFICATION FUNCTION	67
FIGURE 4.28: SmS NOTIFICATION INTERFACE	68

Introduction

“Tech gives the quietest student a voice”

Jerry Blumengarten

Like an information society¹ our world have been transformed to a software world. Software exists everywhere, more precisely, from our mobile phones and our computers, to our vehicles, houses and all places in between. The extent of the used software in all over the world is transcendent and cannot be known. People has not even defined a specified measure to determine its extent or appraise [1]. It is believed that more than 1 billion lines of code have accumulated over time [1, 2]. On request of \$875 billion was spent globally on software in 2010. About the half of this amount was for packaging software and licenses and the rest for programmer services, consulting as well as outsourcing [3]. In the U.S. about 2 million people work as programmers or in a related field [4].

It goes without saying that software represents a really great deal [1]. In a non-static context, companies need to accomplish newfound rivalry and to have an in-out world vision of their institution. This claim exceptional notion and tendency at all levels and, for which, strategic management tools are postulated. One strategic tools establishing the system, depending on computer machinery that permits the incorporation of all the information needed, for productive management and successful quality. [5]

In general, hotels are complicated and high-priced when maintenance comes to with various uses of spaces that have not common or related schedules and uses for guest rooms “restaurants, health club, swimming pool, retail store and each one of these have

¹ http://en.wikipedia.org/wiki/Information_society

a practical engineering system needed for its maintenance. This is the most important reason for which ontology technology should be used as a solution in developing a repository referring also to hotel industry. [5]

Throughout the dissertation there is a presentation of some existing systems similar to the one that is going to be developed for the Hotel Resort Porto Carras. The objective is to introduce a short, concise and well documented survey of the overall field. The advantages and the disadvantages of the intended implemented technology.

In the dissertation scope, there is a description of the system analysis and design which are key factors for the System Development Life Cycle (SDLC). The stages are project selection, feasibility, analysis, design, implementation, and post implementation stages. The idea for the project is originated in the environment or from within the organization. Once the problem is verified an initial investigation is conducted to determine whether a change is feasible. If the answer is yes, a feasibility study is conducted. Furthermore, for the term of analysis there is a detailed report of the various operation performed by a system. System design concerns the technical specifications that will be applied in implementing the candidate system. Implementation is referring to the details of the candidate system. After implementation, maintenance starts containing enhancements, modifications, or any modification from the original specifications. To ensure the success of the system, careful and often extensive planning is required. The overall management process is crucial to the successful completion of system.

The last chapter of the present dissertation is referring to the description of the Hotel Resort for which the software application it being developed. It concerns the plan definition, where the objective and the covered need by the system are presenting. The chapter introduces the design as well as the implementation pointing out the crucial issues that analyst and designers should focus on when developing software applications so as to provide an accessible environment of the published software application invoking every type of user (familiar, unfamiliar with tech).

Finally, the author of the dissertation implemented a web-based application software presenting all the procedure that taken place during the application development, the way in which every part of the application was built up and the way it works. In particular, how users can navigate throughout the application and the way in which every part of the software app was developed, mentioning even the executed code. At the end, the author is presenting the innovative introductions that the application software provides in comparison to other current used systems.

Chapter 1

In this chapter, it is being presented issues regarding the aim of the dissertation, explaining the concepts that are being used. More specifically, the advantages and disadvantages of the ontology technology that is used for the development of the intelligent maintenance management system for a specific hotel resort, Porto Carras, are being presented. Furthermore, it is going to be described in detail the term ontology and similar existing intelligent maintenance management system.

1.1 System

The word system is extensively utilized. It has turned to be groovy to adjoin the word system to constitute a current aptitude when indicating things or processes. People talk about the exercise system, investment system, delivery system, information system, education system, computer system etc. System might be relating to any set of components, which activity and functionality in intermediated way for a mutual causation or goal. [6]

1.2 Definition of the Term System

Before talking more about the system that is being developed it is wise to give a detailed definition of the term *system*. The term system is derived form a Greek word, sistema. Sistema stands for an incorporated and methodical relation among operating components or elements. A system occur by cause of being formed to accomplish one or more goals. The human world come across with a daily contact with systems in order to accomplish performance and effectiveness in the application of information systems. It is essential to adjust the methodical and ordered structure of the organization. This step represents a fundamental milestone for a successful project of a transportation system, telephone system, accounting system, production system, as well as for a

computer system. In the same way, for a business system is related with the association as a system containing corresponding subsystems or departments like production, sale, personnel, plus an information system. Those subsystems are not of a great use solely. While if those subsystems are efficiently integrated, the company/organization is able to run successfully, and fruitfully.

A hundred definitions exist for the term word system, however most of them appear to hold a collective thread that indicates that a system is a controlled group of autonomous components associated with each other based on a scheme in order to accomplish a particular goal.

When the term *component* come to, it might be referring to a physical part such as engines, wings of aircraft, car, or managerial steps like planning, organizing, and controlling. It might be also referring, to a multi-level system. The component might be simplistic or complicated, fundamental or highly evolved. In addition, a component might be a mere device like a computer with a keyboard, memory, and printer or a sequence of rational terminals joined to a mainframe. In either case, each one of the components represent a segment, element of the entire system. Each component need to perform its proportion of task for the system to accomplish the intended objective. This arrangement demand an orderly group of the components for the form of a productive system.

The analysis of system notion, deals with three fundamental implications:

1. A system has to be formed in a way in order to accomplish a prearranged goal.
2. Interrelationships and interdependence need to be in existence among the components.
3. The goals of the association as a whole, hold a superior priority than the goals of the subsystems that form it. For instance, computerizing personnel applications need to be adjusted to the organization's policy regarding privacy, confidentiality and security, as well as turning specific data (e.g. payroll) accessible to the accounting division on request. [6]

For the aim of the present dissertation the ontology technology will be used. In the following paragraphs it is going to be presented in detail the concepts and the reasons of choosing the ontology way for the implementation of the intelligent maintenance management system for hotels.

1.3 Ontology Concept

To begin with, ontologies as conceptualizations of field of interest, are, in general, preferably adjusted for performing the work of conceptual perspectives over data repositories. As for this point of view to turn to be efficient, it is essential that the abstract layer via which the elementary data layer is obtained does not launch a noteworthy upper in confronting with the data. [7]

1.4 Definition of the Term Ontology

In order to define the term ontology, it could be mentioned that the review of ontologies has performed a crucial role in numerous classic and contemporary sociological theories. Ontologies represent categorical systems, notions, and identities within which actors and actions are situated. The goal of ontological analysis is to reveal the guidelines and the regulations that confine the objects filling human natural and social worlds. [8]

Some other definitions find in bibliography regarding the term ontology are presenting in the following paragraphs.

Ontology might be characterized as one of the more intimidate terms for people dealing for the first time to semantic technologies. The word long and without mutual antecedents, as well as it is a term that has at large altered use and comprehension within the community. It can be argued that this not-so-little word is one of the barriers to mainstream understanding of the semantic Web. [9]

The root of the term is the Greek *ontos*, or *being* or the *nature* of things. Although the etymology is Greek, the earliest extant record of the word itself is the New Latin² form *ontologia*, which appeared in 1606, in the work *Ogdoas Scholastica* by Jacob Lorhard(Lorhardus)³ as well as in 1613 in the *Lexicon philosophicum* by Rudolf Göckel(Goclenius).

“The first occurrence in English of "ontology" as recorded by the OED (Oxford English Dictionary, second edition, 1989) presented in Nathaniel Bailey's⁴ dictionary of 1721, which defines ontology as 'an Account of being in the Abstract'. However, of course, an entry like this suggest that the term was already in use at that time. It is probably the word was first used in its Latin form by philosophers based on the Latin roots, which themselves are based on the Greek. The current on-line edition of the OED (Draft Revision September 2008) gives as earliest documented occurrence in English a work by Gideon Harvey (1636/7-1702)” [10]

To the letter and in long-established philosophy, ontology used to be applied in conjunction with the analysis of the nature of creatures or the world, the nature of existence and endurance. Tom Gruber⁵, among others, made the term famous in conjunction with computer science and artificial intelligence almost since 15 years when he determined ontology as a “formal specification of a conceptualization.”[9]

Rather like taxonomies or relational databases, ontologies operate to regulate information. It makes no difference what the sector or field, an ontology is a report or a review of a world conception. That conception may be restricted and miniscule, or it may be earthly and expansive. Nonetheless, unlike those substitute hierarchical views of concepts such as taxonomies, ontologies usually have a joined or networked *chart* scheme. Various things can be associated to other things, all in a possibly multi-way sequence of relationships. [9]

² http://en.wikipedia.org/wiki/New_Latin

³ http://en.wikipedia.org/wiki/Jacob_Lorhard

⁴ http://en.wikipedia.org/wiki/Nathaniel_Bailey

⁵ <http://tomgruber.org/>

Ontologies provide the scheme for associating information to other information in the semantic Web or the Linked Data domain. Therefore, ontologies supply a matching model for the association of data that is supplied by relational data pattern. Owing to this pattern role, ontologies are crucial to the consistency and interoperability of interrelated data.

Meanwhile, if one utilizes the notion of *world view* as synonymous with an ontology, it is not meant to be cosmic, just simply a manner to carry of how a given operation or dilemma can be outlined. One group might select to outline and arrange, state, automobiles, by color; while another may select body mode like pick-ups or sedans; besides another may utilizes labels like *Honda*⁶ and *Ford*⁷. None of these aspects is intrinsically correct (in fact, repetitions may be linked with a given ontology). However each depicts a special manner, a *world aspect*, of looking at a field.

All the same, there is much scope regarding the way that a given field may be outlined, there are both good ontology practices and bad ones. In the following paragraph, it is presented some aspects of what establishes good ontology design and practice.

1.5 Benefits

At the minimum past decade, ontologies and semantic Web-related approaches have been segment of this concoction, as well. A good synopsis of these trials originated from Michael Uschold in an address at FOIS 2008 [1]. In this analysis, he directs to the advantages for ontology-based approaches to software engineering: [1]

- ❖ *Re use, abstract/general notions* might be utilizes to instantiate additional concrete/specific notions, allowing more reuse.
- ❖ *Reduced development times*, generating software artifacts which are more familiar to the way of how human beings think, linked with reprocessing and automation which permits applications to be developed more rapidly.
- ❖ *Increased reliability*, formal structures with automation limits human errors.

⁶ <http://www.honda.gr/>

⁷ <http://www.gofurther.com/>

- ❖ *Reduced maintenance costs, expanded reliability and usage of automation* to modify and adjust prototypes to executable code eliminates errors. A formal connection between the prototypes and the code transform the software easier to apprehend and hence maintain.

Those four parameters are much the same to the benefits claimed for other software engineering approaches, still with some particular turns owing to the semantic ground. Nevertheless, Uschold continues proposing benefits for ontology-based methodologies not stated by other approaches:

- ❖ *Reduced conceptual gap*, application developers might interact with the tools in a manner that is closer to their way of thinking.
- ❖ *Facilitate automation*, formal framework are agreeable to automated analysis, diminishing the load and pressure on the human.
- ❖ *Agility/flexibility*, ontology-driven information systems offer more flexibility, owing to the fact that one is able to apply changes much more easily and reliably in the prototype than in code. [1]

1.6 Relational Database

Relational Databases are normally work in what it is called tables. The data is stored in different types of tables. For instance, suppose that there are three main tables

- ❖ account table (see FIGURE 1.1)
- ❖ address table (see FIGURE 1.2)
- ❖ employment table (see FIGURE 1.3)

Note that a few or several tables may contain data which are associated with data from other tables. If one wants to access the info belonging to 9999 record of the account table a *sql query* needs to be executed in order to access all and every record till it will reach the one that it is looking for. Furthermore, in case we need the info belonging to 9999 record of the account table as well as the address table and the employment table,

the system will need to access all the necessary records one by one till it will reach the requested record.

Account Table	
Account*	Etc
1	This is account 1
2	This is account 1
3	This is account 1
9999	This is account 9999

FIGURE 1.1: ACCOUNT TABLE

Address Table	
Account*	Address
1	This is address 1
2	This is address 2
3	This is address 3
9999	This is address 9999

FIGURE 1.2: ADDRESS TABLE

Employment Table	
Account*	Employee
1	This is Employee 1
2	This is Employee 2
3	This is Employee 3
9999	This is Employee 9999

FIGURE 1.3: EMPLOYMENT TABLE

On the other way, using ontologies to organize data appears to have not only the benefits described above but the different ways of classifications offer more advanced services, as well. Below it is presenting the different classification ways.

1.7 Ways of Classification

The ideas around the ontology-driven information systems (ODIS) have had considerable influence on the semantic Web community, particularly in the utilization of formal ontologies and modeling approaches. [1] Still, as Uschold carefully mentions, the idea of ODIS stretch out over the software engineering to revolve all of information systems. According to the author's opinion the classification of the way that ontologies might advance information systems is described below:

Domain modeling, this grouping contains the field of knowledge picture and rational and surmise establish that represent the conventional comprehension of ontologies in the semantic field.

The *fundamental attitudes are similar to a database pattern meaning*, the single views of ontologies abide in their rational establishments and chart construction, which provide more strength in deductioning, reasoning as well as chart study than traditional methods.

Model-driven architectures (MDA), such as UML⁸, these are platform-independent features that offer the practical and dataflow meaning of prototypes executed by the system. Those are the typical offspring of earlier case methods. Like those systems possibly permit pictural or visual ways for developing or hooking together components as alternate to aim coding.

*Program specifications and executable*s, however reasonably initiatory currently, those techniques utilize the languages of RDF⁹, OWL¹⁰ or straight utility of rational languages to develop the analogue of executable software programs. A set of experimental systems contain Fhat and Neno, for instance, indicate to feasible future directions in this field.

[9]

⁸ http://en.wikipedia.org/wiki/Unified_Modeling_Language

⁹ http://en.wikipedia.org/wiki/Resource_Description_Framework

¹⁰ <http://en.wikipedia.org/wiki/Owl>

Runtime or utility components, accurate development of ontologies could be a spring for mark and instant within user interfaces and other runtime usage. Due to ontology grounds, those conferral might be hypothetical, as well. [1]

Automated agent, based on circumstances, user selections and the dominant ontologies, fresh commands group could be provoked through what some term mechanical agents or *robots* to command following steps in the software, containing possibly examination or validation. Mission Critical IT (IT: Information Technology) is evidently the most highly evolved in this field; it is debated their ODASE technique¹¹ more in the following paragraphs. [1]

Indicated drivers of generic applications, via the use and combination of a collection of the views above, this technique is a very different pattern, as it is outlined below. [1]

It should always be kept in mind that a good ontology provides a combination suite of advantages not befitting to taxonomies, relational database chart, or other regular methods to arrange information. Among those advantages are:

Consistent navigation by providing the means to move from concept to concept in the ontology form.

Adaptable entry points due to any particular attitude in the ontology could be determined and associated to all of its related notions. There is no class of structures or ways for not alternating with the ontology.

Connections that stress associated information, and data while help and precise results without requesting previous knowledge of the domain or its terminology.

Ability to depict any structure of information, containing unstructured, semi-structured (XML or Web-pages) and structured (common databases) data.

¹¹ <http://www.missioncriticalit.com/odase.html>

Inferencing, by identifying one notion for instance mammals, someone might understand that it is also relating to associated notion such as mammals are a kind of animal.

Concept mating, this means that despite of the fact that things might be outlined in a different way, it could still be mated to the same concept (like glad or happy; both are relating to the notion of a lively condition of mind). Therefore, this indicates that it could be integrated an outside subject as well by appropriate matching and outlining of those notions.

A setting for disambiguation by nature of the matching and study of notions and samples in the ontology chart.

Reasoning, the capability to utilize the cohesion and framework itself to notify inquires of relatedness or to reply to questions. [9]

Flexible Access, the ability of a system to permit the creation of a centralized knowledge field with several access level

Information Integration, a crucial quantity relating with every causal mechanism apt of selecting among options, showing a duality between causation and information.

To sum up, those are the most important aspects stated worldwide, that ontology tech should be adopted for constructing data structures. In the next paragraph, there is a presentation of similar existing systems like the one that is being developed for the purpose of this dissertation.

1.8 Similar Existing Systems

In the following, it is going to be described some representative intelligent maintenance management system as well as the innovative part of the current implemented one.

FacilityONE

FacilityONE developed by Facility Management Software for Hospitality. [11] FacilityONE represents more than a Computerized Maintenance Management Software (CMMS)¹² or Computer Aided Facility Management system (CAFM)¹³. The SMARTPRINT Editor consists the root of the most effective and well-arranged facility management solution on the market nowadays. Despite of the SMARTPRINT Editor one is able to elucidate life safety, fire suppression systems, egress routes, storm shelters, etc.



FIGURE 1.4: FACILITYONE-COMPANY'S LOGO

The FacilityONE Facility Information Solution (FIS) runs like a sole point for directors' accessing, maintenance crew, engineers, technicians, housekeeping staff, and guest services, permitting them to:

- ❖ Accelerating Diagnosis of System Issues via a Device Chain.
- ❖ Arranging for an event.
- ❖ Using the Device Notebook, rapidly detect related data about any benefits (objects like lift review certificates, board of well-being review, safety of food restaurant, fire safety correspondence).

¹² http://en.wikipedia.org/wiki/Computerized_maintenance_management_system

¹³ http://en.wikipedia.org/wiki/Computer-aided_facility_management

- ❖ Accessing all of one's systems documentation and places of valves and switches, and view those on their floor plan drawings for each of one's means with a just one login.
- ❖ Being inclined for correspondence reviews.
- ❖ Annotating egress routes on floor scheme drawings.
- ❖ Scheduling for maintaining the pool.
- ❖ Document correspondence of life safety equipment by location.
- ❖ Creating, Arranging, and Following Daily Duty lists.
- ❖ Producing Service Requests from every PC which is connected to the Internet.
- ❖ Optimizing the way of using both Equipment and Personnel.
- ❖ Setting Up automated declarations of ordinarily Recurring Duties.
- ❖ Accomplishing Workflow from Start Point to Finish Point.
- ❖ Replying to Service responds in Real Time from every PC.
- ❖ Improving Employee gratification by maintain Service Requesters up to date of the Status of the request. [11]

FacilityONE's Facility Information Solution is able to receive and understanding work demands from every Internet Connected PC. Once received, the system furthers the demand or request to the individual or firm one has allocated, and is able to communicate using email service, or text message. Adding every critical cross-department declaration simply to certify that everyone can obtain access to current information on every service inquiries. [11]

Systems Documented for the every day tasks and Maintenance of the Facility:

- ❖ Electrical
- ❖ Mechanical/HVAC
- ❖ Lighting
- ❖ Plumbing and Fixtures
- ❖ Emergency Generators
- ❖ Elevators
- ❖ Air Compressors

- ❖ Computers and Office Equipment
- ❖ Outdoor Lighting
- ❖ Parking plot
- ❖ Ovens or Stoves
- ❖ Means like room for particular things such as TVs, carpet, and bedspreads could be instanced for budgeting and life cycle.

Everything than these on the assets that the personal commonly services or maintains.[11]

Hotel Hero

Another similar system is the one that Hotel Hero utilizes. Hotel Hero uses a hotel software for handling one's hotel matters, including several occasions, schedules, reviews, and so on. Hotel Hero declines guest concerns and possible problems while it expands their gratification constituting more repeat business, and aids one's hotel to turn to be more propitious.



FIGURE 1.5: HOTEL HERO -COMPANY'S LOGO

Hotel Hero is constituted by two basic components:

1. Web Application that operates on every computer from a website url utilizing Secure Socket Layer safekeeping.
2. Mobile App that operates with iOS (iPhone,iPod,iPad) and Android Devices.

Some characteristics of the in question system are describing below:

Issue Tracking: Log and Report

Hotel Hero saves every daily data regarding housekeeping, maintenance, and every other section so that they are able to be study in detail. One is able to see what topics are occurring at one's place in real-time. Hotel Hero permits one's departments to contact rapidly and simply with each other. Personnel could enter many topics simultaneously without the concern of clogging up the radio with inquires. Departments may analyze their remarkable topics and confirm that they are all resolved in a precise way. No further unremembered rooms.

Inventory: Follow of one's Inventory

Hotels maintain inventory and a much of it. Linens, Shampoos, Soaps, Light Bulbs, and much more. There are both a lot of things to compute, however, they are unfold over various closets / floors, as well.

Log, Track and Facilitate with Hotel Hero

Hotel Hero performs multi-closet inventory a breeze utilizing even a mobile app. One easily walk the halls and label the numerate in the app. Once accomplished, the application will display one person what he or she is lacking in comparison to his or her preset inventory demands. Furthermore, the application gives one's order amounts containing Vendor and Part information. Utilizing Hotel Hero makes regularly inventory a piece of cake.

Room Inspections-Custom Room Inspections

Managers are able to utilize the room inspection wizard in the mobile Hotel Hero application to record every day room inspections. Inspections are totally customizable to personal assets from examining under the bed to utilizing the white glove test above the television. One can ascertain precisely that things necessity to be inspected and their point values. Once an inspection is finished the personal member obtains a score that is saved with the inspection review. Inspection scores aid to record personal members who

are making a tremendous work and those that necessity more instruction to encounter the hotel standards.

Reviewing

Hotel Hero supply with a wealth of Data. With ease one can see which rooms, sections, or departments are having the most problems. User Activity Reports show one's most fertile employees and which necessity enhancement. Inventory reviews allow one to follow of one's supplies. Trend reports reveal fundamental problems which should be determined whereas they continue reproducing. Not ever have to sort through a coupler of paper to detect what occurred a month ago in a specific room. Examine the history record of topics to detect particular events.

Remote Access

Hotel Hero is accessible on every side. One is not restricting utilizing Hotel Hero just in local level. Senior management is able to login to Hotel Hero at every place just having internet connection to see real-time hotel state information. For instance, to see the kinds of problems are active currently.

Review former topics.

Reports of every Hotel Hero summary.

Utilize a mobile version for mobile devices (iOS/Android)-General Watching

Excursion Advisor, Facebook, and Twitter Instagram. Business Twitter and Facebook pages combined with Hotel Hero. One's team can simply watch one's former Tweets and facebook posts as well as interact with them simply. The most important, one might be associated with his or her hotels *Excursion_Advisor* site and following of one's ranking and reports. The feature of the photo documentation of Hotel Hero is describing in the following scenario, showing how the specific feature of the software can help the hotel to save money.

“The front desk manager springs to action and provides the guest help with getting off the floor. The guest mentions that he or she has hurt his or her ankle. The front desk manager communicate with 911 and the guest’s situation is being deteriorated.

Hotel Hero Documentation

The responsible employee moves towards to the desk and switches on the Hotel Hero web application. He or she sign in to “Slip and Fall” in the “Lobby” for guest “Lea Broose”.

Mechanically, Hotel Hero sends sms to the General Manager as well as sends e-mail to the company attorney regarding the occasion. Hotel Hero cause the front desk manager to publish the company *INCIDENT_REPORT* and prompt him or her to take a picture. The front desk manager diffuse the instant report and track one’s firm protocol for filling it. The instant report is recorded and joined in Hotel Hero. By a digit way they are stored. The front desk manager utilizes the Hotel Hero application on his or her phone to join pictures of the scene regarding the instant. He or she confirms to take a photo depicting the yellow caution wet floor sign. The instant depicts are joined in Hotel Hero to the alike file.

6 Months Later one’s corporate office is declared of a coming lawsuit concerning “Lea Broose”. The hotel General Manager checks the instant, downloads the instant review as well as every saved picture. Finally it is sent to the attorney working for the hotel. Therefore, Hotel Hero is able to sustain one’s belongings by providing the documentation one might necessity to assert his or her firm from false claims.”

Hotel Heros notifies the way of depicting the management team that rooms deals with the most problems, who employees are appeared to be most dynamic, and which rooms need more care. The reviews permit the General Manager to emphasize where care is needed most.

The application logs hotel topics, informs staff members, follows response times, producing sufficient reports, clarifying hotel procedures, permits remote data collection, saves photos for future reports.

Hotel Hero diminishes guest topics, multiply guest pleasure, and moderates guest recovery losses.

Maintenance Connection

Maintenance Connection offers *Enterprise Web-Based Maintenance Management Software* (or Web-Based CMMS¹⁴ Software) for firms having the need of an Equipment Maintenance Software, Work Order Software, Building Maintenance Software Facility Maintenance Software, Facility Management Software, Asset Management Software, Manufacturing Maintenance Software, Hospital Maintenance Software, School Maintenance Software, or Government Maintenance Software. Features of Maintenance Connection's Web-Based CMMS Software include Work Order Tracking, Preventive Maintenance, Asset Management, Asset Tracking, Built-in Maintenance Procedure Libraries, Inventory Tracking, Purchasing, Maintenance Scheduling, Service Requests, and a comprehensive Report Writer - all accessible by easily with a web browser.



FIGURE 1.6: MAINTENANCE CONNECTION -COMPANY'S LOGO

¹⁴ http://www.maintenanceconnection.com/mcv18/online/mc_services.htm

Maintenance Connection is the technology leader of Web-Based CMMS Software, EAM Software, and MRO Software solutions for firms all over the world. Maintenance Connection's maintenance software solutions are accessible both by the online hosted CMMS solutions or onsite CMMS solutions allowing firms to boost the level of life, follow maintenance expenses, hinder and forecast failure matters, illuminate labor efficiency, degrade expensive equipment downtimes, diminishing funding in inventory, and reduce the whole expenses of maintenance.

Promoting a contraceptive maintenance software along with following asset task order record will altering a maintenance sector from a reactive manner into a programmed / preventive manner and Maintenance Connection's browser-based maintenance software is the foundation for this transition.

Maintenance Connection's Computerized Maintenance Management System & Enterprise Asset Management Software can simply be interfaced to 3rd party systems like ERP software, GIS and SCADA systems, and Computer Aided Facility Management Software.

Moreover, Maintenance Connection's characteristics lavish services for maintenance experts are revolutionizing the manner of maintenance is achieved. The particular blend of technology and customized service is a crucial element of client satisfaction. The concern to service is obvious in the employees being hired, the program that is developed and the how is the interaction with the clients. [13]

In addition, offers a full-characteristics *maintenance management system* solution which works totally inside one's Internet browser, without utilizing Java applets¹⁵, Active-X objects¹⁶, plug-ins¹⁷ or restrictive code running on one's computer. That permits to one person to set up and run the program simply, without the need to install something on the client computers. One can convene on what one does better than having the need to persevere maintenance software. Employees, contractors, requesters and management

¹⁵ http://en.wikipedia.org/wiki/Java_applet

¹⁶ [http://msdn.microsoft.com/en-us/library/windows/desktop/ms221401\(v=vs.85\).aspx](http://msdn.microsoft.com/en-us/library/windows/desktop/ms221401(v=vs.85).aspx)

¹⁷ <http://en.wikipedia.org/wiki/Plug-in>

are able to enter the Maintenance Connection from every place that they are utilizing a browser. Firms with many sites can simply keep their maintenance reports in just one place. [13]

1.9 Conclusion of the Chapter

To sum up, the current chapter presented some representative existing systems similar to the one that is going to be developed for the Hotel Resort Porto Carras. The aim was to present a short, concise and well documented survey of the overall field. The advantages, the disadvantages of the intended implemented tech. In the next chapter there will be a description of the problems/shortcomings of the existing approaches as well as the objective of developing such a web-based system for the Hotel Resort and the innovative part in comparison to the already similar used systems.

Chapter 2

In Chapter 2, it is being presented issues regarding the development of the system. More specifically, it is being described in detail the steps of deploying an intelligent maintenance management system similar to the one of Porto Carras Hotel Resort. In precise, there is a presentation of the aim developing the intelligent maintenance management system, the analysis that needed, the strategies for determining information requirements, the design of the system, the implementation as well as the maintenance of the developed system.

2.1 Aim

This work makes up a knowledge production in the scheme of the progress of a study work. The framework and the implementation of an Information System for Management in the Hotel industry. It is generally accepted the fact that when one thing collapses, when something breaks or lacks of repair, guests are bother which mirror not affirmatively in the entirely firm. For hotel industry is it crucial to offer advance services not only to their customers but to their collaborators. An intelligent maintenance management system is essential for every hotel company in order to be able to manage in the most highly evolved all the procedures of every tasks. For the particular case of Porto Carras such a system was missing and this is what the author of the current dissertation was assigned to do as part of her studies in IHU.

2.2 Analysis

In the world of business, System Analysis and Design relates the process of testing a business circumstances with the firm of upgrading it through better processes and techniques. System study and design associated with representing firms, upgrading

performance and accomplishing goals for profitability and growth. The stress relies on systems in action, the associations among subsystems and their supplement to meeting a mutual objective. [6]

Firms are complicated systems that includes for interconnected and interlocking subsystems. Modifications in one component of the system have both predictable and unpredictable outcomes in other components of the system. The systems agreement is a mode of considering the study and scheme of computer based app. It offers a settings for visualizing the managerial and environmental factors that run on a software. When a machine is suggested into an firm, some services works properly while others not so properly both on the user's machine and on the firm. Among the positive outcome is rectify the performance while it gives a feeling of accomplishment with useful information. Among the unexpected outcome, it could be a feasible concern to employees task, a diminished morale of staff owing to the fact that the back of association and a feeling of constraint by users because of computer illiteracy. The inquisitor's role is to eliminate fears like those and turn the system to become a success. [6]

System analysis and design give emphasis on systems, procedures and technology. Systems development might nearly be considered as having two primary factors:

- ❖ Systems analysis
- ❖ Systems design

System design is referring to the procedure of designing a new business system or one to substitute or fill out the one that is already operating. Nonetheless, ahead of this design, it should be utterly comprehend the existing system and decide about the way that machines could best be utilized in order to turn its offered service to be more operative. System analysis, therewith, is the procedure of collecting and clarifying occurrences, identifying obstacles, and utilizing the information to suggest improvements to the system. This is the task of the systems analyst. [6]

It should also be mentioned that systems analysts perform more than resolving existing problems. Those people are regularly charged to support the designed augmentation of a business or part of a business. In our case of the intelligent maintenance management system, the systems study is future oriented, since no system currently exists. Analysts estimate as thoughtfully as possible the prospective inadequate and needs of the business as well as the modifications that should be taken place to satisfy these inadequate and needs. In this instance, and in most others, analysts might suggest modifications for improving the condition. In general more than one strategy is workable. [6]

Co-operating with managers and employees in the firm, systems analysts suggest which modification should be adopted, regarding the worries as the applicability of the solution to the specific firm and environment. Occasionally, the time needed to develop one option, in comparison to others, is the most crucial matter. Expenses and profits are significant factors, as well. In conclusion, management, that will compensate and utilize the outcome, precisely determine which option to concede. [6]

Heretofore this determination is done, a formula is made to accomplish the approval. The formula contains all systems design characteristics, like recent data capture demands, file specifications, operating process, equipment and personnel demands. The systems design match with the drawing for a building: it distinguish all the characteristics that are to be part of the finished release. [6]

Designs for an intelligent maintenance management system will offer means to captivate data about damages and repairs. Mentioned by customers or staff or distinguish the modes with which data will be stored, either on paper forms or on a computer- based way on readable mean, such as magnetic tape or disk. The designs will allocate tasks to be accomplished both by people and computers. Designs differ on their portion of human and computer tasks. [6]

The staff will necessity information about the business, as well. Every design summarize amount to be produced by the system, like inventory reports, sales studies, purchasing synopsis, and accounting. In fact, the systems analysts determine which amount will be used and the way with which they will be produced. [6]

Analysis identifies what the delivered product should do. Design declare the way by which to achieve the goals. Notice that every procedure declared contains humans. Managers and employees hold good notions regarding what operates and what does not, regarding what runs effortless and what creates obstacles, regarding where modifications should take place and where it is not, and particularly regarding where modification will be approved and where it will not. Although technology, human still constitute the main factor that will turn the firm to run properly. Therefore, communication and dealing with human being is crucial for the system analyst's job. [6]

Finally, it should be kept in mind that before one can design a system to capture data, update files, and produce reports, one needs to know more about the store operations. More precisely, what forms are being used to store information manually, such as requisitions, purchase orders, and invoices and what reports are being produced and how they are being used. [6]

2.3 Management Information Systems (MIS)

The computer has had a crucial influence on the approaches being utilized by management to run a business. The role of the manager in the firm is a factor in deciding the sort of information needed to overcome an obstacle is crucial, as well. Lower-level management necessity elaborated internal data to provide day to day, related basic control decisions. Higher-level management, for whom long-range goals are the principal consideration, request outlined information from a diversity of references to overcome obstacles. In every condition, management action is grounded to information that is precise, related, fulfilled, compact, and prompt. MIS has been proved to be a success, satisfying the above information criteria rapidly and responsively. [6]

MIS is a human being, machine system and a remarkably grouping of information processing operations designed to offer management with an inclusive representation of particular functions. It is precisely a mix of information systems. In order to complete the task, it should run in real time, dealing requests as directly as they are accepted. Management information should be accessibly promptly fairly to influence a decision, as well. Operationally, MIS must offer for file definition, file maintenance and updating, transaction and interrogation processing and one or more databases connected to an organizational database. Within a MIS, a sole transaction can concurrently refresh all relevant files in the system. In doing so, data redundancy as well as the time it takes to remake data are being maintained to a minimal, therefore guarantee that data are being maintained current at all times. [6]

A fundamental component of MIS is the database, a non-redundant aggregation of complementary data units that might be handled via an app software and accessible to several users. All records might be relevant in a manner. Exchanging mutual data implying that several software might make use of same files or records. Information is available via a Data Base Management System (DBMS). It is a component of the program that deals practically every activity containing the real database. [6]

The system analyst provides a system process project meaning and direction. A candidate software is appealed after the analyst has a comprehension of user demands and obstacles. A workable solution is running and therefore connects with the same. Candidate systems regularly cut across the limit of users in the firm. To ensure that every user's needs are satisfied, an activity from that depicts every user runs the study in order to perform a system development activity. [6]

Analysis is an elaborate study of several functions running by a system and their associations within and outside of the system. A fundamental inquire is, what should be made in order to overcome an obstacle. One point of view is that analysis outlines the boundaries of the system and decides either a possible system should take into consideration other relevant systems or not. While analysis is occurring, data are

selected from accessible files, decision points, and transactions dealing by the current system.

Data flow diagrams interviews, surveillance, and question forms represent instances of analysis tools. The interviews is a frequently utilized tool in analysis, it request particular tasks and irritability to the subjects being interviewed. Bias in data selection and explanation could turn to be obstacle. Training, experience, and regular sense are requested for selection of the information needed to prompt the analysis. Heretofore, analysis is accomplished the analyst has a firm comprehensive of what should be occurred. The following movement is to determine the way of the obstacle might be overcome. Therefore, in systems, design proceed from logical to physical view of the life cycle. [6]

The first movement in the system development life cycle represent the classification of a need. This is a user's require to modify, rectify or boost a current system. Due to probably to be a stream of such requires, typical process should be demonstrate to deal with them. The goal of project choice is to decide about a suggestion and an approach to do or not to do anything, rectify or adjust the current system or develop a new one.

The user require distinguish the necessity for modification and license the primary survey. It might tolerate certain changes prior it turns to be the last one. The achievement of a system depends chiefly on the way efficiently a problem is outlined. The user's requires should be connected whether the firm's staff and other resources are to be favorably enlisted to develop and sustain a feasible information system scheme. [6]

2.4 Strategies for Determining Information Requirements

There are three basic methods or general approaches for extracting material concerning the user's requirements: (1) inquiring, (2) obtaining information from the current information system, and (3) modeling. As far as the inquiring is concerned, it is refereeing to a method getting information from users by easily inquiring them regarding the requirements. It is supposed to be a reliable system where users are well acquainted and are able to overwhelm biases in determining their problems. There are three basic inquiring approaches: [6]

1. Questions might be open-ended or closed.
 - ❖ An open-ended question permits the respondent to compose a reply. It is utilized when feeling or assumption are considerable. For instance, "How does one assess the recent addition to one's hardware?"
 - ❖ In the contrary, a closed question inquires one reply from a particular set or replies. It is utilized when accurate replies are known. For instance, "How long has one been manager of the computer centre?"
2. Brainstorming is an approach utilized for expressing fresh points of view and getting common information requirements. This approach is a technique to brainstorming requires every participant to determine the best solutions and then choose the ideal practicably one. It runs properly for users who have system knowledge, however, present obstacles accepting new points of view.
3. Group consensus requires participants for their prospects concerning particular variables. In a Delphi inquiry¹⁸, for instance, every participant answers a questionnaire. The results are outlined and provided to participants with a follow-up questionnaire. Participants are requested to modify their replies. The finding is one more outlined and fed back to the participants. This process by questionnaire goes on till the participants' replies have assembled abundantly. This approach is

¹⁸ <http://www.delphibasics.co.uk/>

a superiority over brainstorming in that participants are not dominated to psychological stress from others with presumed authority or influence. [6]

2.5 Design

A more productive and ambitious phase of the system life cycle is the one called system design. The term design is referring to an ultimate system and the procedure with which it is created. It concerns the technical specifications (equivalent to the engineer's outlined) that will be used in implementing the candidate system. In addition to this, it contains the structuring of programs and program testing. The basic quest at this point is: How should the obstacle be overcome. The significant movements in design are pictured in Figure 2.1.

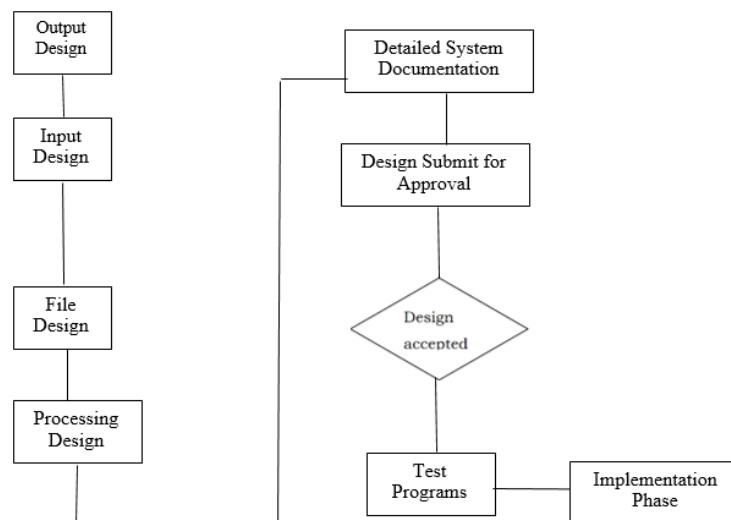


FIGURE 2.1: STEPS IN SYSTEMS DESIGN

The first movement is to decide the way with which the output is to be contrived and in what format. Examples of the output as well as the input are also displayed. Secondly, the input data and master files (in this case the database) have to be designed so as to cover all the requirements of the suggested output. The operational, meaning the processing steps are dealt via program construction and testing containing a list of the programs needed to confront with the system's goals and conclude documentation. The

final movement, details referring to the justification of the system and an assessment of the influence of the candidate system on the user and the firm are documented and review by management as a phase towards implementation. [6]

The final report before the implementation step contains procedural flowcharts, record layouts, report layouts, and a workable plan for implementing the candidate system. Information on staff, economic factors, hardware, amenities, and their-estimated cost should be accessible, as well. At this point, projected costs should be almost precise to real costs of implementation. [6] For the case of Porto Carras, this is of no importance because of the fact that the implementation of the system is part of the author's Postgraduate studies.

In several organizations, individual groups of programmers do the programming, while other organizations take on analyst- programmers who do analysis and design and the code programs. For this discussion, it is assumed that two individual man perform the analysis and the programming. There are several services, nevertheless, the analyst should accomplish during programs are being generated. Operating process should be generated, as well. [6]

2.6 Implementation

The implementation step is as productive as the system design is. It is basically referring to user training site preparation, and file conversion. By the time the candidate system is connected to terminals or remote sites, the telecommunication network and tests of the network with the system are contained under implementation, likewise. [6]

While the last tests are taking place, user approval is also tested, followed by user training. Based on the *character* of the system, commodius user training might be needed. Conversion often occurs around the same time the user is being trained or even in a later period. In the extreme, the programmer is secretly being behaved as someone who has to be aggregate from other factors of the system development. Programming is, nonetheless a design work. The original criterions of the candidate system ought to change as a consequence of programming attempts. Programming offers an "actual test"

for the suppositions expressed by the analyst. It is not hence correctly to eliminate programmers from the primary system design. [6]

2.7 Implementation and Maintenance

Following the installation step the personal is applied to the modifications formed by the candidate system, evaluation and maintenance starts. Such as every system there is an aging procedure that inquires repeated maintenance both hardware and software. If fresh and modish information is changeable with the design specifications, the modification is occurred. Furthermore, hardware inquires recurrent maintenance to follow the design specifications. The weight of maintenance is to go on to deliver the new system to covering all the standards. [6]

User priorities, modifications in firm requirements, or environmental factors call for system furtherance, as well. To contrast maintenance with furtherance, assume a bank system. More precisely, if a bank determined to extend its functions charges on reviewing accounts from Rs 3.00 to Rs 4.50 for a minimum balance of Rs 300, it is maintenance. Nonetheless, if the same bank decided to create a personal loan on negative balances when customers overdraw their account, it is enhancement. This change inquires evaluation program changes, and additional tests. [6]

2.8 Conclusion of the Chapter

To sum up, system analysis and design are key factors for the System Development Life Cycle (SDLC). The stages are project selection, feasibility, analysis, design, implementation, and post implementation stages. The idea for the project is originates in the environment or from within the organization. Once the problem is verified an initial investigation is conducted to determine whether change is feasible. If the answer is yes, a feasibility study is conducted. Analysis is a detailed study of the various operation performed by a system. System design refers to the technical specifications that will be applied in implementing the candidate system. Implementation is concerned with details of the candidate system. After implementation, maintenance begins includes

enhancements, modifications, or any changes from the original specifications. To ensure the success of the system, careful and often extensive planning is required. The overall management process is crucial to the successful completion of system.

In the following chapter, there will be a detail description of the system developed in terms of the author's studies in IHU¹⁹.

¹⁹ <http://www.ihu.edu.gr/>

CHAPTER 3

In the previous Chapter the basic concepts were analyzed for the analysis, design, implementation as well as the maintenance procedure of an intelligent maintenance management system. Throughout the current Chapter, it is being presented specifically and in detail the phases focusing on the dissertation's system including the intending innovative part of the current system, as well.

The project is centralized in the app of an information system with the utilization of computer and mobile application technology in the hotel industry. In particular, an intelligent maintenance management system is being developed for the hotel resort Porto Carras in order to record, manage and inform the corresponding responsible about potential damages and impairments inside the hotel resort.

The developed web-based application is addressed to the personal of the hotel resort Porto Carras. The application's name is "Malfunctions". The choice of name was based on the contents of the application and the aim of developing the software.

The software application was developed from scratch by the author of the dissertation. In particular, the author of the in question dissertation designed all the graphics of the application. Moreover, the author was also responsible for the analysis, the design and the implementation of the software application. The menu of the application, which is described in the followings paragraphs, is carefully built up in order to be easily accessible by all people no matter how familiar are with technology and computer machines. The software application "Malfunctions" needed about three months to be developed, including the study made.

The software application is supported by both Microsoft Windows and Linux operating system. In addition to this, the app is also accessible by smart phones and tablets machines.

3.1 Porto Carras Grand Resort

To begin with, Porto Carras (Porto Carras Grand Resort) is a hotel complex situated in Sithonia Halkidiki, Northern Greece. Located approximately 120 kilometers south-east of Thessaloniki. The complex includes three renovated luxury, honey, Sithonia and the Village Inn. Porto Carras contains the largest private marina in Northern Greece and one of the largest in the Balkans, golf, basketball, football, horse riding and the largest Spa of eastern Europe. Approximately three kilometers is the popular tourist coastal town of Neos Marmaras.



FIGURE 3.1: PORTO CARRAS GRAND RESORT

Built in the 1970s by the owner John Carras. The study was originally made by the architect Walter Gropius, who however died in 1969. In June 2003 the hotel hosted the Summit of the European Union that presented the draft EU Constitution. During the Summit hotel besieged by thousands of protesters against the European Union, with relatively serious incidents around the area. In 2004 part of the estate "Porto Carras" a landmark political scandal in response to trading houses and engage members of the

region. Every year while sailing races every summer takes place the namesake festival crowd with artistic events. [14]

Finally, the hotel complex is gated and only guests of the hotel. Considered the largest complex of its kind in the Balkans, with the largest SPA center for thalassotherapy. It consists of three hotels and a villa and has a marina for 315 yachts, private 9 km beach and golf course. Guests can also benefit from the Convention Center for 2,300 people, casino, horseback riding, theater, cinema, shopping mall, kids cartoons and a small train rounds the band. There are water sports, scuba diving lessons, yachts, tennis, football, volleyball, table tennis, gym, mountain bike rental. [15]

3.2 Plan Definition

The plan definition begins from representing the issue that needs to be solved, as an innovation need with technology implementation as competitive advantage in the hotel industry. Below, certain queries are cited that needs to be answered in an optimal manner:

- ❖ Which is the current state of the Hotel Enterprise, “Porto Carras” and what are the problems to be dealt in the future within a higher performance sustainability framework?
- ❖ How to deal with the higher performance maintenance sustainability strategy, to accomplish competitive advantage in the local and regional framework, implementing an information system with computer and mobile application technology?
- ❖ What are the benefits of the plan?

With the goals that have been suggested, the following were aimed at:

- ❖ To develop a database and computerized system for the accomplishment of competitive advantages within the framework of a sustainable exceptional enterprises in the hotel industry services field.
- ❖ To accomplish distinction in comparison to other competitors.

- ❖ To utilize the computerized database system as tool for optimizing the firm management.
- ❖ To viscerally run the enterprise in a more effective and productive manner.

The development sets off from of an intra and extra managerial diagnostic, determining the goals and the particular practices for their accomplishment. [5]

The technique planning of information systems, at the current contains the implementation of systems with critical influence in the business. The business rely on well pattern to information technology, owing to three significant factors for their execution: [16]

- ❖ To accomplish distinction to other competitors.
- ❖ As a marketing tool.
- ❖ To internally run the business in a more effective and productive manner.

This project search for the app of an information system, utilizing computer and mobile technology centralized in the hotel industry.

3.3 Information Systems Strategic Planning As a Model for Hotel Industry Management

In the first place, the information deals with the received data, their significance and knowledge is the practice that is produced with that information. [17] In that way, the information is examined as an unsubstantial benefit. This is because of the fact that with the particular information one is able to generate knowledge for the sustainable and distinction progress of the firm.

In every sense, it is crucial to bear in mind Tañski's ideas, who suggested that, “the companies of hotel field will be able to survive in competitive times, using the technological innovation appropriately.” [19]

This information system deployment plan, is a phase of the strategic plan, and responds to the following logical outline (see FIGURE 3.2)

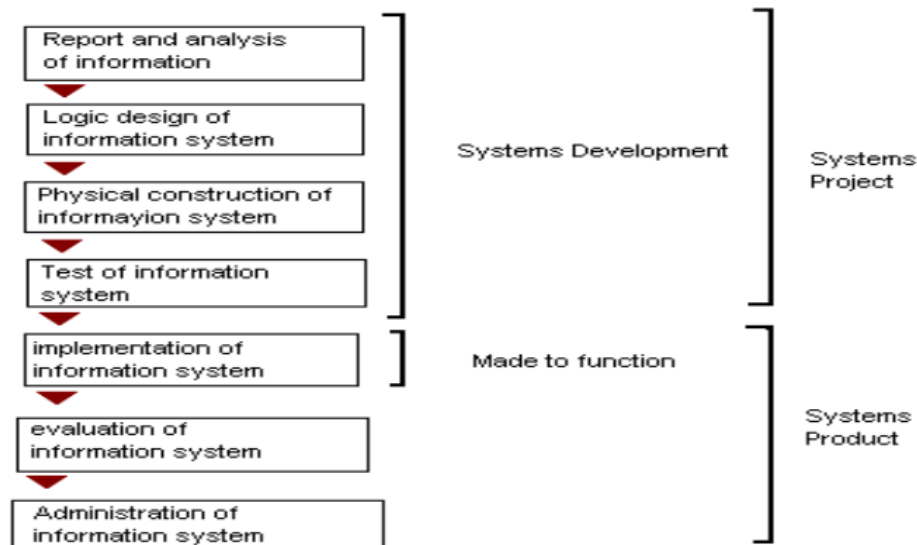


FIGURE 3.2: INFORMATION SYSTEM DEPLOYMENT PLAN

The development of the system forecast two essential stages: The development itself and the deliverable. The initial stage includes four phases:

1. Study of information system: It deals with the database that is produced as from the procedures in the production of hotel industry functions.
2. Rational design of the information system: It contains the engineering of the system.
3. Physical implementation of the information system: It is the project of structuring the software that turns to be the tailor-made system.
4. Information system test. The starting up in a testing manner, so as to be known that the system's produced outcome, and to discover possible faults.

The second stage contains the deliverable itself and it consists of three phases:

1. Employing the system: Software pragmatic implementation.
2. Information system assessment: Study of the outcome produced by the system.
3. Information system administration: The utilization of the data provided by the system as an immaterial resource for the firm administration.

In order for the system to be implemented, a former well-based analysis of the situation needed to be studied and developed. By means of an internal and external identification to the firm, to demonstrate the comparative and competitive advantages by dint of the incorporation of the computer and mobile app tech and its involvement.

3.4 Computer Technology and Information Systems for the Management of Hotel Industry

The use of computer technology in the companies is based on the necessity of innovating on the traditional systems of development of production processes. The mega tendencies as regards computer technology and information system refer to the development of products, services technology and methodologies that influence everything, and will model the future of the information processing [18]

In relationship to the implementation of computer technology in services development, in the hotel management industry, it is worthwhile to keep in mind Lardent's contributions that makes reference to the current requirements (and future ones) for its users, among which are mentioned, the following necessities:

- ❖ To be able to access to the data from any place of the enterprise.
- ❖ To integrate the data which are dispersed in different applications and systems and to develop a multidimensional vision of them.
- ❖ To trust the integrity of the data with which one is operating.
- ❖ To avoid the unnecessary duplication of resources.
- ❖ To have the possibility of applications portability.

Without forgetting the disadvantages offered by the use of computer science, as for example the necessity to depend on a computer team, or the vulnerability of the data, when being connected to Internet. In addition to this, there is always the possibility of being used by other people. Nonetheless, using this type of technology is justified fully:

- ❖ To support the process of decision making, opportune and right.
- ❖ To fundamentally change the form in which business operations are executed; to facilitate the management "by processes" and not "by functions."
- ❖ To reduce the processing costs, communication, storage and development of applications.
- ❖ To facilitate to achieve greater productivity to the user.
- ❖ To facilitate the reach to a greater organization effectiveness.

3.5 Analysis for Porto Carras

As it has already stated in the previous paragraphs analysis defines the boundaries of the system and determines if a system should consider other associated systems or not. In order to accomplish this, interviews from the managers of every departments, and the personal in general were taken. This step was necessary in order to define the decision points the way that hotel staff wanted to operate the system. The interviews was a regularly used tool during the analysis phase. In addition to this, the training, experience, and typical sense were inquired so as to select the essential information to prompt the analysis phase. The analysis stage is crucial because during this phase possible problems might be uncover that need possible suggestion to overcome any obstacle that might come up. Hence, in systems, design pass on from logical to physical view of the system life cycle. [6]

For the developed system there were no previous system so there was no need to interview the user about the ways of modifying, rectifying or boosting an already existing system. The objective of the project was to introduce an approach, a system, that will manipulate any malfunction occurred inside the zone of the hotel.

More or less up to this point the phase of the analysis including the gathering of information requirements and the summary regarding the extent of the system, like inventory reports, purchasing synopsis etc is finish. Then, the systems analysts determine which amount will be used and the way with which they will be produced and the phase of design comes into view.

3.6 Design

The current paragraph presents the way in which the system is suggested to operate. Below it is displaying the UML²⁰ diagrams regarding the tasks that the Hotel Employee is able to perform. In addition to this, there is a definite and extensive description of every task (see FIGURE 3.3).

²⁰ http://en.wikipedia.org/wiki/Unified_Modeling_Language

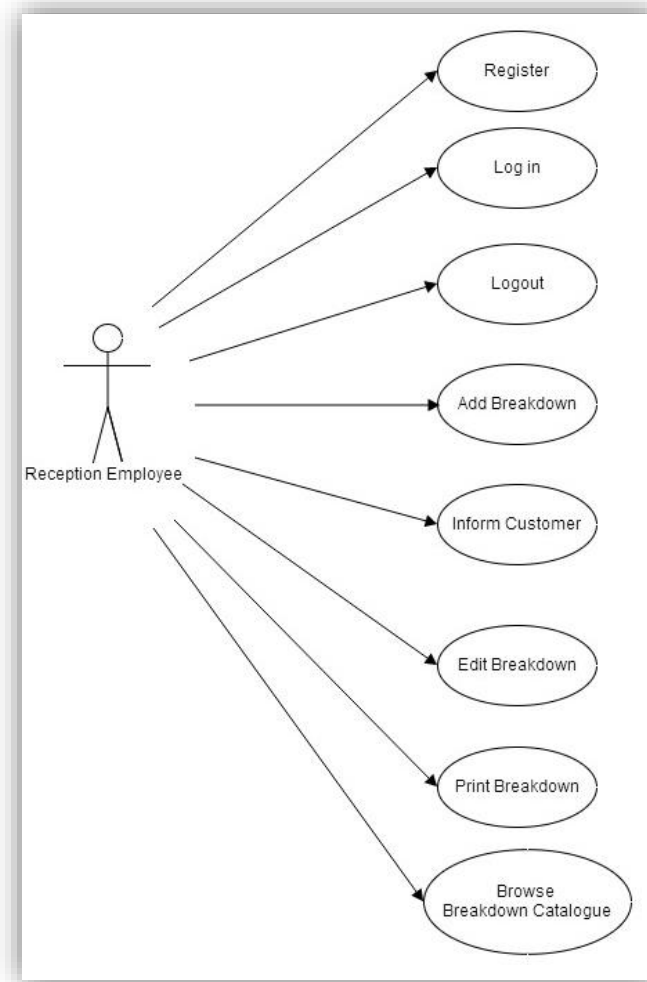


FIGURE 3.3: USE CASES

Title: Register

Short description: The user register himself/herself to the system

Actors Involved:

Primary actors: User, System

Secondary actors: -

Primary flow:

1. The user enters the system.
2. The system requests the username.
3. The user enters the username.
4. The system requests the password.

5. The user enters the password.
6. The system requests to re-enter the password.
7. The user re-enters the password.
8. The system requests the user's mail.
9. The user enters his/her mail.
6. The system verifies the user's identity and welcomes him/her with an appropriate message..

Secondary Flow:

1. In Step 6, the system checks the entered username and password with those saved in the users' list (i.e. in which are stored the registered user accounts). If the verification fails (no registration with this username and password) the system displays an error message.
2. The user returns to Step 2.

Pre-condition:

1. The user should have an account to login.
2. The application is online.

Post-condition:

1. The application displays the appropriate initial interface of the user.

Title: Login

Short description: The user enters the system after a validation/checked process have taken place verifying the identity of the user.

Actors Involved:

Primary actors: User, System

Secondary actors: -

Primary flow:

1. The user enters the system.
2. The system requests the username.
3. The user enters the username.
4. The system requests the password.
5. The user enters the password.

6. The system verifies the user's identity and welcomes him/her with an appropriate message..

Secondary Flow:

1. In Step 6, the system checks the entered username and password with those saved in the users' list (i.e. in which are stored the registered user accounts). If the verification fails (no registration with this username and password) the system displays an error message.
2. The user returns to Step 2.

Pre-condition:

1. The user should have an account to login.
2. The application is online.

Post-condition:

The application displays the appropriate initial interface of the user.

Title: Logout

Short description: The logged in user regardless of the type exits the system.

Actors Involved:

Primary actors: User, System

Secondary actors: -

Primary flow:

1. The user selects the option Sign out.
2. The system displays a confirmation message.
3. The user confirms his/her choice.
4. The system displays a goodbye message.
5. The user exits the system.

Secondary flow:

In Step 3, if the user does not confirm his/her choice the system will return to his/her initial interface.

Pre-conditions:

1. The user has logged in.
2. The current interface has the option Exit.

Post-condition:

Ends the session of the user.

Title: Add Breakdown

Short description: The user insert a new breakdown.

Actors Involved:

Primary actors: User, System

Secondary actors: -

Primary flow:

1. The system requests from the user to insert the new breakdown.
2. The administrator inserts the new breakdown.
3. The system requests from the user to insert the department where the breakdown took place.
4. The administrator insert the department.
5. The system requests from the user to clarify/define/specify the department that needs to be notified about the breakdown :
 - a. Plumper Department
 - b. Electrician Department
 - c. Manager Department
6. User chooses the type for the department.
7. The system confirms that the proper department is successful notified and presents a unique breakdown id.
8. The user returns to his/her initial interface.

Secondary flow:

- 1.1 In Step 6 the system checks if the department is one of the options.
- 1.2 If not so, the system presents an error message.
- 1.3. The administrator returns to Step 5.

Pre-condition:

1. The application is online.
2. The user has logged in.
3. The administrator has selected the appropriate menu choice (Add Breakdown).

Post-condition:

1. The creation of a new breakdown is saved in the breakdown list.
2. The system returns the user to the initial interface.

Title: Inform Customer

Short description: The user informs the Customer about the process of the breakdown.

Actors Involved:

Primary actors: User, Customer, System

Secondary actors: -

Primary flow:

1. The system requests from the user to insert the unique breakdown id.
2. The user inserts the unique breakdown id.
3. The system presents the details of the specific breakdown as well as the field to contact with the Customer
4. User compose the appropriate message and press send.
5. The system confirms that the message was sent to the customer successfully.
6. The user returns to his/her initial interface.

Secondary flow:

- 1.1 In Step 6 the system checks if the unique breakdown id is correct.
- 1.2 If not so, the system presents an error message.
- 1.3. The user returns to Step 1.

Pre-condition:

1. The application is online.
2. The user has logged in.
3. The user has selected the appropriate menu choice (Inform Customer).

Post-condition:

1. The customer receives a message regarding the breakdown update.
2. The system returns the user to the initial interface.

Title: Edit Breakdown

Short description: The user is able to edit an already inserted breakdown.

Actors Involved:

Primary actors: User, System

Secondary actors: -

Primary flow:

1. The system request from the user to insert the unique breakdown id.
2. The user inserts the unique breakdown id.
3. The system request for the modifications to be made.
4. The user modifies the inserted info of the breakdown.
5. The system returns a message of successful modification.
6. The user returns to his/her initial interface.

Secondary flow:

1. In Step 2 the system checks if the unique breakdown id exists.
2. If the code entered does not exist the user returns to Step 1.

Pre-condition:

1. The application is online.
2. The user has logged in.
3. The user has selected the appropriate menu choice (Edit Breakdown).

Post-condition:

1. The modification of the selected breakdown was made.
2. The system returns the user to the interface of the user.

Title: Print Breakdown

Short description: The system displays the details of a selected breakdown.

Actors Involved:

Primary actors: User, System

Secondary actors: -

Primary flow:

1. The system request from the user to insert the unique breakdown id.
2. The user inserts the unique breakdown id.

3. The system displays the details regarding the breakdown.

Secondary flow:

1.1. In Step 1, if the order list is empty the system presents a message.

1.2. The user returns to his/her initial interface.

2.1. In Step 1, if the user inserted a no-existing breakdown id the system presents a message.

2.2. The user returns to his/her initial interface.

Pre-conditions:

1. The application is online.

2. The user has logged in.

3. The user has selected the appropriate menu choice (Print Pending Orders).

Post-conditions:

1. The system presents the details of the selected breakdown

2. The system returns the user to his/her initial interface.

Title: Browse Breakdown Catalogue

Short description: The user is able to see all the inserted breakdowns with their detailed description. Tasks that are of high attention are being highlighted. Moreover, tasks which might be highlighted are work duties, maintenance requirements that need approval, project requirements, preventive schedules, or inventory parts that might need reorder.

Actors Involved:

Primary actors: User, System

Secondary actors: -

Primary flow:

1. The system presents the breakdown list.

2. The user chooses a breakdown.

3. The system presents the details of the selected breakdown

Pre-condition:

The application is online.

1. The user has logged in.

2. The user has selected the appropriate menu choice (Browse Breakdown Catalogue).

Post-condition:

1. The system presents a more detailed description of the chosen breakdown.
2. The system returns the user to the initial customer's interface

3.7 Implementation

The software tools used for the development of the software is a group of software tools that are being presented below thoroughly:

- ❖ *Protégé-OWL ontology editor and knowledge-base environment.* Protégé is a free, open source editor for generating ontologies in a knowledge-based environment. The Protégé platform provides the ability to model ontologies using a web client or a desktop client. Protégé ontologies might be generated in a diversity of formats containing OWL, RDF(S), and XML Scheme. Protégé is based on Java, is extensible, and offer a plug-and-play framework that turns it to a adaptable base for apt prototyping and developing applications and software in general. For this particular case it was used the Protégé-OWL ontology editor version 3.5 (Build 663).
- ❖ *Sesame Workbench:* The Sesame Workbench appears bundled with the Sesame dispersal and permits people to run some basic tasks on Sesame repositories using a web browser. Those tasks are relating with the creation of repository, the addition of “vocabulary” to the repository, the modification of “vocabulary” in the vocabulary function, the removal of a repository of the removal of elements belonging to a repository etc.
- ❖ *Adobe Dreamweaver CS6:* Dreamweaver is a tool for web development produced by Adobe Systems. Dreamweaver was initially generated by Macromedia in 1997, and was persevered by them till Macromedia was acquired by Adobe Systems in 2005. It offers to web designers the knowledge and hands-on practice that they need to produce and manage professional web

sites. In particular, provides an intuitive visual interface for making and editing HTML websites and mobile apps. Dreamweaver utilizes new Fluid Grid Layout²¹ designed for cross-platform compatibility to develop adaptive layouts. Review designs with the enhanced Multiscreen Preview²² before publishing.
[24]

Regarding the programming languages PHP 5.5²³ HTML5²⁴ and CSS²⁵ was chosen for the way of manipulating the data as well as the way that data are presenting to users (interference). While for the request to the data was used mysql²⁶ and sparql²⁷. Finally, the developed deliverable can run both under Windows OS (OS: Operating System)²⁸, MAC OS²⁹ and LINUX³⁰.

3.7.1. Creating the Repository

The first thing that needed to be done was the repository. In order to generate the basics of the repository the Protégé-OWL ontology editor was used.

This is the initial screen appeared in Protégé-OWL ontology editor, where it is selected the option “Create new OWL ontology” (see FIGURE 3.5).

²¹ <http://www.adobe.com/inspire/2012/08/fluid-grid-layouts-dreamweaver-cs6.html>

²² http://help.adobe.com/en_US/dreamweaver/cs/using/WS5262178513756206-2a84b2e112a5608de1b-8000.html

²³ <http://en.wikipedia.org/wiki/PHP>

²⁴ <http://en.wikipedia.org/wiki/HTML>

²⁵ http://en.wikipedia.org/wiki/Cascading_Style_Sheets

²⁶ <http://en.wikipedia.org/wiki/MySQL>

²⁷ <http://en.wikipedia.org/wiki/SPARQL>

²⁸ <http://www.britannica.com/EBchecked/topic/645197/Windows-OS>

²⁹ http://en.wikipedia.org/wiki/Mac_OS

³⁰ <http://en.wikipedia.org/wiki/Linux>



FIGURE 3.5: CREATING A NEW OWL ONTOLOGY_1

This is the uri of the in question ontology.

<http://www.owl-ontologies.com/Ontology1374655143.owl>

Then, it was needed to create the classes. In order for this to be done, the *class tab* is selected. Every new class that is wanted to be created must be a subclass of the most general class *Thing*. (see FIGURE 3.6).

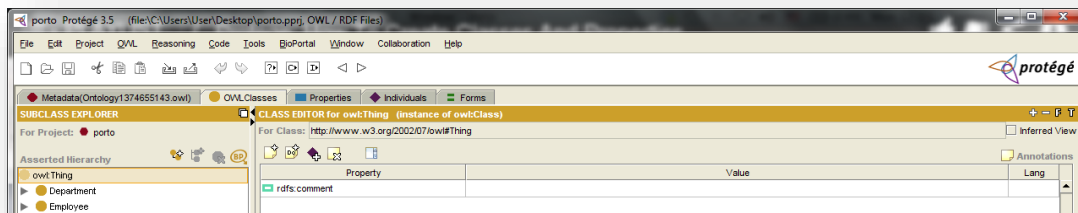


FIGURE 3.6: CREATING A NEW OWL ONTOLOGY_2

It should be stressed that every class created should always start with capital letter. For instance Employee.

Protégé gives the ability of inserting comments just by pressing the item (class, instance/individual, property etc. and adding annotation or comment (based on the OS of the using machine).

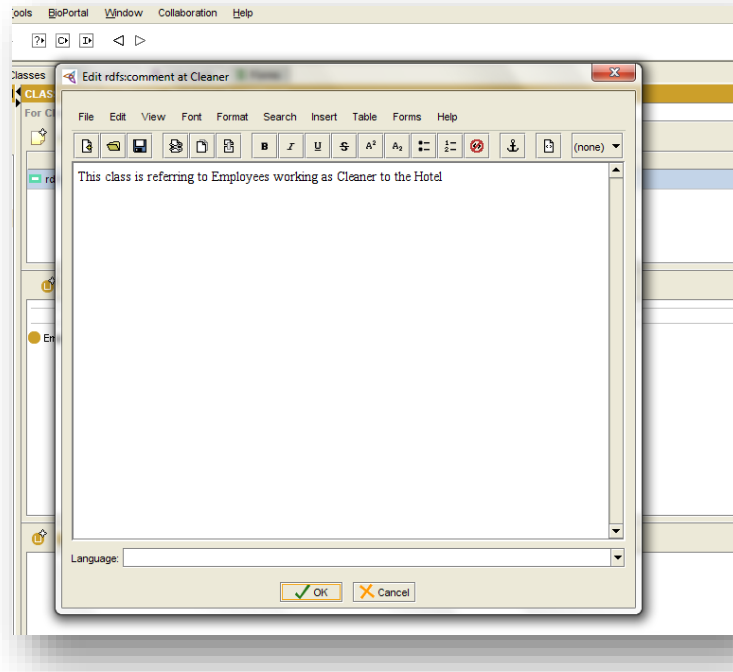


FIGURE 3.7: INSERTING COMMENTS

After creating all the necessary classes, the next step is to create the data properties. Just like in the previous step, there is a *topDataProperty*. Every data property being created will be a subproperty of the *topDataProperty* (see FIGURE 3.8).

For every data property it was needed to define basically, a domain (i.e. class) and the ranges of the specific data property (i.e. integer).

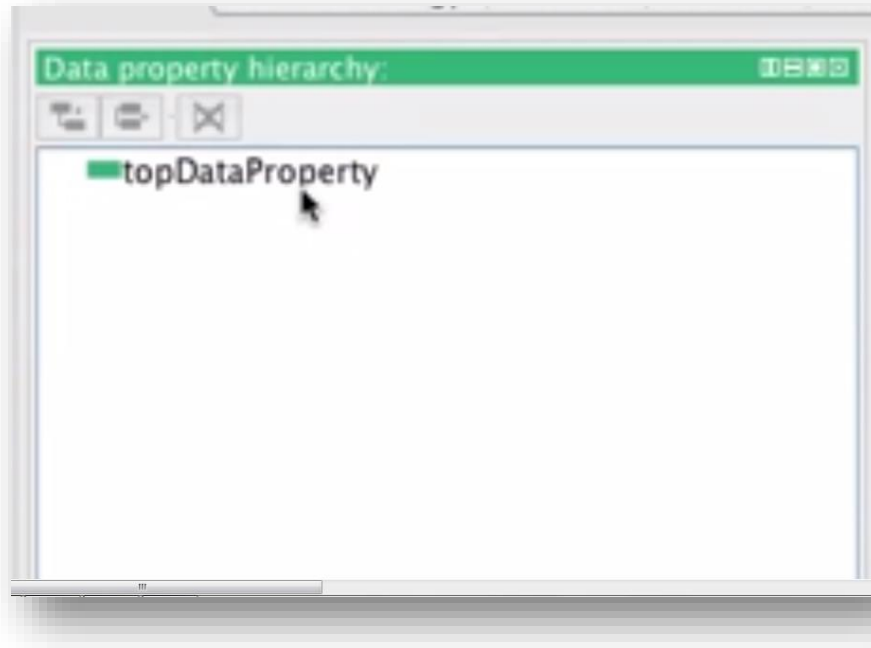


FIGURE 3.8: topDataProperty IN PROTÉGÉ

In addition to this, it had to define the object properties. Like previously, there is a *topObjectProperty*. Every new object property that is created, is a subproperty of the *topObjectProperty*.

Similarly, for every object property it was needed to define a domain (i.e. class) and the ranges of the specific object property (i.e. integer).

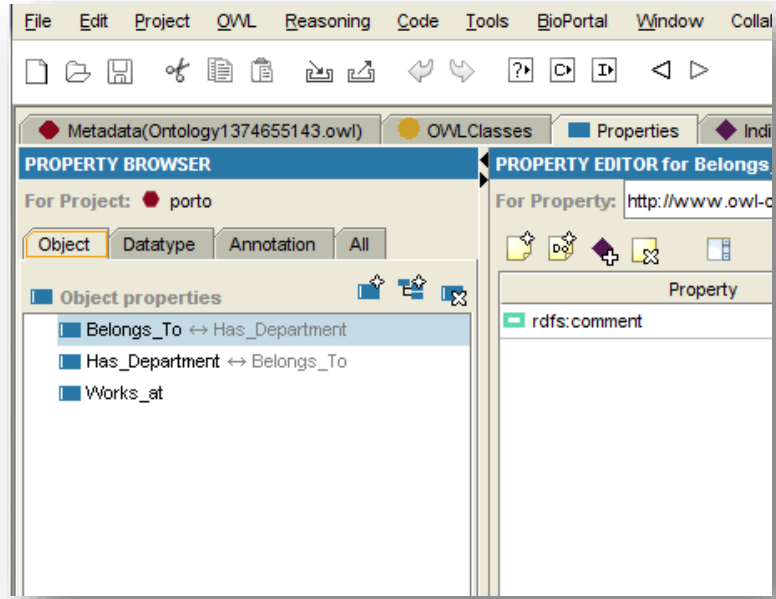


FIGURE 3.9: topObjectProperty IN PROTÉGÉ

Note that for everything created it is given the ability to the author to add comments.

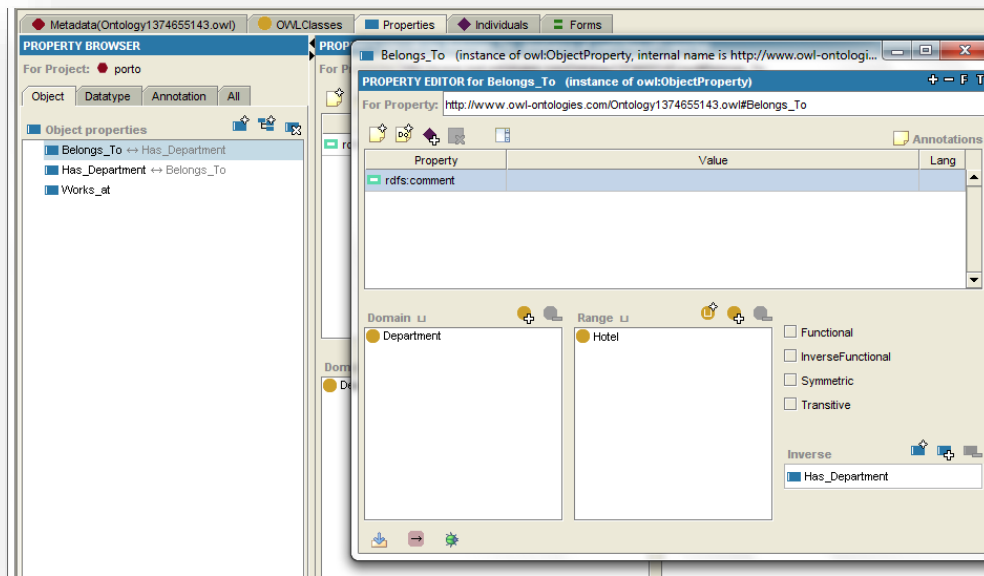


FIGURE 3.10: INSERTING COMMENTS IN PROTÉGÉ

In order to add individuals, it is selected the tab *individuals* and then *create instance* (after selecting the proper class that it is wanted the individual to be created) (see FIGURE 3.11).

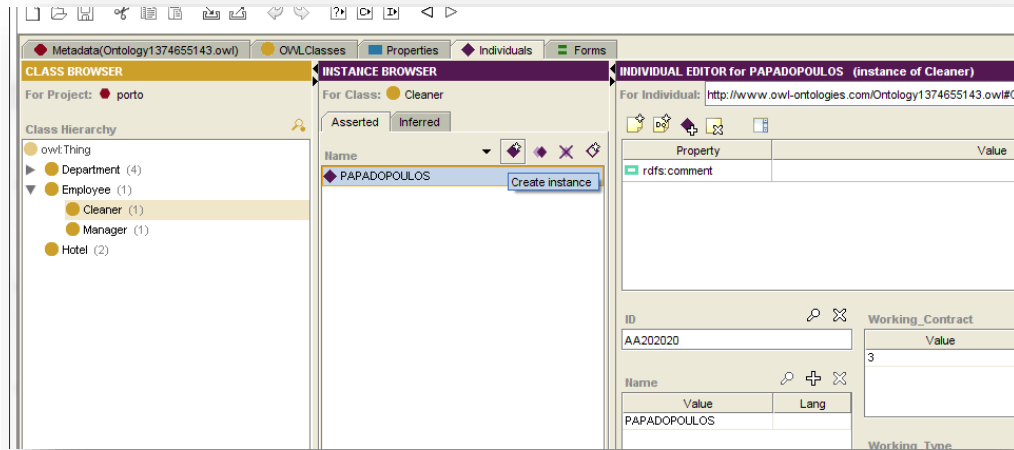


FIGURE 3.11: INSERTING COMMENTS TO INSTANCES IN PROTÉGÉ

For every individual it is offered the ability to define more details regarding the specific individual. Take for instance the *id* of the individual or the *working_contract*.

3.7.1. Uploading the Repository

After developing the basic scheme of the repository, it had to be uploaded to a server. For the purpose of the current dissertation it was used the *The Apache Software License, Version 2.0*³¹. Then, it was used the *Sesame Workbench* (described above) as the platform to manipulate the repositories and test sparql queries (see FIGURE 3.12).

³¹ <http://www.apache.org/licenses/LICENSE-2.0.html>

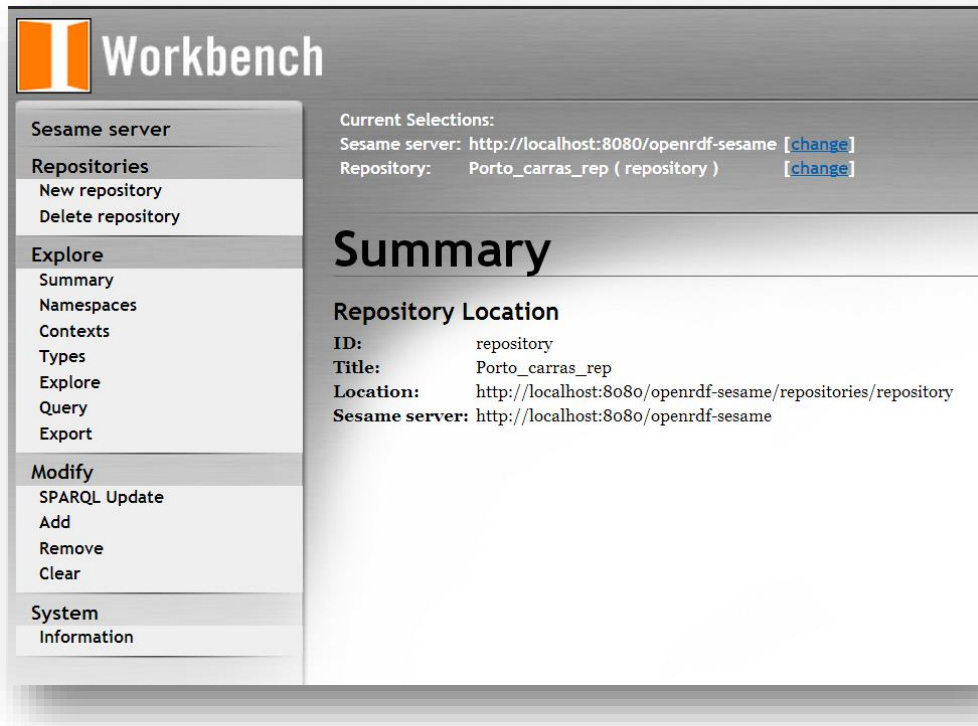


FIGURE 3.12: UPLOADING THE REPOSITORY IN WORKBENCH PLATFORM

In <http://localhost:8080/openrdf-workbench> one is able to manipulate and manage the uploaded repositories (i.e. ontologies) just like in traditional databases. In particular:

- ❖ The option *add* adds a new ontology (OWL file)
- ❖ In the option *explore*, one is able to browser inside of an ontology.
- ❖ The option *query* provides the ability of sending SPARQL testing one ontology.

Nonetheless, the bases of the developed software is web, hence a web-based programming language was used (i.e. PHP as mentioned in the previous paragraph).

3.7.1. Code Implementation

In this paragraph it is presenting some key parts of code written by the author of the dissertation concerning the implementation of the web-based software.

To begin with, firstly it was built the HTML/CSS skeleton. HTML and CSS are referring to the way that data is presenting to the user as well as the interference of the software.

Below, it is introducing a part of CSS (see FIGURE 3.13) that was used for the presentation of information to the users of the application software.

```
index.php x style.css x
1 body,td,th {
2   font-family: Verdana, Geneva, sans-serif;
3   font-size: 14px;
4   color: #003;
5 }
6
7 body {
8   background-image:url('White_Wallpaper_29.jpg');
9 }
10 a {
11   font-size:14px;
12   color: #003
13 }
14 a:link {
15   text-decoration:none;
16 }
17
18 a:visited {
19   text-decoration:none;
20   color: #003;
21 }
22 a:hover {
23   text-decoration:none;
24   color: #003;
25 }
26 a:active {
27   text-decoration:none;
28   color: #003;
29 }
```

FIGURE 3.13: CSS CODE FOR THE SOFTWARE APPLICATION

Beneath, it is showing part of implementation of the register use case (see FIGURE 3.14). In particular, it is presenting the form for inserting user data as well as the implementation submit button.

```

40     </p>
41     <-->
42     <p>
43     <label for="username" >Username : </label><br />
44     <input type="text" autofocus="on" id="username" name="username" />
45
46     </p>
47     <p>
48     <label for="password" >Password : </label><br />
49     <input type="password" name="password" />
50
51     </p>
52     <p>
53     <label for="password2" >retype Password : </label><br />
54     <input type="password" name="password2" />
55     </p>
56     <p>
57     <label for="user_email">Email : </label> <br />
58     <input type="text" name="email" />
59     </p>
60     <p>
61     <input type="submit" name="submit" value="Submit" /><br />
62     </p>
63     </fieldset>
64     </form>
65
66
67 </div>

```

FIGURE 3.14: PHP CODE FOR THE FORM OF USER REGISTER

While, the code below shows the register action that is needed in order to complete the registration process of a new user (FIGURE 3.15).

```

5
6 $username = $_POST['username'];
7 $password = $_POST['password'];
8 $password2 = $_POST['password2'];
9 $email = $_POST['email'];
10 if ($username&&$password&&$password2&&$email)
11 {
12     if ($password==$password2)
13     {
14         if (isset($_POST['submit']))
15         {
16             {
17                 $con = mysql_connect("mysql14.000webhost.com","a8447554_lipping","adonis24");
18                 if (!$con)
19                     die("Regards..Cannot connect: " .mysql_error());
20                 //selecting the table
21                 mysql_select_db("a8447554_lipping",$con);
22                 $sql="INSERT INTO members (username, password, email) VALUES ('".$username."', '".$password."', '".$
23
24                 mysql_query($sql,$con);
25
26                 mysql_close($con);
27
28                 $_SESSION['username']=$username;
29                 $_SESSION['logged_in']=TRUE;
30                 header("location: http://lipping.webuda.com/index.php");
31             }
32         }
33     }
34 }

```

FIGURE 3.15: CODE FOR THE USER REGISTER ACTION

The code in the next figure is referring to the logout use case (see FIGURE 3.16).

```
logout.php
1
2 <?php
3 session_start();
4 $_SESSION['logged_in']=0;
5 session_destroy();
6 header("location: http://lipping.webuda.com/index.php");
7 //testing: echo "You have been logged out! <a href='index.php'> Click her
8 ?>
```

FIGURE 3.16: PHP CODE FOR THE USER LOGOUT

Next, it is showing the code executed when a user attempts to login (see FIGURE 3.17):

```
1 <?php
2
3 session_start();
4
5
6 $username = $_POST['username'];
7 $password = $_POST['password'];
8
9 if ($username&&$password)
10 {
11     if (isset($_POST['login']))
12     {
13
14         $con = mysql_connect("mysql14.00webhost.com", "a8447554_lipping", "adonis24");
15         if (!$con)
16             die("Regrets..Cannot connect : " . mysql_error());
17         //selecting the table
18         mysql_select_db("a8447554_lipping", $con);
19
20         $sql = mysql_query ("SELECT * FROM members WHERE username='$username'");
21
22         $numrows = mysql_num_rows ($sql);
23
24         if ($numrows!=0)
25             { //code for login in
26                 while ($row=mysql_fetch_assoc($sql))
27                 {
28                     $dbusername = $row ['username'];
29                     $dbpassword = $row ['password'];
30                 }
31
32
33
34                 //checking to see if they match
35                 if ($username==$dbusername&&$dbpassword==$password) {
36
37                     $_SESSION['username']=$dbusername;
38                     $_SESSION['logged_in']=1;
39
40                     //testing :echo 'log in successfull! Go to <a href="index.php"> home page</a>';
41                     header("location: http://lipping.webuda.com/index.php");
42
43                 }else
44                     echo "Incorrect password!";
45
46             }
47         }
48     else
49         die ("User does not exist!");
50
51
52
53 }
54
55 else die ("Please enter again username and password!");
56
57 ?>
```

FIGURE 3.17: CODE FOR THE USER LOGIN


```
1 <div id=pageFooter" align="center"><h1> Copyright International Hellenic University 2013.  
2 <p>All rights reserved.</h1>  
3 </p>  
4 </div>  
5
```

FIGURE 3.19: CODE FOR FOOTER TEMPLATE

The next step concerns the code implementation of the use case “Browse Breakdown List”: In FIGURE 3.20 the code execution is presenting.

```

1 <?php
2     session_start();
3 ?>
4 <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transi
5 <html xmlns="http://www.w3.org/1999/xhtml">
6 <head>
7 <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
8 <title>Browse Breakdowns of Hotel Resort Porto Carras </title>
9 <link rel="stylesheet" href="style/style.css" type="text/css" media="screen"/>
10 </head>
11
12 <body>
13 <?php include_once("template_header.php");?>
14 <div align="center" id="mainWrapper">
15 <?php
16     $con = mysql_connect("mysql114.000webhost.com","a8447554_lipping","adonis24");
17     if (!$con) {
18         die("Regrets..Cannot connect : " .mysql_error());
19     }
20     mysql_select_db("a8447554_lipping",$con);
21     $per_page=3;
22
23 // we select all the breakdown that will be presented, initially prepering the SQL string so as to select all
24     $sql="Select * FROM breakdown ";
25
26 // pagination
27     $breakdownCount=mysql_num_rows(mysql_query($sql,$con));
28     $pages= ceil ($breakdownCount/$per_page);
29
30     $page=(isset ($_GET['page'])) ? (int) $_GET['page'] : 1 ;
31     $start= (($page -1) * $per_page);
32     $sql_q=$sql.' LIMIT '.$start.', '.$per_page;
33
34     $pages= ceil ($breakdownCount/$per_page);
35
36     $page=(isset ($_GET['page'])) ? (int) $_GET['page'] : 1 ;
37     $start= (($page -1) * $per_page);
38     $sql_q=$sql.' LIMIT '.$start.', '.$per_page;
39
40 //select everything from breakdown
41     $sql="Select * FROM breakdown ";
42
43 // we select the breakdown from db
44     $query = mysql_query($sql_q,$con);
45
46     while ($query_row= mysql_fetch_assoc($query)){
47
48         $id=$query_row["id"];
49         $employee_id=$query_row["employee_id"];
50         $department=$query_row["department"];
51         $description=$query_row["description"];
52         $condition=$query_row["condition"];
53         $comments=$query_row["comments"];
54
55 // prepering the HTML code for showing every breakdown
56     $breakdown_list = '<table border="3" cellpadding="1" cellspacing="1" bordercolor="#000033" >
57
58         <td width="284" valign="middle"><p>Breakdown id:'. $id. ' </p>
59         <p>employee_id:'. $employee_id. </p>
60
61         <p>Department:'. $department. </p>
62         <p>Description:'. $description. </p>
63         <p>Condition:'. $condition. </p>
64         <p>Comments:'. $comments. </p>
65
66         <p>Condition:'. $condition. </p>
67         <p>Comments:'. $comments. </p>
68
69         </td>
70     </tr>
71     </table> ';
72 // showing the page of breakdowns
73     echo $breakdown_list;
74 }//end of while
75
76 // showing the pages of the breakdowns
77 if ($pages >= 1 && $page <= $pages) {
78     for ($x=1; $x<=$pages; $x++){
79         echo ($x == $page) ? ' <strong> <a href="?page='.$x.$link.'"> '.$x. ' </a>
80         </strong>' : ' <a href="?page='.$x.$link.'"> '.$x. ' </a>';
81     }//end for
82 }//end if
83 mysql_close();
84 ?>
85 <?php include_once("template_footer.php");?>
86 </div>
87 </body>
88 </html>

```

FIGURE 3.20: CODE FOR BROWSE BREAKDOWN LIST

Regarding the specific use case, it should be mentioned that there was used pagination³³ function. Pagination is referring to automatically paginate documents based on a page size that one specifies. By doing so, it makes the browsing process much easier for the user, especially, if the user is not so familiar with technology and computer machines. This is also an innovative part of the current application delivery.

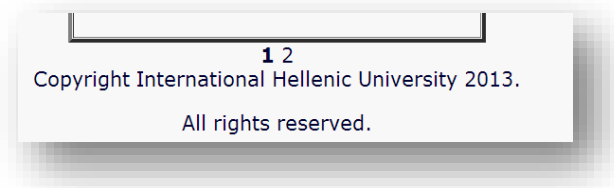


FIGURE 3.21: PAGINATION FUNCTION

Keeping on, in order to implement the use case of *Insert Breakdown* the beneath code was written (see FIGURE 3.22).

³³ <http://en.wikipedia.org/wiki/Pagination>

```

1 <?php
2 session_start();
3 ?>
4 <!--connect to the data base-->
5 <?php $con = mysql_connect("mysql14.000webhost.com","a8447554_lipping","adonis24");
6     if (!$con) {
7         die("Regrets..Cannot connect : " .mysql_error());
8     }
9 mysql_select_db("a8447554_lipping",$con);
10 ?>
11
12 <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
13 <html xmlns="http://www.w3.org/1999/xhtml">
14 <head>
15 <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
16 <title>Add Breakdown Form</title>
17 <link rel="stylesheet" href="style/style.css" type="text/css" media="screen"/>
18 </head>
19 <body>
20 <div align="center" id="mainWrapper">
21 <?php include_once("template_header.php");?>
22 <div id="pageContent"> </div>
23 <?php
24 if ($_SESSION['logged_in']==1)
25 echo '<form id="add_breakdown" action="breakdown_form.php" name="breakdown" method="POST" accept-charset="UTF-8">
26 <fieldset>
27 <legend><b>Add Breakdown Form</b></legend>
28
29         <p>
30             <label for="department"><b>Department :</b></label> <br />
31
32             <select name="department">
33                 <option value="Reception_Hotel_Meliton">Reception_Hotel_Meliton</option>
34                 <option value="Reception_Hotel_Sithonia">Reception_Hotel_Sithonia</option>
35                 <option value="Cleaning_Hotel_Meliton">Cleaning_Hotel_Meliton</option>
36                 <option value="Cleaning_Hotel_Sithonia">Cleaning_Hotel_Sithonia</option>
37                 <option value="accounting">accounting</option>
38                 <option value="booking_department">booking_department</option>
39             </select>
40
41             <label for="description"><b> Description : </b></label><br />
42             <input type="text" name="description">
43
44             <label for="comments"><b> Comments : </b></label><br />
45             <textarea cols="40" rows="5" name="comments"> </textarea>
46
47         <p>
48             <input type="submit" name="submit" value="Submit" /><br /></p>
49         </fieldset>
50     </form>'
51 ?>
52 <?php
53     $username = $_SESSION['username'];
54
55 if (isset($_POST['submit'])) {
56     $con = mysql_connect("mysql14.000webhost.com","a8447554_lipping","adonis24");
57     if (!$con) {
58         die("Regrets..Cannot connect : " .mysql_error());
59     }
60     mysql_select_db("a8447554_lipping",$con);
61     $sql = " INSERT INTO breakdown ( employee_id, department, description, comments ) VALUES ('".$_SESSION['username']."',$_POST[department], '$_POST[description]', '$_POST[comments]')";
62     mysql_query($sql,$con);
63     mysql_close($con);
64 }//end of if
65 else
66 echo "Please sign up in order to insert a Breakdown!!!";
67 ?>
68 </div>
69 </div>
70 </div>
71 <?php include_once("template_footer.php");?>
72 </div>
73 </div>
74 <?php include_once("template_footer.php");?>
75 </div>
76 </body>
77 </html>

```

FIGURE 3.22: CODE FOR INSERT BREAKDOWN

The specific added functions implemented in this use case that should be pointed out are:

1. The user should both be a register member and login in order to be able to insert a breakdown. Otherwise, the system requires from the user to login.
2. The web-based system gets the details of the login user automatically and identifies who is the person (i.e. employee id) that inserts the breakdown.

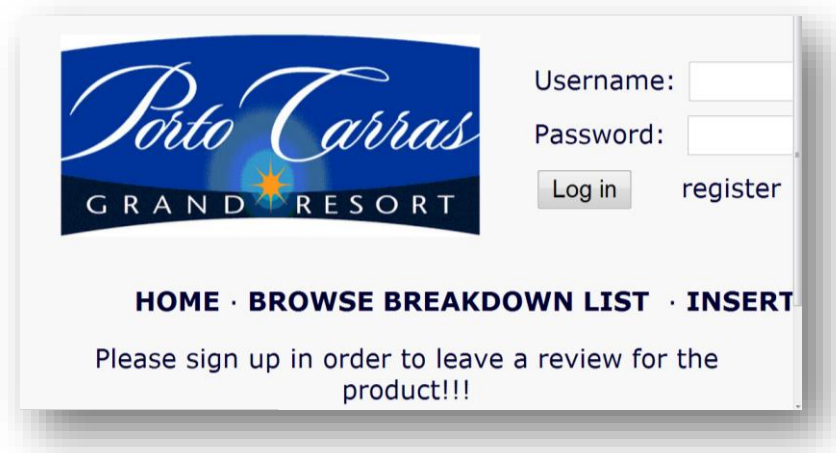


FIGURE 3.23: INSERT BREAKDOWN INTERFECE

Finally, needless to say, there is a tab *Help Desk* (see FIGURE 3.24), where the personnel of the Hotel Resort can contact with the Technical Department if one needs any help using the system. In Figure it is presented the executed code, while in Figure is presenting the Interface.

```

2 <?php
3 session_start();
4 ?>
5 <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional
6 <html xmlns="http://www.w3.org/1999/xhtml">
7 <head>
8 <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
9 <title>Help Desk</title>
10 <link rel="stylesheet" href="style/style.css" type="text/css" media="screen"/>
11 </head>
12 <body>
13 <div align="center" id="mainWrapper">
14
15 <?php include_once("template_header.php");?>
16 <div id="pageContent" align="center">
17 <p>
18 <p>
19 <p>
20 <table align="left"><b>Need help...?
21 <p>Just contact with us!</b>
22 </p>
23 <p> <p>
24 <p> email: info@portocarras.gr
25 <p> Phone: 2310585985
26 <p> Technical Department, Office 5
27 </table>
28 </div>
29 <?php include_once("template_footer.php");?>
30 </div>
31 </body>
32 </html>

```

FIGURE 4.24: CODE FOR HELP DESK

FIGURE 4.25: HELP DESK INTERFECE

Finally, a really functional service offered by the implemented web-based system for the Hotel Resort is the *SmS Notification*. The in question system offers the ability to the users of the software to notify the one being charged to fix/ repair the stated malfunction/ breakdown. Beneath it is showing the code and the interface of this particular innovative function (see FIGURE 4.26) .

```

51
52 //variables for sending sms notification
53 $smsusername = "evimpt@yahoo.gr";
54 $smspassword = "adonis";
55
56
57 $number = $_POST['numbertext'].$_POST['number'];
58 $message = $_POST['message'];
59 $vars = "uname=".$smsusername."&pwd=".$smspassword."&message=".$message."&selectednums=".$number."&info=1&test=0";
60 if ($_POST['submitted']=="true")
61 {
62     $curl = curl_init('http://www.txtlocal.com/sendsmspost.php');
63     curl_setopt($curl, CURLOPT_POST, true);
64     curl_setopt($curl, CURLOPT_POSTFIELDS, $vars);
65     curl_setopt($curl, CURLOPT_RETURNTRANSFER, true);
66     $result = curl_exec($curl);
67     curl_close($curl);
68
69     die("SmS Notification Has Been Sent!!");
70 }

```

FIGURE 4.26: CODE FOR THE SmS NOTIFICATION

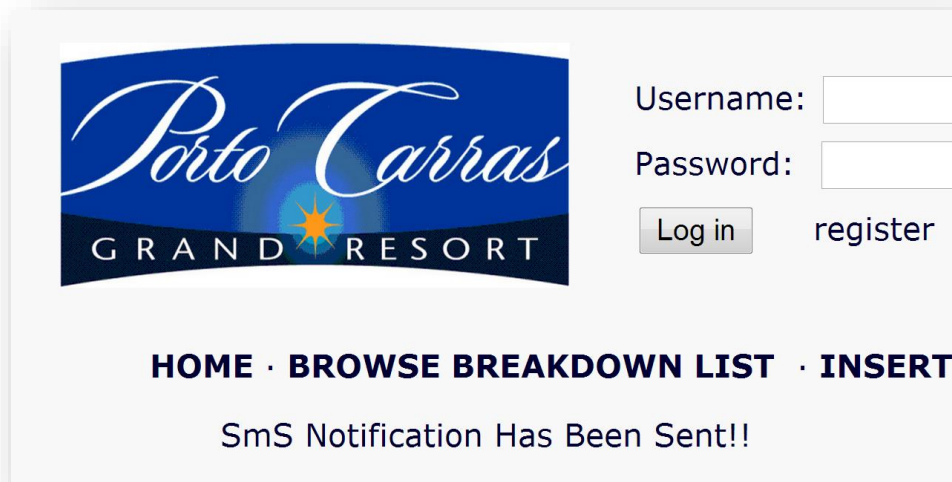
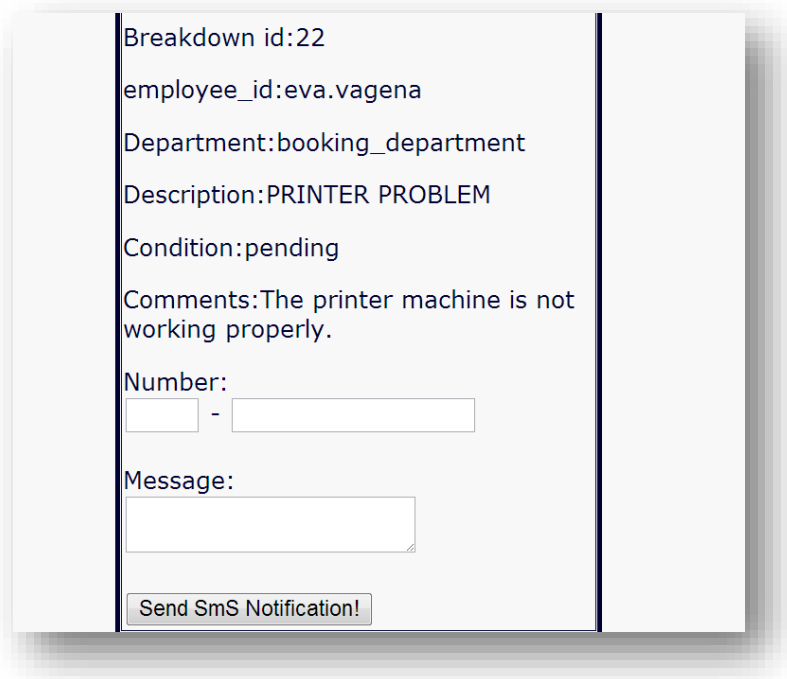


FIGURE 4.27: SmS NOTIFICATION FUNCTION



Breakdown id:22
employee_id:eva.vagena
Department:booking_department
Description:PRINTER PROBLEM
Condition:pending
Comments:The printer machine is not working properly.

Number:
 -

Message:

FIGURE 4.28: SmS NOTIFICATION INTERFACE

*TextLocalon*³⁴ was the sms sending company that was used for the *Send SmS Notification* function of the Hotel. The reason for choosing this specific company was because of the fact that *TextLocalon* offers a straightforward log in, the layout of the account and navigation is simple while the reports are clear. Somebody that is not very tech savvy finds this very straightforward and has no hesitation to use it at all. Furthermore, there is a Helpdesk teamw, which is a real bonus. Some other similar companies are presenting in the following list:

- ❖ Web2SMS³⁵
- ❖ Skebby™- Mobile Solution Srl³⁶
- ❖ TextMagic³⁷
- ❖ BulkSMS³⁸

³⁴ <http://www.textlocal.com/>

³⁵ <http://www.yuboto.com/en/services/sms-and-mms-services/web2sms>

³⁶ <http://www.skebby.com/sms-solution-provider/who-we-are/>

³⁷ <http://www.textmagic.com/app/pages/en/solutions/business-sms>

³⁸ <http://www.bulkSMS.com/>

3.7.4 SPARQL Definition

To begin with, SPARQL (pronounced “sparkle”) is a query language for the Semantic Web³⁹. Along with RDF⁴⁰ and OWL⁴¹, it represents one of the three main technologies of the Semantic Web. More specifically, SPARQL is a recursive acronym that stands for SPARQL Protocol and RDF Query Language.

SPARQL contains two elements: query language and protocol. The query element is more or less straightforward. SQL is used to execute queries referring to relational data. XQuery is used to execute queries referring to XML data. SPARQL is used to execute queries referring to RDF data. Although this resembles, SPARQL is different in that it was designed to run over non-connected sources over a network along with a local database.

More specifically, SPARQL protocol permits the transmission of SPARQL queries and proceeds between a client and a SPARQL engine via HTTP. Engineers are given the opportunity to make use of that fact to query live, public SPARQL endpoints. A SPARQL endpoint is solely a server that reveals its data via the SPARQL protocol.

3.7.5 SPARQL Query Structure

A SPARQL query contains:

The prefix declarations: *PREFIX foo: <http://example.com/resources/>*

The result clause: *SELECT*

The query pattern: *WHERE { ... }*

And the query modifiers: *ORDER BY ...*

³⁹ http://en.wikipedia.org/wiki/Semantic_Web

⁴⁰ http://en.wikipedia.org/wiki/Resource_Description_Framework

⁴¹ <http://www.w3.org/TR/owl-features/>

3.7.6. SPARQL Queries

In this paragraph, there is a representative presentation of the sparql queries code that need to be executed in order for the system to run properly. In particular, below it is showing in an exceptional manner, the set of code for Connecting to the Repository and Selecting functions.

Connecting to the repository:

```
<?php
require_once('sparqllib.php');
$db = sparql_connect('http://dbpedia.org/sparql');
$query = "SELECT ?film
WHERE { ?portocarras <http://purl.org/dc/terms/subject>
<http://dbpedia.org/resource/Category:Department> }";
$result = sparql_query($query);
$fields = sparql_field_array($result);
while($row = sparql_fetch_array($result))
{
foreach($fields as $field)
{
print"$row[$field] \n";
}
}
}>>
```

Selecting data from the repository:

SPARQL allows clients to ask for *specific data*. For instance, the beneath query looks for names of Employees in the Hotel Resort who are born in a city named “Thessaloniki”.

```
SELECT ?name WHERE {
?person dbpprop:name ?name.
?person a dbpedia-owl:Employeeet.
?person dbpedia-owl:birthPlace ?city.
?city dbpprop:name " Thessaloniki "@en.
}
```

Note that each piece of the query is a *triple*⁴², a short sentence of precisely three pieces long that machines can interpret. [25]

3.8 Innovative Part

This paragraph summarizes the innovative part of the in question developing system. First of all, it should be stressed the fact that the software application offers accessibility, not only via computer machines but using smart phones and tablets machines, as well. Another innovative function in comparison to the other similar existing systems is the function of the *SmS Notification*. The in question system provides to the users the ability to send sms pointing out to the sender details, reminders etc concerning a specific malfunction/ breakdown. Furthermore, the software application is making use of the pagination ability, so as to be smoothly for the users to search or browse the defined breakdown list.

3.9 Conclusion of the Chapter

In this chapter is was introduced a description of the Hotel Resort for which the software application was developed. Starting with the introduction of the plan definition, where the aim and the covered need by the system are describing. The chapter covered the design and the implementation mentioning the key issues that analyst and designers should address when developing software applications so as to offer an accessible environment of the published software application invoking every type of user. Finally, the author of the dissertation implemented a web-based application software presenting all the procedure that taken place during the application development, the way in which every part of the application was built up and the way it works. In particular, how users can navigate throughout the application and the way in which every part of the application was developed, mentioning even the executed code. At the end, the author is presenting the innovative introductions that the application software offers in comparison to other current used systems.

⁴² <http://en.wikipedia.org/wiki/Triplestore>

Overall Conclusions

Taking everything into consideration, it shall be reminded and sum up that the success of any hotel or resort is based on the level of service that is provided to its guests. By storing all of one's buildings, floors, rooms, and equipment in an asset management solution one might track the maintenance on everything [8]

Throughout the current dissertation there were presented some representative already in use systems like to the one that was built for the Hotel Resort Porto Carras. Furthermore, there was presented a short, concise and well documented report of the overall field of hotel industry. As it can be sum up the advantages outweigh the disadvantages of the intended implemented tech.

There was presented an introduction of a plan definition for a hotel resort, where the aim and the covered need by the system were described. In addition to this, there was a detail design, including the use cases. The key issues of analysis and design were addressed when developing the software application so as to provide an accessible environment of the published software application invoking every type of user, familiar or unfamiliar with the technology.

The author of the dissertation implemented a web-based application software showing not only the procedure that occurred during the application development, but the way in which every part of the application was built up and the way it works, as well. In particular, how users can navigate throughout the software application and how every part of the application was developed, mentioning even the executed code. Nonetheless, it was sum up that the ontology technology presented difficulties in connecting the repository with the web-structured site. Although, it is far easy for the user to test sparql queries using the Sesame Workbench platform but when the connection and the website

part was coming up, obstacles were appeared. It should also be stressed that the ontology technology is still being developed and comprehended. This can easily be realized with the limited sources and tutorials that exist all over the web world.

The software application supports the ability of handling more than one user at a time, both at the user level and at the administrator level. Any amount of people in a firm should be able to insert data and open tickets at the same time. Similarly, multiple administrators should be able to change staff such as scripts and status flags at the same time, and not be needlessly limited by waiting for someone else to fulfill their modifications or logout before they can do any work.

In the section of the overall conclusions of the current dissertation, it should be mentioned the innovation part. More specifically, the innovative introductions that the application software offers in comparison to other current used systems is the quick and easy-used function of sending sms notifications. In addition, the way that the pagination feature works, offers effortlessness to the users to navigate in the system platform.

Finally, it should also be pointed out that the software application is accessible through smart phones and tablets, meaning both iPhone OS⁴³ and Android OS⁴⁴. Along with, the software app is accessible by disable people. In particular, people dealing with vision problems and people dealing with physical disabilities.

Future Work

After implementation, maintenance begins, including enhancements, modifications, or any changes from the original specifications. To ensure the success of the system, careful and often extensive planning is required. The overall management process is crucial to the successful completion of system. Once the problem is verified an initial investigation will be conducted to determine whether a change is feasible and the way in which the change will be done.

⁴³ <http://en.wikipedia.org/wiki/IOS>

⁴⁴ [http://en.wikipedia.org/wiki/Android_\(operating_system\)](http://en.wikipedia.org/wiki/Android_(operating_system))

As part of the future work are some characteristics such as the *Online Help*, which will be available from within each module by clicking the Help button. Furthermore, one might click on any field name and popup will appear giving information pertaining to the selected field, as well. This help will be named inline help and will be customizable. This permits to one employee to insert notes in the help that are specific to a particular firm.

Of course, there will be also any enhancements, modifications, or any changes from the original specifications and the deliverable system in order to provide more advanced services.

People should keep in mind that the objective should not be software per se. It is important to understand that people can hold the concept of generating software from becoming this generation's new buggy whip example. [22] Finally, it should never be forgotten that a maintenance management system is developed to track maintenance, reduce costs and give a higher level of service to the customer.

“Software is merely an intermediary artifact to accomplish some given tasks. Rather than engineering software, the point of convergence should be on how to fulfill those tasks in an optimal way and that require a system implication. “

Bibliography



[1] <http://www.mkbergman.com/category/ontology-best-practices/#app1>

Accessed: August 2013

[2] <http://www.mkbergman.com/category/ontology-best-practices/#app2>

Accessed: August 2013

[3] <http://www.mkbergman.com/category/ontology-best-practices/#app3>

Accessed: August 2013

[4] <http://www.mkbergman.com/category/ontology-best-practices/#app4>

Accessed: August 2013

[5] *ANALYSIS AND DESIGN OF INFORMATION SYSTEM FOR THE MANAGEMENT OF THE "DOMINGO SAVIO" HOTEL. STRATEGIC PLAN FOR THE IMPLEMENTATION OF THE GUESTS MANAGEMENT SYSTEM.* (2007) Vera Silva, Ricardo Universidad “Católica Nuestra Señora de la Asunción” Sede Regional Itapúa Faculty of Economic Sciences Antequera entre Arq. Tomás Romero Pereira 14 de May, Encarnaciónp. p.3-4

[6] *Overview of System Analysis & Design*, (2011) Dr. Jawahar

[7] <https://www.youtube.com/watch?v=Bt-aEDG7w9g&list=PL5ABC65A8C288304A>,

Accessed: August 2013

[8] *Design and development of a fuzzy expert system for hotel selection E.W.T.* (2003) Ngai, F.K.T. Wat

[9] <http://www.mkbergman.com/900/an-executive-intro-to-ontologies/>

Accessed: August 2013

[10] <http://en.wikipedia.org/wiki/Ontology>

Accessed: August 2013

[11] <http://www.facilityone.com/industries/hospitality/>

Accessed: August 2013

[12] http://www.maintenanceconnection.com/mcv18/online/mc_features.htm

Accessed: August 2013

[13] http://www.maintenanceconnection.com/mcv18/online/mc_services.htm

Accessed: August 2013

[14]

[http://el.wikipedia.org/wiki/%CE%A0%CF%8C%CF%81%CF%84%CE%BF_%CE%9A%CE%B1%CF%81%CF%81%CE%AC%CF%82,](http://el.wikipedia.org/wiki/%CE%A0%CF%8C%CF%81%CF%84%CE%BF_%CE%9A%CE%B1%CF%81%CF%81%CE%AC%CF%82)

Accessed: August 2013

[15] <http://www.feelgreece.com/gr/porto-karas>

Accessed: November 2013.

[16] *Information Systems for Enterprise Management. Planning, Technology and Quality*,(2003) Larbert, Alberto,. Prentice Hall Ed. Buenos Aires, Argentina, p. 31.

[17] *Marketing Administration. Markets Integral Segmentation*. (2005) Ed.Gráficos Tañski, Nilda C. S. R.L. Posadas, Argentina. p.58.

[18] *The Book Depository*, (2001), Lardent, Alberto p. 149

[19] *The project of the system foresees two fundamental phases: The project itself and the product. Development of Information System*, (2003),Tañski, Nilda p. 5, 52.

[20] <http://www.hoteldna.com/i/hotel-hero.php>

Accessed: November 2013.

[21] http://www.maintenanceconnection.com/mcv18/online/mc_industry_resort.htm,

Accessed: November 2013.

[22] <http://www.mkbergman.com/category/ontology-best-practices/#app13>,

Accessed: November 2013.

[23] http://www.maintenanceconnection.com/mcv18/online/mc_industry_resort.htm,

Accessed: November 2013.

[24] http://en.wikipedia.org/wiki/Adobe_Dreamweaver

Accessed: November 2013.

[25] <http://ruben.verborgh.org/blog/2013/09/30/can-i-sparql-your-endpoint/>

Accessed: November 2013.

Web Resources Used for the System Implementation

- ❖ http://www.maintenanceconnection.com/mcv18/online/mc_system.htm,
Accessed: November 2013.
- ❖ http://www.maintenanceconnection.com/mcv18/online/mc_system.htm,
Accessed: November 2013.
- ❖ <http://saml.rilspace.org/content/testing-set-up-of-sparql-endpoint-for-smw-using-rap-and-netapi>
Accessed: November 2013.
- ❖ http://logd.tw.rpi.edu/tutorial/retrieving_sparql_results
Accessed: November 2013.
- ❖ <http://api.querypath.org/docs/index.html>
Accessed: November 2013.
- ❖ <http://wifo5-03.informatik.uni-mannheim.de/bizer/rdfapi/tutorial/usingtheSparqlClient.htm>
Accessed: November 2013.
- ❖ <https://marinemetadata.org/guides/vocabs/ont/provider/registeraccessont>
Accessed: November 2013.
- ❖ <https://marinemetadata.org/community/teams/ont/mmirepository/orinstructions>,
Accessed: November 2013.
- ❖ https://github.com/njh/easyrdf/blob/0.7.2/examples/basic_sparql.php
Accessed: November 2013.
- ❖ <http://johnwright.me/blog/sparql-query-in-code-rest-php-and-json-tutorial/> ,
Accessed: November 2013.

TERMINOLOGY

A

Active-X: Loosely determined set of technologies generated by Microsoft for sharing information among several applications.

Applets: Program developed to be executed from another application.

C

Class: Template that are being utilized to generate objects, and to determined object data types and methods.

Chart Scheme

Component: Identifiable part of a larger software or construction.

D

Dataset: Collection of data records for computer processing.

Data Properties: Property that can get and set a value

E

Endpoints: Entity, processor, or resource referencing to which web services messages are capable of being addressed.

F

Footer Template: Presenting data that appears at the bottom of web sites.

H

Header Template: Presenting data that appears at the top of web sites.

L

Linked Data: Method of exposing and connecting data on the Web from different sources.

M

Magnetic Tape: Sequential storage medium being utilized for data collection, backup and archiving.

O

Object Properties: Determined a new property directly on an object, or modifies an existing property on an object, and returns the object.

Ontology: Set of representational primitives with which to model a domain of knowledge or discourse

P

Pagination: Number the pages of (a book, manuscript, etc.) in sequence.

Plug-ins: Hardware or software module that adds a particular characteristic or service to a larger system.

Property: Characteristic of an object, the term property is being utilized to describe attributes associated with a data structure.

R

Record: Special data structure.

Relational Databases: Collection of data items organized as a set of formally-described tables from which data can be accessed or reassembled in many different ways without having to reorganize the database tables.

RDF: Resource Description Framework. RDF is a general framework for describing a Web site's metadata, or the information about the information on the site. It provides interoperability between applications that exchange machine-understandable information on the Web.

Repository: central place in which an aggregation of data is kept and maintained in an organized way, usually in computer storage.

T

Triple: Logical language for reasoning with parameterized views over semi-structured data, and define a model theoretic semantics for the language

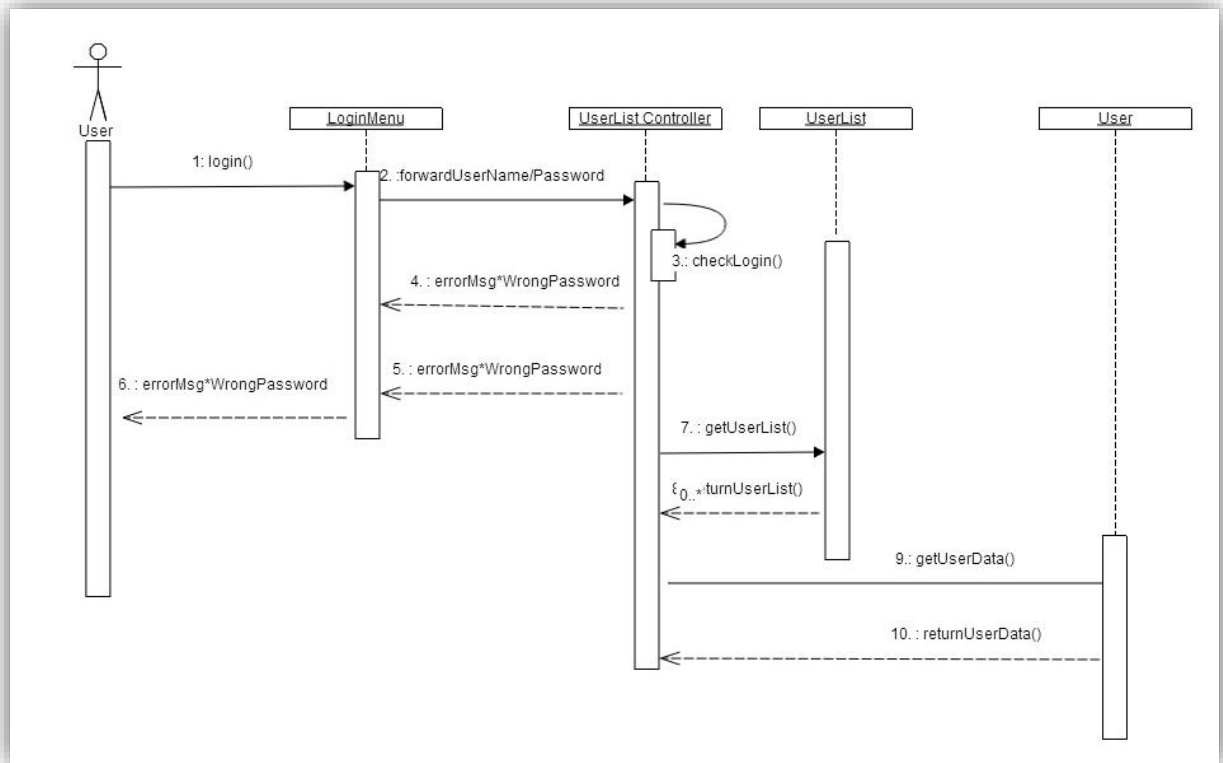
Triple Store: A database designed for the storage and retrieval of RDF metadata in the form of triples.

U

UML: Unified Modeling Language, a standardized modeling language enabling developers to specify, visualize, construct and document artifacts of a software system.

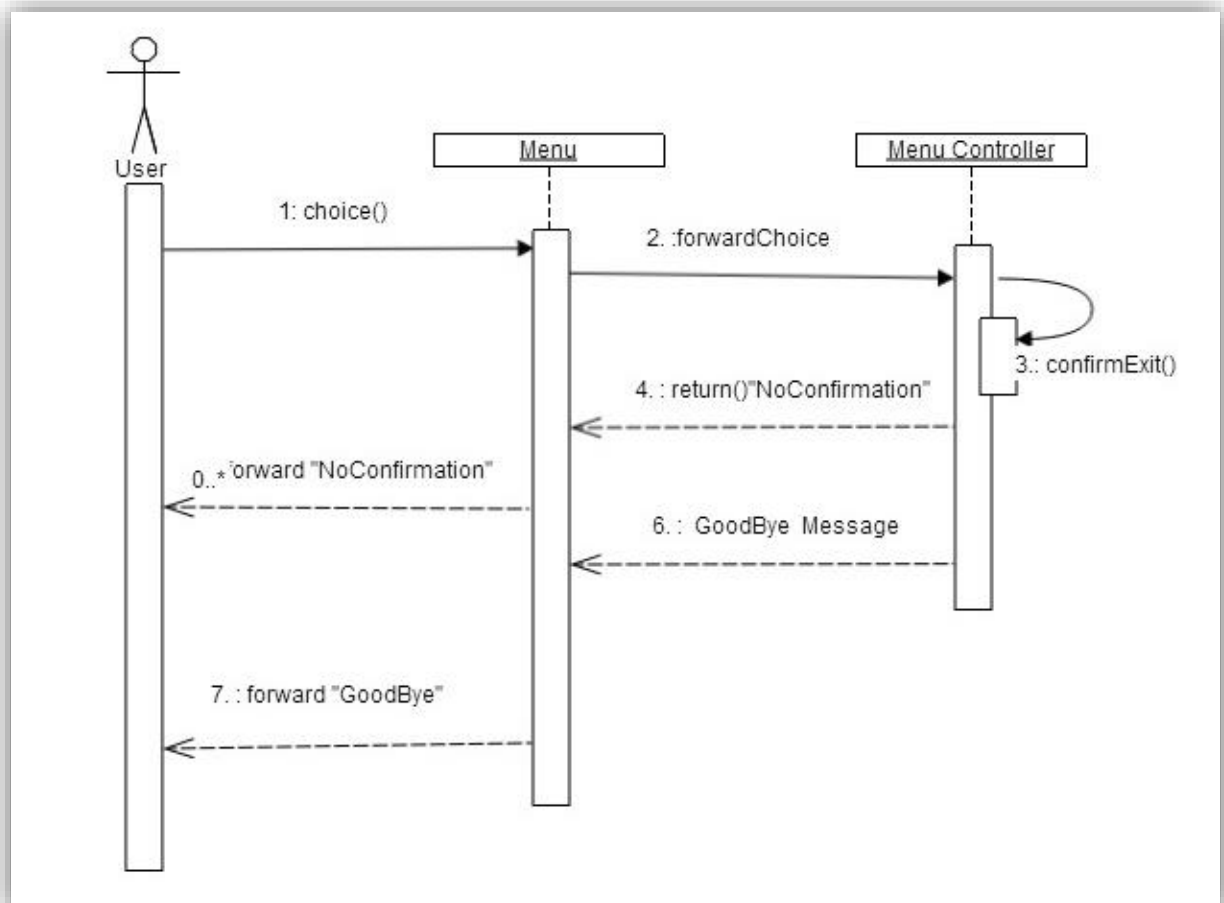
Appendix I

Flow Diagram for the *Login* Use Case.



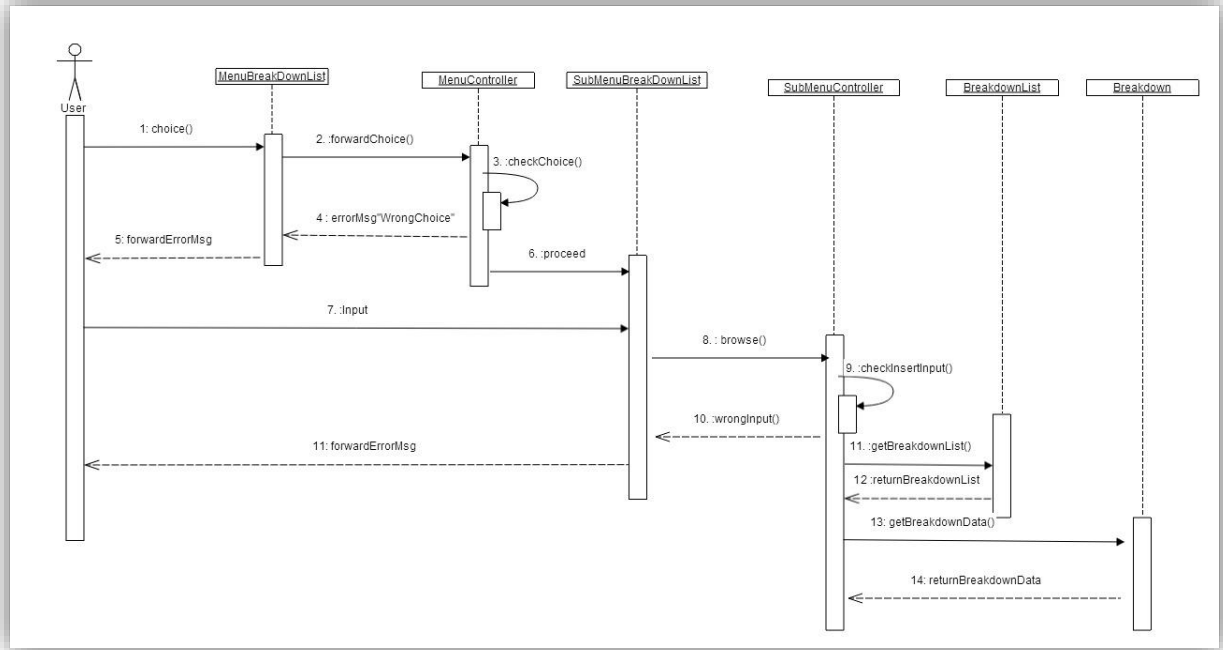
Appendix II

Flow Diagram for the *Logout* Use Case.



Appendix III

Flow Diagram for the *Browse Breakdown List* Use Case.



Appendix IV

Flow Diagram for the Inserting *Breakdown* Use Case.

