Edu World 2016
7th International Conference

PROJECT MANAGEMENT INFORMATION SYSTEM BASED ON WEB TECHNOLOGIES

Adrian Lupaşc (a)*

* Corresponding author

(a) University "Dunărea de Jos" of Galati, Domnească, 47, Galati, România, alupasc@ugal.ro

Abstract

Information systems are considered essential for project managers, being of great support to planning, organizing, controlling, reporting and taking decisions. The purpose of this paper is to describe the positive effect of using web technologies on the development of project management software tools and the impact of this software on individual and organizational levels. Therefore, a project management information system based on a client-server architecture is implemented and described. The system uses Java Web Technologies, as servlets and JSP, on the server part and JavaScript scripting language to provide enhanced user interface and dynamic web pages on the client part. This project management information system is meant to provide managers with the decision-making support needed in planning, organizing, and controlling projects. Advantages obtained from project management information systems use are not limited to individual performance but also include project performance. These systems have direct impact on project success, as they contribute to improving budget control and meeting project deadlines as well as fulfilling technical specifications.

© 2017 Published by Future Academy www.FutureAcademy.org.uk

Keywords: Project management; design; unified modelling language; web technologies; planning; control.

1. Introduction

The information systems specific to project management are considered essential for project managers, having an important role in supporting the tasks of planning, organizing, control, reporting and decision making.

Even though the use of information systems for project management do not guarantee the success of a business, they have become a necessity. A successful information system for project management

should have an individual impact on what all involved users' needs are concerned (Heagney, 2012). At the same time, a good system for project management should have a significant organizational impact; the success of such a project implies, among others, following a budget, a schedule or some technical specifications.

The research showed that, although the information systems for project management are being used more and more by project managers from various fields of activity, many of their characteristics that contribute to the implementation of a successful project are unknown. In specialty literature, studies that empirically evaluate the quality of the information systems for project management are recognized and used now in different organizations and their impact over the project management and project performance is examined, obtaining positive results (Raymond & Bergeron, 2008).

In the context of the things specified above, the main objectives in this work aim to achieve an introduction to project management, as well as to present a solution, designed and implemented for project management of SMEs. The proposed IT solution integrates the main functions of such a system, in order to provide strong support to project managers and team members and, on the other hand, to highlight the positive impact of information systems developed using web technologies in project management and subsequently on the success of businesses. Thus, the objectives associated with the information system designed and implemented refers, primarily, to the facilitation of communication between team members and the project manager, eliminating the geographical barriers and the extension of access area, to monitoring and continuous control of their project development through team, costs, time and risk management. Another important objective refers to the assessment of projects by preparing reports based on web technologies.

The paper is divided into five sections and offers an overview of the practical necessity of using such a system for project management and for the design and implementation of projects. Thus, a short incursion on specific theoretical concepts of project management at organizational level is made, to provide a clearer picture on the applicability of software tools in this field. Aspects related to system design based on Unified Modeling Language (UML) are also highlighted, then it goes on to describe the architecture on which the designed system is based, together with technologies required for implementation. Aspects regarding the implemented system functionality were also presented and the way it will achieve its previously proposed objectives. In the last part the conclusions and directions for further research are being exposed.

2. Paper theoretical foundation and related literature

Projects are unique activities, goal oriented, with a high degree of novelty and a complex workload. They are limited in time and in terms of human and material resources, usually requiring interdisciplinary collaboration in a special organizational structures and special methods involving specific risks (Mocanu & Schuster, 2004).

The functions of a project manager in relation to his team and project tasks are closely related to the environment and involve planning, organization, coordination, control, information, communication etc.

Effective time management is a prerequisite for a successful project. Effective time management requires the ability to realistically estimate the time required to perform a task depending on its

complexity, to prioritize tasks according to importance or expected results and organize activities to meet deadlines (Leach, 2014).

Cost is the burden or expense incurred by an economic entity to achieve a productive activity or use a product or an ensemble of activities. Cost management for a project involves a number of particularly refined and delicate issues, with a high degree of risk due to more or less justified working conditions: exceeding the set budget by performing additional activities not included in the initial project, the stagnation of activities because of defective supply or of unfulfilled subcontractors in time, failure to fulfill the set objective at the assumed performance level, improper distribution of the allocated budgets and their lack of correlation with deadlines or technological problems and improper estimation of the volume and distribution of the necessary budget for the project implementation. Costs planning resembles human resource planning. The costs of each process are determined, and their sum represents the total project costs.

During the project implementation there is a risk of total or partial failure to fulfill the objectives set by the beneficiary (Marchewka, 2012). These risks are usually derived from the specific contract conditions; most often, the risks are materialized through failure to comply with deadlines, by exceeding the approved budget or the failure to comply with imposed performance and quality parameters.

3. Methodology

At the start of the project, the beneficiary establishes a budget and a deadline for finalizing the project. Given these data, the project manager should identify possible risks and should establish a strategy to minimize their effects in case of occurrence.

The assessment, mitigation of risk, namely risk management is the task of the project manager. Whatever the project manager profile, it is important that, once a risk is revealed, to develop alternative scenarios to provide activities to be undertaken in the event of or non-occurrence of the undesirable event.

In terms of the project, planning must ensure efficient use of resources. Resource planning is done taking into account both the cost factor and the time factor. More efficient resources or more staff can speed up execution of tasks, but typically involve higher costs.

Based on research conducted it can be summarized that planning is a continuous decision making process at organization level through the perspective of the future and methodical organization of the effort for the implementation of these decisions. Whatever the method used, based on the description of activities, the staffing need, its profile requirements and cost are determined. After determining the structure of tasks and job profiles, for each team member the activities that must be met and the timeframe will be established.

The structure of decomposed activities is a tree structure, in which the leaves are basic activity. For each activity a specific authority and responsibility can be established. Activities are independent or have a dependency and a reduced interface with other ongoing activities.

The Gantt chart is a bar chart that consists of a two-dimensional coordinates system, with a timeline and a task dimension, which is correlated with a task matrix. Bars are traced, whose length renders the time planned and whose position corresponds to the beginning or end of the activity.

Bar charts can be complemented by a second bar to represent real progress of the project, i.e. the state of the art. Due to the possibility of comparison between planned and achieved, the bar chart

becomes, in addition to a planning and coordination instrument, a management and control instrument of small and medium projects.

Critical Path Method calculates deterministic values for minimum and maximum time limit for both the start and end of each activity, taking into account the logic of the activities' network. The critical path is vital for planning and resource allocation, as the project manager can recalculate those events that are not on the critical path, so as to ensure the maximum use of resources, without exceeding the total time.

4. Results

To achieve the desired results, both at project level and at organization level, a detailed plan that defines all efforts to be undertaken, that establishes responsibilities for each organizational element and the deadlines and budgets for the performance of work is required. The preparation of this plan falls under the responsibility of the project manager who is assisted in this work by his team. Planning starts with the specification of activities that has been prepared by the project beneficiary, which he details according to the envisaged project structure and imposed constraints (Georgescu, 2005).

According to the Use-Case diagram (see Figure 1), actors and their interactions with the system were identified, as well as the links between scenarios and actors. The scenarios can be seen as processing associated to the achieved system.

Thus, five actors were identified: website visitor, the company employee, the member of the project team, the project manager and the company. Also, the diagram shows the relationships (generalization) of the actors identified, the links between actors and scenarios, as well as dependencies of the scenarios presented. The scenarios presented in the USECASE chart reflect the behavior of the designed system and reproduces its dynamics. Being a software tool dedicated to small and medium-sized organizations, most times the company manager often plays the role of project manager and takes over all tasks.
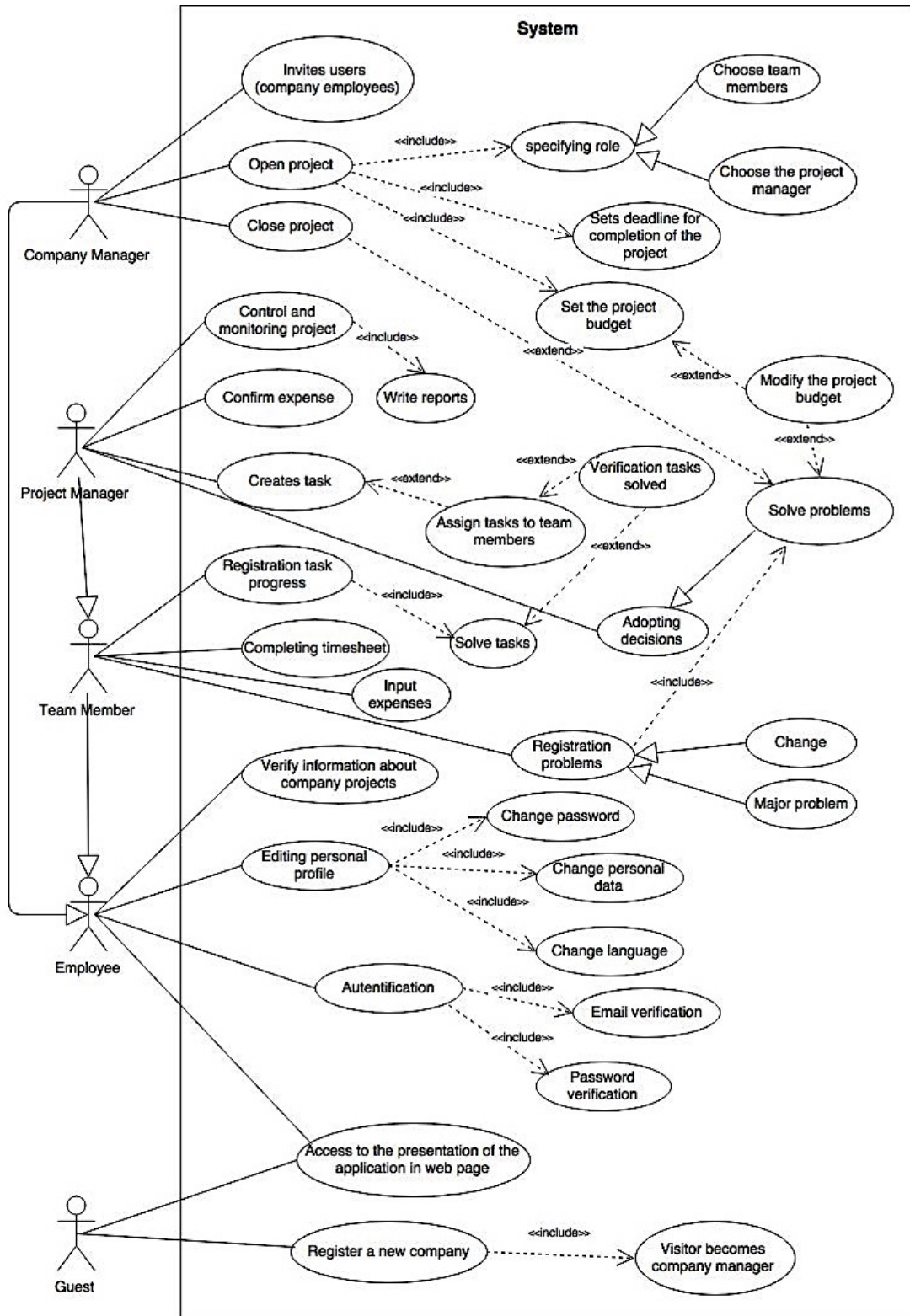
Fig. 1. Use-case diagram for the system proposed

The developed system is designed on a client-server architecture (see Figure 2), because it is based on current web technologies. The server part was developed using Java EE (Enterprise Edition) technologies and is functionally divided into three levels: data, logic and presentation.
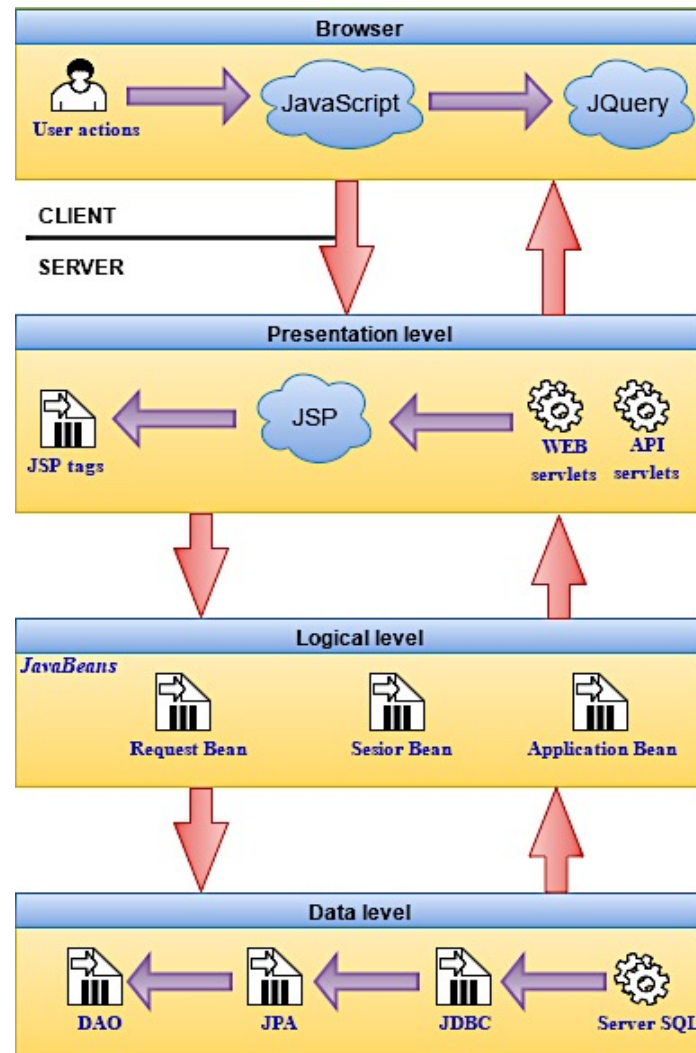

Fig. 2. Architecture technology for the developed system

The data level provides access to data sources, using the DAO model (Data Access Object) for abstracting data sources. The implementation of a particular DAO object is based on the ORM (Object Relational Mapping) method. This functionality is provided by Java Persistence API provided by Hibernate ORM library. At the bottom level of the database is the SQL server and for data storage required by the system, PostgreSQL was used as a relational database system. The logic level consists of JavaBeans objects that provide the operations on the level of data, being practically reusable classes written in the Java programming language, according to a particular convention. The presentation level provides the interface of the server part of the architecture and uses as technology, Java servlets and Java Server Pages (JSP) to access the application via the Internet.

The client part is based on using the JavaScript language. This is mainly used to insert dynamic content in the web pages. The JavaScript code on these pages is run by the browser, using the facilities of the jQuery library and communicates with the server, i.e. with API servlets (Application Programming Interface) of the presentation level by asynchronous requests (Ajax) and through the JSON format of representation.

5. Discussions

The success of a project depends largely on the computer system used. The project manager's ability to monitor events, to anticipate crisis situations and to initiate corrective measures to be taken to prevent or resolve these crises, depends largely on the information system of the project. In a dynamic business context web technologies are the only ones that provide the ability to act coherently, as they provide the solution to overcome the traditional barriers of time, distance, complexity and heterogeneity of participants. It provides in this way the conditions for achieving a dynamic and collaborative environment within projects.

The analysis and design of the proposed information system for project management is based on the objective approach, based on the Unified Modelling Language (UML – Unified Modelling Language). Using an object-oriented approach provides the following advantages: facilitating the design of classes and objects of applications, modularity, re-usability and extensibility of the code, that lead to a higher productivity and to improvement of the quality of developed applications.

Object-oriented design contributes to the development of modern software products, capable of meeting a wide range of requirements. In addition, the usefulness of this approach is clear from the desire to develop software products customized according to each organization's requirements and that will guarantee an increase of the economic efficiency of their activity.

6. Conclusions

Project managers need active information systems that support specific project management processes, such as control and monitoring of the project, reporting activity, detecting problems and identifying solutions to solve them. To be really active, the project management systems must support proactive communication between project participants. Also, they must implement automatic control procedures, through which corrective actions should be initiated when a situation is identified inadequate.

The changes specific to the IT field have also marked the project management. One of the most significant effects of IT progress is the changed requirements profile of the project manager. It is no longer enough for him to manage well the processes taking place in the organization; he must have the ability to work more effective by using modern project management techniques and tools.

Personal contribution to the field is linked to the design of a system for project management dedicated to small and medium organizations, based on web technologies. The control of projects through planning, monitoring and reporting, the facilitation of communication between project team members and the extension of access area, are the main advantages of the proposed system.

The implementation of the information system is not limited to the features presented in this paper. As directions for further research, the design of the possibility of adding new modules or improving existing ones will considered. In addition, the integration in an enterprises resource planning system (ERP) can be achieved, as well as collaboration with other decision support systems at the organizational level. As the systems are more efficient, so more information is available to the team for decision making.

Nevertheless, information systems are only auxiliary tools that cannot replace the human factor activity. The success of a project depends, mainly on the contribution of the project manager. Thus, we followed, through this work, to achieve a sensitization of the researchers in this very interesting field, to direct their attention towards adopting in practice such information systems that can certainly lead to significant benefits to organizations that adopt them and are able to improve the economic efficiency of the activities concerned.

References

Georgescu, C. (2005). *Abordarea relaţională şi obiectuală*. Bucureşti: Editura Didactică şi Pedagogică.

Heagney, J. (2012). *Fundamentals of Project Management. Fourth Edition*. American Management Association.

Leach, P. L. (2014). *Critical Chain Project Management, Third Edition*. Artech House – A Horizon House Company Publisher.

Marchewka, J. (2012). *Information technology project management Providing Measurable Organizational Value*. Wiley.

Mocanu, M., & Schuster, C. (2004). *Managementul Proiectelor – Managementul proiectelor – Cale spre creşterea competivităţii*. Bucureşti: All Beck.

Raymond, L., & Bergeron, F (2008). Project Management Information Systems: An empirical study of their impact on project managers and project success. *International Journal of Project Management*, 26(2), 213-220. doi:10.1016/j.ijproman.2007.06.002.