E-Work Platform for Automatic Creation and Intelligent Task Management in Collaborative Applications

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Abstract

This paper proposes a web application that provides adaptive pen management for the activities within a university or an IT company, in order to facilitate the work of employees and to improve the learning and internal development process. The proposed system is focused on planning, organization and, last but not least, on improving performance. Teamwork is an important factor for the success of any project, both in education and in industry. As a result, developing an efficient team is one of the essential responsibilities of an educational or administrative manager. Teamwork amplifies the results of each member so that the overall result is superior to the individual contributions made by each individual member.

Keywords: E-activities, E-work, Task Management, Business Intelligence, Educational Web Application, Automatic Platform, Collaborative Work Systems, Software Tools, Advanced Technologies, Online Management, Virtual Learning

1 Introduction

In order to promote high performance and effective teamwork it is necessary to clearly define the project objectives for all team members, to ensure that all members understand the assigned tasks and, last but not least, to encourage collaboration, which in the proposed application is represented by feedback. In order to be more efficient in terms of the activities required for a university or an IT company, it is necessary to automate these processes, so there is a need for a software system that includes all these activities, to help minimize the time required to carry out activities, as well as providing users with a friendly and easy-to-use interface.

Many existing platforms are mostly project management and not task management or employee performance improvement apps. The main objective of this paper is to provide a software solution in this regard for a university or an IT company. This solution aims to facilitate the work of employees through the functionalities it provides. Taking into account the observed, it is deduced the need to create a compact application that has functionalities for task management and performance improvement.

2 Task Management Tools

2.1 Electronic Task Management Tools

Using computing power, electronic task management tools offer increased flexibility and functionality. Digital or electronic task management tools are not limited to physical space, but allow users to add as much or as little information as they want. These usually include a wider range of features, such as tracking and analysis. Unlike manual ones, electronic task management tools can be accessed from a portable device (laptop/phone) (Riss et al, 2005).

Electronic systems typically come in a variety of forms, from basic spreadsheets to intensive load management applications. These tools can also be integrated with other work and organizational applications to build a complete task management solution.

2.2 Online Task Management Tools

They combine the depth of an e-task management tool with the unlimited expansion of the internet, resulting in online task management. These systems can be packaged as software or online applications, allowing individuals or teams to organize and monitor tasks from any location.

Online task management tools are especially useful for multi-tasking teams with different descriptions and priorities, in addition to helping collaborate with remote team members. They allow information, measurements, reports, analyzes or any other files to be easily accessed through an internet connection. Most online task management tools work in the Cloud, so users can allocate storage and store critical information without overloading their internal networks. Online task management tools also provide teams with better ways to communicate and collaborate. Using an internet connection, team members can receive status updates via email or discuss task details.

2.3 Benefits of Using Task Management Tools

Task management tools are an effective communication resource for teams, but can also be used by individuals. Task management tools help end users work smarter and be more successful.

When applied correctly, task management tools can:
- Manage and organize the workload – It is known what needs to be done and what elements have priority.
- Increase efficiency and productivity – Applying an optimal amount of resources and time for a task means reducing the time allocated in the business cycle.
- Improves the quality of work – Quality is never sacrificed for work speed when tasks are well organized and information is used correctly.
- Lead to good collaboration – Teams work best when there is a common understanding of what needs to be done and ideas can be easily communicated through a visual task management system.
- Reduce unnecessary information – It eliminates time spent analyzing what needs to be done next or redone after because tasks were not completed correctly on the first attempt.

2.4 Choosing Appropriate Task Management Tools

Selecting the task management tool that best suits your needs takes time and thought, not something that should be guessed or assumed. There are top tools to choose from: (Trello, 2020), (Tomuş, 2018), (Microsoft Project, 2020), (Basecamp, 2020), (Asana, 2020), (Hibernate, 2020), (H2 Database, 2020). Some of them are extremely basic, while others offer a wide range of functionalities, offering enough values to satisfy even the most numerous teams. It is essential to remember that the simplicity or complexity of an instrument is not the most important criterion. It is essential to balance the needs to help teams work better together, become more efficiently organized and stimulate production. Software dimensions that cross almost all task management product lines include task creation, task viewing, notifications, resource allocation, compatibility, configurability, scalability, and reporting.

3 Software Tools

A few years ago, Web technologies were used only by large companies, mainly due to the high costs of developing software licenses. Today, thanks to the growing development of Open Source solutions, anyone can afford to build web applications at no cost. The IT tools used in the development of the e-work platform are: Maven (Microsoft Project, 2020), Spring Boot, Thymeleaf (Spring Boot & Thymeleaf, 2020), Hibernate (Hibernate, 2020), Bootstrap (Bootstrap, 2020), Angular (Web Technologies, 2020), IntelliJ IDEA (IntelliJ JetBrains, 2010), MySQL workbench (Docker, 2020), and Visual Studio Code (Visual Studio Code, 2019).

4 System Functionalities

This section presents the features that underlie the implementation of the web application. The system is analyzed from several perspectives: a general analysis and an analysis that follows the functionality of each component were performed then a research on the technologies used for the development of the web application was performed. A task planning and management system was developed for work needs using Agile methods (Agile, 2020). The system is modeled on the basic functions of existing solutions (jira / trello / tfs / redmine).

4.1 Features

The objectives proposed for this project can be achieved by building a web application, which offers the possibility to manage projects, tasks, project and task assignment processes as well as the feedback process between employees, and for analysis on complex projects, reports can be viewed which help to draw conclusions and make appropriate decisions. The application main functionalities are: creating user accounts, project/sprint/task management, and sending feedback messages.

4.2 Description of the Main Application Components

The management of user accounts is done by filling in a form for creating the account. Relevant user data is completed by existing project administrators in the application. Users will be managed later by the application administrator.

The main objective of the application is the management of IT development projects of a university or company. This is done through a project creation and management interface. Each project is created by a project administrator, which will be the one who will later have the possibility to edit, delete and manage the details of that project. The project creation form contains some essential details: project name, description, and project administrator (project manager). After creating the project, it is displayed in a list of projects, where one can see all these details.

Another feature of the application is the sprint management part. Sprints are related to existing projects. A list of sprints where one can view the details is displayed. One can create new sprints or edit/delete existing ones. The implementation takes into account the fact that sprints must be validated so that no two sprints with overlapping data can be created. The task management functionalities can be viewed in a list, and their illustration is modeled on the Trello platform (Tasks Modeling, 2019), i.e., a graph can be seen in which they are arranged, depending on the progress, where the person to whom each task is assigned can be viewed. All tasks appear by default in a table, filtered by the desired sprint.

5 E-work Platform Implementation
5.1 The Database

The application must have a simple structure. After analyzing the needs and important functionalities of other applications, we designed the basic structure of the desired application, the implementation starting with the database structure. To implement the model, we need a relational database, in which to define the tables in which the necessary data are stored and the relationships between them. The database diagram is as follows:
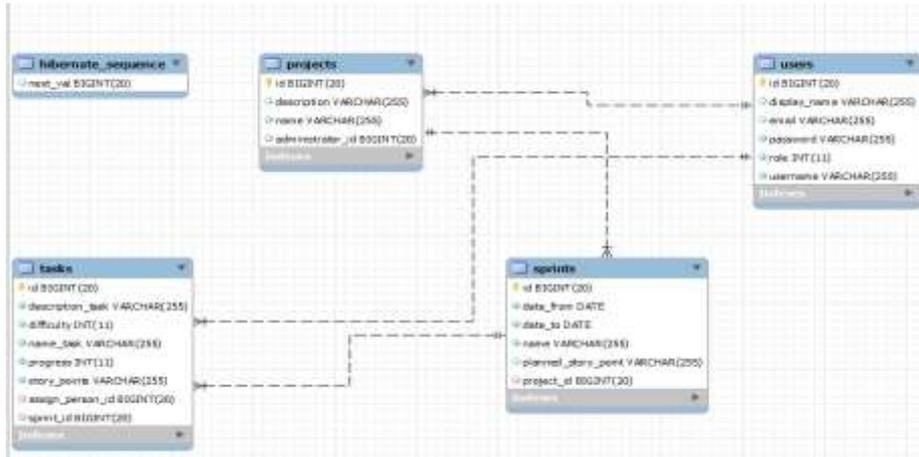
Figure 1. The database diagram

The implemented application allows accessing (creating, editing, listing, deleting) data from a simple database, but which contains most of the basic elements in object-relational correspondence (tables, associations). The database is implemented in MySQL, and the back-end part is implemented using the IntelliJ tool.

5.2 The Structure
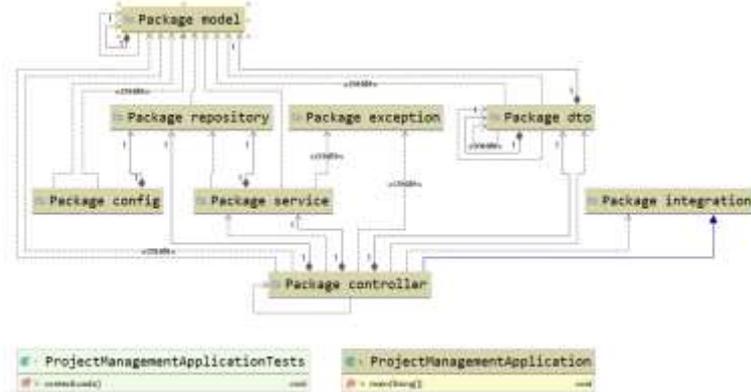The platform contains several components arranged in the 8 packages from Figure 2.

Figure 2. The structure of the designed e-work platform

6 Platform User Manual
The steps described below are consistent with planned use cases following the analysis of existing task management systems. The use cases are extended by exposing the appearance of each component of the system interface and explaining how to use them.

1.
2.   *6.1 Registration and Login in the System*
The registration of users in the system is done by the administrator. Registered users will receive an email with account data, and using their username and password will be able to connect to the system. The tests showed that validations are needed for the user to observe which data must be filled in and which are needed to save in the database. These validations do not allow the user to enter incomplete information.
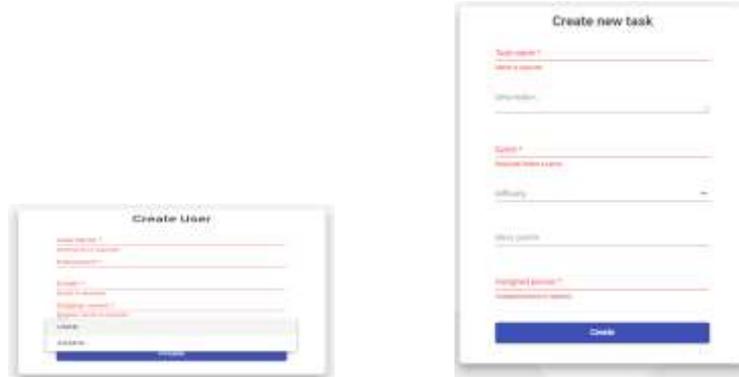
Figure 3. Fields validation to create an account Figure 4. Fields validation to create a task

Figure 3 shows the validations performed on the fields required to create a new account, all data being required, and Figure 4 shows the validations performed on the fields intended for creating a task.

Figure 4 shows the web interface for registering a user, created as a form to enter data. After pressing the "Create" button, the data is saved in the database.

The "Roles" field displays the list of roles that the administrator can select. The Admin role refers to the project manager and is allowed to use several implemented functionalities. A user without the Admin role cannot delete or edit anything, he can only view or create new tasks or sprints. Users with the role of project admin have the responsibility to manage all data and to modify or delete where something is wrong.

Figure 5 shows the Login page, in which the user enters the username and password in the specific fields, and if they are valid then the user has access to the system. If the user does not fill in one of the two fields he will receive a warning message, as in Figure 6, that field is mandatory, and if he does not enter the authentication data correctly he will receive another error message warning that the data entered is wrong.

Figure 5. Login page   Figure 6. Validation of authentication data

6.2 Detailing the Functionalities

The key functionalities of the application are the visualization, modification and deletion of projects, sprints and tasks. Below are detailed some of the main features provided by the platform. After authentication, users with the role of Project Admin have the opportunity to create users and projects, being able to view the status of all projects, sprints and tasks. The platform has a menu on the left where each user can see his name and email address with which he is registered in the application.
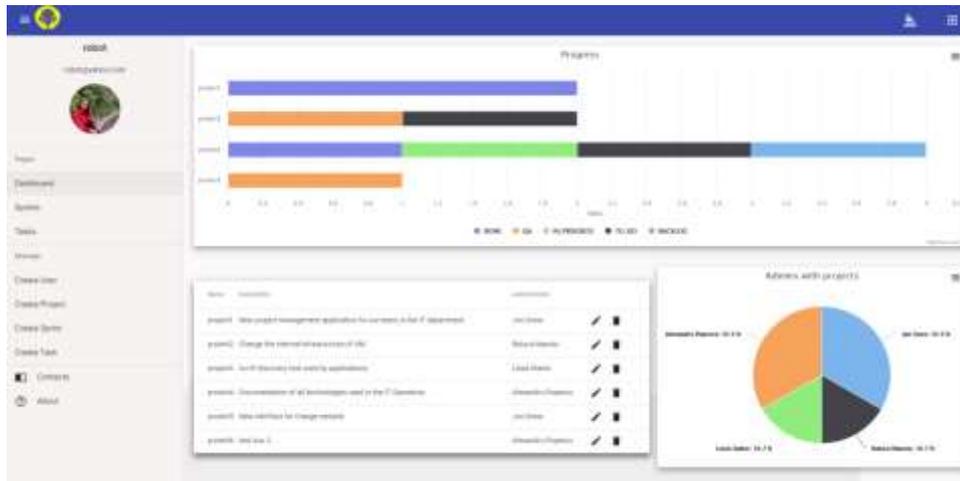
Figure 7. Main page - Dashboard

Figure 7 shows the main page, which shows the list of projects and graphs of interest. Next to each project there are two buttons, edit and delete. In order to have an overview of the statuses of each project, several graphs have been created in which you can see the evolution of the projects, what projects each of the admins has and the status of each one.

Add project and assign manager to project. This operation is performed by the user with the role of Admin. To add a new project the user fills in the required fields, which can be seen in Figure 8. To add a project admin, a manager for that project is selected from the list. After creating a project, it is saved in the database and displayed in the interface, where it can be edited later. The edit form looks the same as the creation form, but the existing data is already pre-filled in the fields and can be modified. When the update button is pressed, the new records are saved in the database under the same name and project ID, meaning the database is updated with new information.

Creating an individual to-do list. It is possible for each user to individually set a "to do list" for that day, as in the example in Figure 9.

Figure 8. Manager assignment

Figure 9. Individual to-do list

Feedback. So that users can easily communicate and send feedback on tasks assigned to other users, everyone has the option to send a message by selecting a task and then filling out the form

in the interface. As can be seen in Figure 10, they fill in the address and a text message that will later be emailed to the user assigned that task.

Figure 10. Requests and feedback message changes

Contact Us. This is the page where the application admin can be contacted and where each user can send feedback to the application administrator in case of a malfunction or a problem of any kind. The form to be completed can be seen in Figure 11.

Project manager reports. These allow viewing of all project managers and their involvement in the assigned projects. As can be seen in Figure 12, everything can be easily viewed in the form of a PieChart diagram.

Figure 11. Reporting a problem Figure 12. Reporting administrator involvement

Request status report. It allows you to view the status of the requests and the number of requests with the users assigned to them. The report is in the form of a histogram, as shown in Figure 13. All graphs, tables and diagrams are types of histograms, being used to provide a visual way to analyze the information as suggestive as possible.

Figure 13. Request status report

Project progress reports. These allow viewing the progress of each project and the status of the assigned requests, also in the form of a histogram, as in Figure 14.
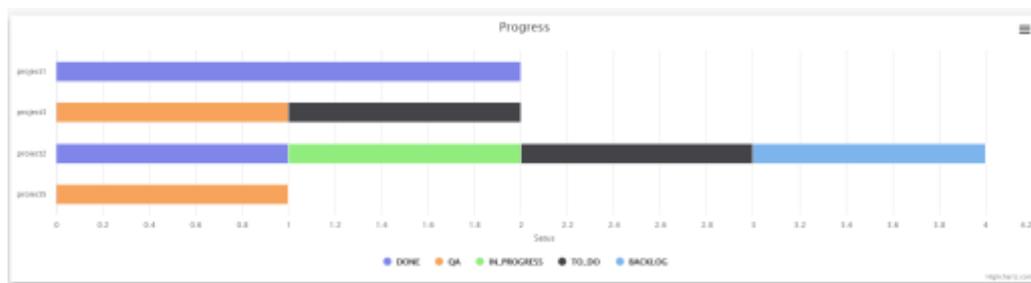

Figure 14. Project status report

7 Testing and Feedback

The testing on the Business Intelligence component was done on a group of 10 people who applied the principles of Agile and BI, and who previously used various platforms for software project management. Following the survey conducted by giving grades from 1 (bad) to 10 (very good), we obtained the results from Table 1. BI and Agile principles and concepts have been implemented and overall expectations were generally favorable.

Table 1. Users' feedback on the proposed e-work learning platform

No.	Aspect and visual impact	Easy to use	BI integration	Expectations
1	7	5	7	10
2	8	7	6	8
3	9	9	8	9
4	9	8	7	8
5	8	6	5	10
6	8	7	9	7
7	8	8	8	9
8	9	6	7	8
9	9	8	8	9
10	9	9	7	9
Av.	8.4	7.4	7.2	8.7

8 Conclusions

The proposed e-work platform achieved its proposed objective, successfully managing the activities within an educational or economic organization. Regarding the analysis of the projects, the platform allows to view reports that help to draw conclusions and make appropriate decisions. The purpose of feedback is to improve employee performance and optimize the operation of relationships between them.

The architecture of the proposed platform is designed to provide users with an intuitive, friendly and easy-to-learn graphical interface, by building it with the help of advanced IT technologies and tools that can meet the desired development requirements. The tools are simple to use, open source, and with well-designed documentation. Task management has a huge impact

on the way projects are carried out within a university or company and knowing that IT systems of this type are frequently subject to extensions, the proposed platform is designed to allow for further developments. The platform is designed to give users the opportunity to learn to do their job easier and to obtain better performance in team work. The platform is easy to expand, thanks to the organization on layers, the addition of new components being facilitated by the implemented design, and users who tested the application were very pleased with this platform.

Today any change, regardless of whether it comes from the educational, economic, social or political environment, is acutely felt by most people. This has led to situations where decisions can no longer be made empirically. Therefore, this paper includes how to implement the concepts of a Business Intelligence system to meet these important conditions. Thus, the implemented system contributes significantly to avoiding decision-making blockages that may occur within an educational or business organization.

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