Working with Legacy Code for Upgrading Tesys e-Learning Platform

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ABSTRACT
Interfaces are the first thing we notice when we launch an application, but aesthetics is not the only reason we must constantly improve them. Usability depends on interface design and is one of the most important aspects of an application as it influences the user experience and engagement. E-learning platforms are a specific type of web application that needs to fulfill the user's needs, which are continuously changing. This paper presents how the Tesys e-learning interface evolved and the main challenges faced during this process. The main problem was that the interface was old and the technologies used to build it, so the upgrading process needed to consider many aspects. The results focus in two directions, the looks and the usability, as many controls were moved and the interface was rearranged according to previous studies. We plan to conduct new studies on this improved interface and better understand how well the system works and the exact user experience after all the upgrades.

Author Keywords
Interaction design; Human Computer Interaction; Interface Design; Bootstrap; E-learning platform; Tesys

ACM Classification Keywords
H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces

General Terms
Design; Human Factors; Reliability

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INTRODUCTION

The project's scope was to upgrade the interface of Tesys e-learning platform to a modern and user-friendly design. The upgrade focused on applying contemporary design principles, employing clean and intuitive layouts and selecting visually appealing colour schemes that align with the platform's branding.

A deep understanding of the needs and expectations of the users of this platform drove the motivation behind the comprehensive interface update.

Popescu et al. state, "The interface of Tesys was designed more than ten years ago and aimed to fulfil specific needs from that time. Due to the continuous development process, the functionalities were upgraded over time, and now it offers most of the standard functionalities. Still, the interface needs to be adjusted to the actual needs of both the students and professors." [1]

Therefore, the upgrade aims to create a proper space where the professors can carry out their activities related to the teaching journey with minimal effort in using, navigating, understanding, and interacting with the platform.

Therefore, considering the age of the platform, the upgrade itself was a challenge because working with legacy code can be both challenging and rewarding. On the one hand, understanding the system's behaviour and dependencies can be time-consuming and requires careful analysis of the existing code. Therefore, balancing modernisation and maintaining backwards compatibility is essential to ensure a smooth transition. On the other hand, this represents an opportunity to learn from past decisions, understand the system's history and appreciate the evolution of software development practices while developing problem-solving skills and refactoring code abilities used for improved maintainability.

Working with legacy code and systems is a challenging part because not only is the interface old, but also the technologies used. On the other hand, we have users who have used the platform before, and they are familiar with buttons and functionalities, so we need to balance moving controls and hierarchies and not disturb the users. Still, we can't make changes too often regarding the current users because it can create confusion.

RELATED WORK

As Peerce et al. stated, "A good place to start thinking about designing usable interactive products is to compare examples of well and poorly-designed ones. By identifying the specific weaknesses and strengths of different interactive products, we can understand what it means for something to be usable or not." [2]

Moodle, Blackboard Learn and Google Classroom are just a few of the LMS (Learning Management Systems) platforms used worldwide by teachers and students in learning. These represent the inspirations for the upgrade of the interface of Tesys. Below, there are some critical aspects of these platforms and their interfaces.

Moodle

The Moodle e-learning system aims to provide "various functions and tools that lecturers can employ to enrich and support the learning experience. These include uploading instructional materials, displaying marks and feedback, conducting online quizzes and tests, supporting communications using four messages, supporting group chats and online meetings, uploading advertisements and news, and sending alerts to students as a reminder to submit materials." [3]

The positive aspects regarding the user-friendliness of the Moodle interface, which were considered while implementing the new interface for Tesys, were pointed out by Hasan: "Most of the students were satisfied with the interface design of the system which included: the interface was not cluttered, information was displayed, and the fonts and colours were appropriate and clear to read". [3]

Blackboard Learn

On the other hand, Blackboard Learn wants to "provide an interface for both faculty members and students, along with college and university professors, for easy communication. Moreover, teachers would be able to upload course content and significant notes regarding courses where all the class students could easily benefit from it." [4]

Alyssa Suarez stated about the Blackboard redesign process that the purpose was "to increase app desirability and usage by reducing usability issues which does not promote a positive user experience", considering that their main concerns were "discoverability of features, organisation of content, inefficient navigation". [6]

Google Classroom

"eLearning Industry tested and made a review of Google Classroom, in which they highlighted many positive and negative aspects. Among the Classroom's strengths, the review highlighted ease of use, universal device accessibility, and use of Google Drive as an effective way for teachers to share assignments with students quickly." [11]

A vital aspect of Google Classroom's user design is the interface metaphor of cards, described by JP as "An interface metaphor that has become pervasive in the last few years". This metaphor was considered during the implementation of the new interface of Tesys and will be further described.

UX is significant in e-learning systems, and its impact is assessed in [7], which seeks to determine the influence of user experience and user interface design of e-learning platforms on the learning experience in higher education. A systematic review of studies regarding the usability of e-learning platforms at tertiary institutions was conducted to determine the common issues and successes. The paper mainly represents a snapshot of research over the last five years that was used in a systematic review to assess the influence of UX/UI on eLearning concerning higher education. Their findings reveal that it is crucial to focus on interface design and user experience of eLearning systems for effective learning.

Another paper that addresses the user interface is [8], which states that the role of the user interface (GUI) in e-learning is critical because it is how a user can intelligently interact with a machine to perform a task. A user-friendly user interface (GUI) is essential in the design phase of online platforms and sites. The paper also illustrates the innovations in the GUI on the E-learning Platform of the University and the website.

One study that examines new e-learning platform features to improve educational technology is [9]. The study proposes that e-learning platforms must prioritise usability and utility from a design standpoint to meet future needs. This article presents an overview of the primary features necessary in an online learning platform and conceptual work linked to design feature variables that may be developed to produce an excellent online learning platform and fulfil local students' preferences.

An older paper presents user interface design for e-learning software [10], stating that a software application's success and failure depends on User Interface Design. They also present in the paper how User Interface Design contributes to e-learning through the educational software built by the authors. Also, they show the way of using User Interface to improve learning and motivate the learners and improve the time efficiency of e-learning software.

Adaptive user interfaces are the next step in improving the user experience, as stated in [12], which presents the approach to identify the learning styles for adaptation as per Felder-Silverman Learning Style Model (FSLSM) [13]. The authors also give an e-learning application developed using Moodle framework with the functionality to capture the usage data of learners. The usage data is used to cluster the learners as per the learning categories of FSLSM. The adaptation of the system is validated using statistical analysis, and the impact of transformation on learning has been identified. Regarding the interface, one important aspect is its evaluation; as the authors state in [15], it has been shown in several studies that poor usability is an area that can significantly impact the success of this communication and students' learning. Another important aspect is that e-learning platforms are web applications, and when someone improves, they need to consider their specificities [16].

PROPOSED APPROACH

Interface Analysis

"The Tesys platform has been implemented at the University of Craiova to support the needs of distance learning students. The platform is currently used at the Faculty of Letters for the distance learning program, which was successfully accredited and deployed in 2011." [5]

As Popescu et al. state, there are several problems considering the platform's usability and regarding the interface's structure for the professors: "Most of the usability problems have been identified when adding and verifying homework for students. The important usability problems are mainly related to the poor design of the home page, especially to the unclear separation of the title page and menu in the upper part of the page." [5]

Considered Concepts

While implementing the new interface, some fundamental concepts have been considered to provide a seamless and rewarding user experience. These concepts will be accompanied by applied examples in the following sections.

Conceptual model and interface metaphors

The first concept is the conceptual model, which is an abstraction or representation of a system or application. It provides users with a mental framework to understand and navigate the functionalities and behaviours of the digital system. A well-designed conceptual model aligns with users' mental models, making it easier for them to predict and interpret the system's responses and actions.

"Metaphors are considered to be a central component of a conceptual model. They provide a structure similar to aspects of a familiar entity (or entities) but also have their behaviours and properties. More specifically, an interface metaphor is one that is instantiated in some way as part of the user interface.

The card is an interface metaphor that has become pervasive in the last few years. Many of the social media apps, such as Facebook, Twitter, and Pinterest, started presenting their content on cards. Cards have a very familiar form factor – having been around for a long time. Just think of how many kinds there are: playing cards, business cards, birthday cards, credit cards, driving cards, postcards, red cards – to name a few. They have strong associations, providing an intuitive way of organising limited content that is 'card size.' They can be easily flicked through, sorted, and themed." [2]

Metaphors are so popular because "people frequently use metaphors and analogies as a source of inspiration for understanding and explaining to others what they are doing, or trying to do, in terms that are familiar to them." [2]

The card is an interface metaphor that has become persuasive in the last few years. Many social media apps like Facebook, Twitter and Pinterest started presenting their content on cards. Cards have a very familiar form factor because they have been around for a long time, like playing cards, business cards, birthday cards, credit cards, etc.

This metaphor of cards was used in the design of Tesys for the main page, where details about courses are designed in a card structure that will be presented in more detail in the following section.

Cognition and attention

There are many ways of describing cognition, starting from the different kinds of it, such as "thinking, remembering, learning, daydreaming, decision making, seeing, reading, writing, and talking" [2] and by describing it "in terms of the context in which it takes place, the tools that are employed, the artefacts and interfaces that are used, and the people involved" [2] or "in terms of specific kinds of processes like attention, perception, memory, learning, reading, speaking, and listening, problem-solving, planning reasoning, and decision making". [2].

"This is the process of selecting things to concentrate on, at a point in time, from the range of possibilities available. Attention involves our auditory and/or visual senses." [2]

Menu design

"Interface menus are typically ordered across the top row or down the side of a screen using category headers as part of a menu bar. The menus' contents are also invisible for the large part, only dropping down when the header is selected or rolled over with a mouse. The various options under each menu are typically ordered from top to bottom in terms of the most frequently used options and grouped according to their similarity.

There are numerous menu interface styles, including flat lists, drop-down, pop-up, contextual, and expanding ones, e.g., scrolling and cascading. Flat menus are good at displaying a small number of options simultaneously or where the display size is small.

Expanding menus enables more options to be shown on a single screen than is possible with a single flat menu list. This makes navigation more flexible, allowing the selection of options in the same window." [2]

The navigation between the main sections of the Tesys website is done using the new navigation bar, which contains regular buttons for the most important pages and a drop-down button for the profile information and login action.

Icons design

"The appearance of icons at the interface followed the Xerox Star project. They were used to represent objects as part of the desktop metaphor: folders, documents, trashcans, and in- and out-trays. An assumption behind using icons instead of text labels is that they are easier to learn and remember, especially for non-expert computer users. They

can also be designed to be compact and variably positioned on a screen.

Icons can be designed to represent objects and operations at the interface using concrete objects and abstract symbols. The mapping between the representation and underlying referent can be similar (e.g., a picture of a file to represent the object file), analogical (e.g., a picture of a pair of scissors to represent cut), or arbitrary (e.g., the use of an X to represent delete). The most effective icons are generally isomorphic since they directly map what is being represented and how it is represented." [2]

Colours

Colors are crucial in interface design, influencing user perception, emotions, and overall user experience. The strategic use of colours can evoke specific moods, convey meaning, and enhance usability [14].

Colours help establish a visual hierarchy within an interface by differentiating between various elements. Designers can use contrasting colours to guide users' attention and highlight important information or interactive features. This enhances the overall usability of the interface by allowing users to identify and navigate through content quickly. They play a significant role in representing a brand's identity and personality.

Consistent use of colours across different touchpoints helps users associate specific colours with a brand, fostering recognition and creating a cohesive brand experience. The right colour palette evokes emotions and creates a memorable and distinct brand image.

INTERFACE PRESENTATION

In this section, the modifications made to the professor's interface of Tesys will be explored, highlighting the changes implemented to enhance its user experience and visual design.

For the interface upgrade, the already used technologies like WebMacro, HTML, CSS, and JavaScript were incorporated with Bootstrap, adding a fresh and modern look to the design.

The upgraded interface of Tesys maintains a similar colour palette to the previous version (Fig. 1), ensuring a sense of continuity and familiarity for users. The colours chosen for the upgrade are closely aligned with those used in the original website, creating a seamless transition between the two versions because we need to balance moving controls and hierarchies and not annoy the users.

Still, we can't make changes too often regarding the current users because it can create confusion.

Although the Tesys yellow is not part of the main colour scheme, it is still present as the principal colour for the background of the buttons.

Figure 1. Old (right side) vs. new (left side) color palette

Besides the primary colours, red and green were used for the buttons, as can be seen in Fig. 2, serving as attention-grabbing elements for essential actions. The use of red signifies caution or alertness, while green conveys positive actions or confirmations.

Figure 2. Examples of colours and icons for the buttons

Furthermore, the icons used for the buttons within the interface play a significant role in enhancing the user experience. These icons serve as visual cues that help users quickly grasp the purpose or action associated with each button. For example, as can be seen in Fig. 2, a pen used for editing, an envelope for a message, a slider with an activate/deactivate button or a bin for delete are worldwide used symbols that everyone recognises.

The navigation bar is an element from this page that will be present on all the pages. It is updated to a modern look by using a Bootstrap *navbar*.

As can be seen in the bottom part of Fig. 3.2, the buttons that provide access to the main sections like Main Page, Videoconference, Active Students, Communication and Help are placed on the left side, and the name of the user, which is a drop-down button is on the right. The drop-down menu (Fig. 3.1) controls password changing and logging out.

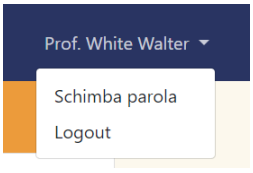

Figure 3.1. Drop-down button from the new navigation bar

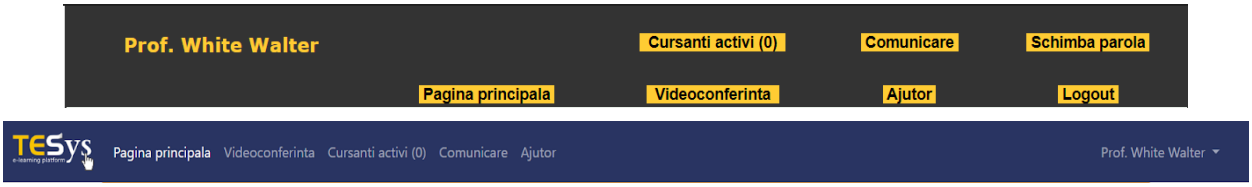

Figure 3.2. Old (top) vs. new (bottom) design of the navigation bar

The first page that professors see after the login is an overview of the specialisations and courses where they can navigate to the different sections of the application. The old design of the page can be seen in Fig. 4, and it contains the courses for each specialisation grouped in separate tables.

Figure 4. The old design of the main page

On the new design, the specialisations are grouped in a Bootstrap accordion design, as seen in Fig. 5. Each is collapsible and contains the content inside.

Each specialisation has multiple courses, and their details are displayed in a separate card, considering the interface metaphor described in the previous section.

Besides the name of the course and the year/semester information, four grouped buttons lead to Administration, Active Students, Students and Analyse.

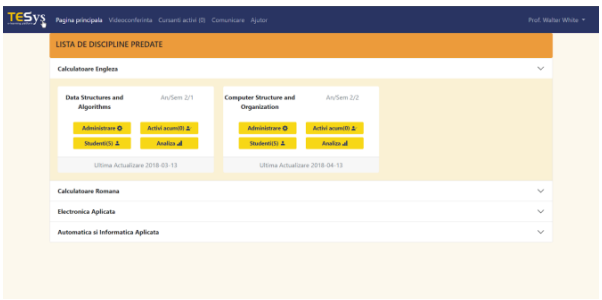

Figure 5. New design of the main page

Clicking on the Administration button will direct users to the corresponding Administration page, which offers a range of actions and functionalities.

Figure 6. The old design of the Administration page

In contrast to the previous version (as shown in Fig. 6), the updated page (Fig. 7) features improved organisation with distinct sections, ensuring a more precise separation of information and functions.

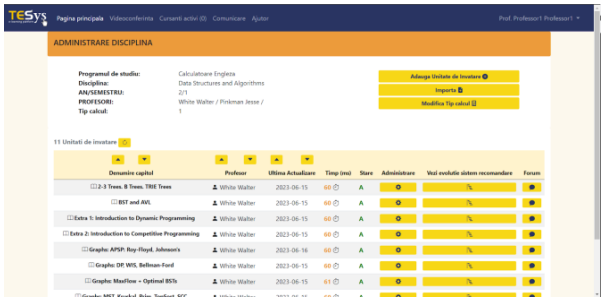

Figure 7. New design of the Administration page

On the new design of the Administration page, a new feature regarding the sorting on the columns like chapter

and professor's name and last update. For this, buttons were added for ascending and descending order, which contains the specific Tesys yellow and meaningful icons to enhance the user experience and provide straightforward functionality.

An important aspect that was improved by the upgrade is the way the deadline is specified when homework is created or updated. The old page had three drop-downs with predefined values for day, month and year, as seen in Fig. 8.

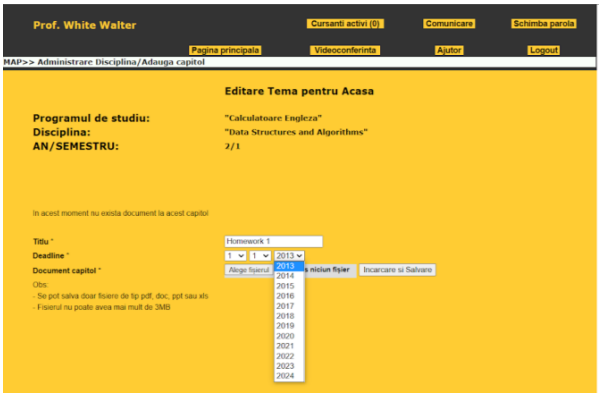

Figure 8. Old design of the edit homework page

The implementation consists of a date picker, which offers a modern look, as seen in Fig. 9, and is simpler to use. For the performance, a Bootstrap date picker and some changes in the corresponding JavaScript were used to set the date in the format retrieved from the backend and highlight the selected day.

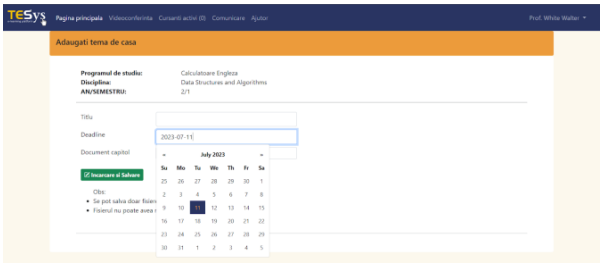

Figure 9. New design of the add homework page

Figure 10. Old design of the forum page

Regarding the forum feature of Tesys, some changes contributed to a cleaner and more streamlined interface. The page where multiple topics were displayed used a table in the old version, as seen in Fig. 10.

As shown in Fig. 11, it was replaced by a list of cards resembling the messages from the ordinary forums.

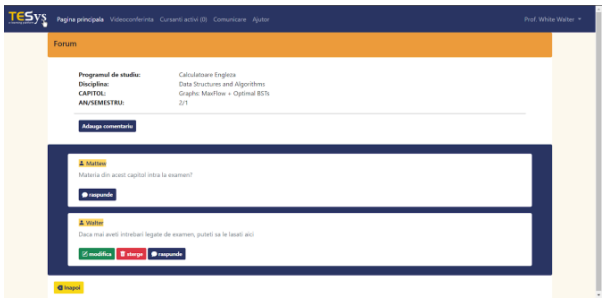

Figure 11. New design of the forum page

The user's username is displayed for each topic, followed by the message and the buttons used for actions like replay (available for all messages), edit and delete (only for own notes).

Since many users nowadays primarily access web applications through smartphones, ensuring the responsiveness of the Tesys interface was an important aspect throughout the front-end upgrade.

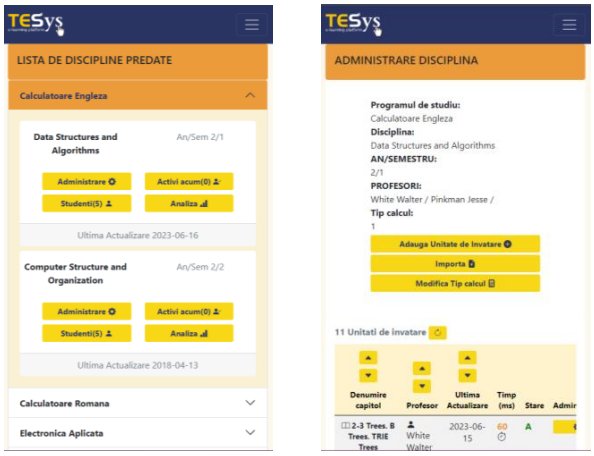

Figure 12. Responsiveness of the design: main page and administration page

By implementing a responsive design approach, the purpose was to provide an optimal viewing and interaction experience across various screen sizes and devices. This improvement allows users to conveniently access and navigate Tesys on their mobile devices without compromising usability or visual appeal.

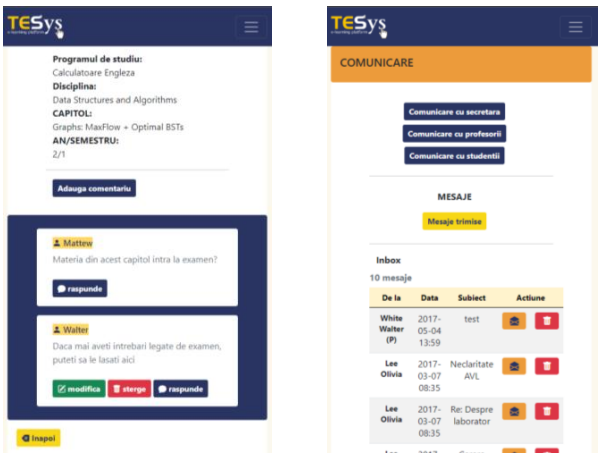

Figure 13. Responsiveness of the design: Edit forum page and communication page

Fig. 12, 13 and 14 show some examples of how the interface appears when the page is resized. The Bootstrap elements were mainly used to obtain these results because they offer a responsive grid system that simplifies the layout of the web pages and also includes a set of responsive utility classes.

While a default style is available, its high degree of customisation was a crucial consideration during the development of the new interface. This customisation was essential to maintain the familiar style, ensuring a seamless transition to the latest version of the interface.

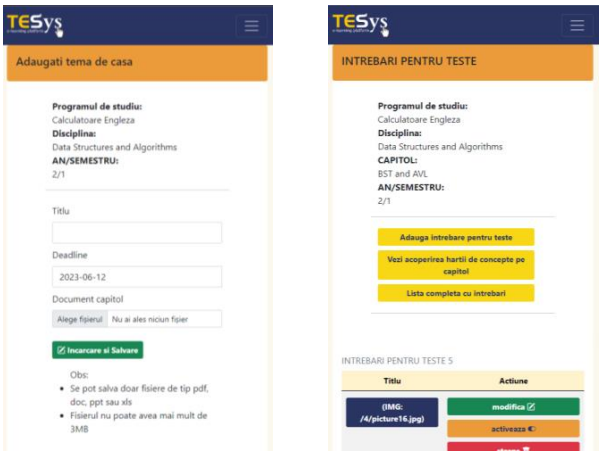

Figure 14. Responsiveness of the design: Add homework page and questions for the test page

CONCLUSION

Improving the Tesys e-learning platform interface is an essential and challenging task that significantly impacts the professor's experience in using the platform. It is crucial because we need to keep the platform up to date in order to fulfil the e-learning requirements and its usability. It is challenging because we do it on the go, and we need to be sure that after the platform is upgraded, the users will adapt fast, and we won't lose their enthusiasm for using it. Another more technical challenge is integrating the new technologies with the old ones, considering their limitations.

For future work, the students' interface is the next upgrade we plan, and after that, we need to continue it to the secretaries' one. The most crucial part will be to make a friendly interface for the students and improve their learning engagement. Still, in the future works area, we have the evaluation part, as we need good insight into how well the interface evolves.

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