Open Rehab Initiative: Second Development Iteration

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Abstract— **A substantial part of rehabilitation tools are developed in the context of research projects, which rarely reach their target audience, in particular clinicians and patients. To address this challenge, the Open Rehab Initiative (ORI) emerged as an international independent online portal with the goal of connecting clinicians, scientists, engineers, game developers, and end-users to interact and share virtual rehabilitation tools. The quality and efficacy of such platform can only be attained iteratively based on a user-centered design approach. This paper describes the design process and features implemented on the second development iteration subsequent to a formative evaluation of the first version of ORI. The main goal of the second iteration was to implement new features and make the platform functional and ready for a second evaluation process with beta testers, which will certainly prompt new features for improvement and will serve as a step toward the final release of the site.**

Keywords—rehabilitation; virtual environments; serious games; web platform; open access; user-centered; iterative design.

I. INTRODUCTION

A myriad of virtual environments (VEs) for rehabilitation are conceptualized, developed, and validated by scientists and researchers worldwide, but few focus on transferring the technology to clinicians and their patients [1]. To simplify the challenge of dissemination from the lab to the clinic, the Open Rehab Initiative (ORI) emerged as an international independent online portal with the goal of connecting clinicians, scientists, engineers, game developers, and end-users to interact with and share virtual rehabilitation tools. Due to the ORI site's complexity and variety of the target audiences, the quality and efficacy of such platform can only be attained iteratively along the development lifecycle based on a user-centered design approach [2, 3, 4]. This paper describes the design process and features implemented during the platform's second development iteration that followed an initial formative evaluation. The objective of this work phase was to have the platform functional and independently ready for a new evaluation process, which culminated in the here described iteration.

II. FIRST ITERATION – FORMATIVE EVALUATION

The ORI was subject to a first formative evaluation that included three groups of participants: clinicians, roboticists, and VE developers [1]. Focus groups, individual interviews and the System Usability Scale (SUS) were used to collect data that was subsequently summarized and analyzed. Although there was a general agreement of the worthiness of the platform, the three groups of participants responded differently. Usability was rated with higher scores by developers and roboticists, while clinicians rated it with lower scores. Likewise, the desired features per group also differed according to their specific needs. A summary of these features can be seen in Table I.

TABLE I. SUMMARY OF THE DESIRED FEATURES PER GROUP

Desired Feature/Characteristic	Clinicians	Roboticists	Developers
1- Simplicity of use	×		×
2- Accessibility	×		×
3- Visual information (Images, Videos)	×		
4- Software categorization	×		
5- Indications/contraindications, dosage/duration	×		
6- Proof of scientific evidence of efficacy	×		
7- Quality rating	×	×	
8- Subjective rating	×	×	
9- Discussion board/forum	×		
10- Technical assistance	×		
11- Simple VEs		×	
12- VEs that allow multiple inputs		×	
13- Data collection from VEs		×	
14- Open source tools		×	
15- Pool of reviewers to test and vet		×	
16- Sharing of open data		×	
17- User's manuals and technical documents			×
18- Number of downloads			×
19- Users' profiles			×
20- Minimal standard of reliability for uploading			×

III. DESIGNING THE SECOND ITERATION

Based on the feedback provided on the first evaluation, a plan of action was defined prioritizing a list of implementations toward feasible desired improvements and prioritizing the clinicians' requests. The first decision was to improve the site accessibility and simplicity of use (1, 2). The site would be enabled with the possibility to display additional resources requested by target users such as items 3, 5, 6, 10, 16, 17 mentioned in Table I, and even other type of information that the software developer may want to share. However, it was

decided that could be very restrictive to impose all those resources as mandatory for the content creators, so most of the resources would be added optionally, but they will be reflected on a quality rating (7). The features 8, 18, and 19 were addressed with the creation of a user login to enable downloading, commenting, and rating applications. Additionally, the submission of software tools to the platform by ORI authorized developers can only be done after joining an affiliation (20). It was decided that the platform would aggregate not only free software, but also paid and open source software (14), prioritizing the free listings. Although a forum (9) already existed on the first iteration site, some issues were detected, such as lack of notifications to the site administrator when a user posted a new thread. To overcome these limitations, it was decided that the forum plugin would be replaced. The features 11, 12, and 13 depend on the contributed software characteristics and relate to user preferences that are addressed through the feedback and commenting features. In the same way, a pool of reviewers to test and vet (15) is considered valuable but it is a management decision that does not affect the development of ORI.

IV. IMPLEMENTATION

Using the Rational Unified Process [4], we created a use cases diagram to define the activities of requirements, followed by the creation of wireframes (Fig. 1), which served as a basis of implementation. The second iteration of the ORI website used the content management system *WordPress* [5] and web programming languages such as *HTML*, *PHP*, and *JavaScript*. To improve the site accessibility the font size was increased and the contrast of the native images was refined.
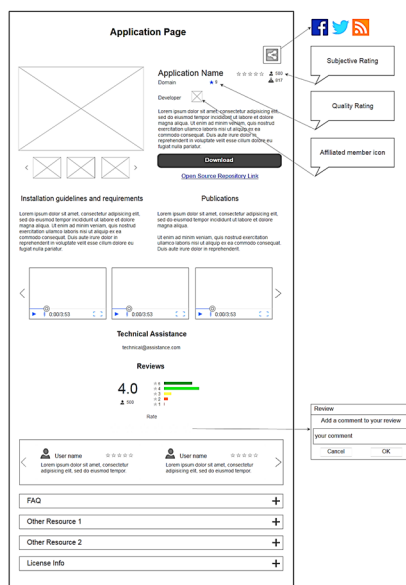

Fig. 1. Wireframe of the redesigned application page

This new iteration enables external developers to autonomously upload and manage their own applications. Additionally, a rating system or control of access has been added to gather information on the number of downloads and who was using each application. The new implementation enables content to be dynamically added through application forms. Developers fill out with the information about the application (including resources such as images, videos, publications, or manuals), which will only be published after ORI administrators' approval. Further, a quality rating system provides information on the completeness of the software information. A new subjective feedback system allows registered users who already downloaded an application to rate and comment it. These features require all ORI users to be registered. A user can apply for a new institution to become ORI member and, if approved by ORI administration, a new member page is dynamically generated. All applications submitted by affiliated developers to an ORI member are also displayed on the associated member page. Currently, each user has access to his/her own dashboard containing a list of all downloaded and uploaded applications and their respective status. Finally, a webpage with all available applications is dynamically generated allowing ordering by different criteria such as: name, date, number of downloads, completeness, or user rating.

V. CONCLUSION AND FUTURE WORK

By focusing on user experience and feedback from the first formative evaluation, we structurally planed, designed, and implemented the second iteration of the ORI website. Most of the desired features and improvements have been implemented based on users' feedback. The goal of having the platform functional for researchers, scientists, and developers to upload their own applications and make them available for clinicians and end-users was accomplished. To culminate this iteration a new evaluation process will be conducted with beta testers from both developer and clinician groups, to collaboratively build a valuable and efficient resource.

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