



Work Package 3

ICT infrastructure and integration

Deliverable D3.3

Web-EMCS online

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This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

List of abbreviations

CMS: Content Management System

GUI: Graphical User Interface

IIS: Internet Information Server

MVC: Model-View-Controller

PUE: Power Usage Effectiveness

URL: Uniform Resource Locator

VPN: Virtual Private Network

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1. Introduction

This brief report is meant to accompany the Web-EMCS prototype which is the main output of WP3 ICT infrastructure and integration. The work leading to the Web-EMCS creation has been divided in two main tasks.

Task 3.1 was dedicated to the creation of the ICT architecture needed to set up the communication between the Web-EMCS and the pilot hospitals. The main results of this activity are described in Deliverable 3.1 We-EMCS drivers.

Task 3.2 has been devoted to the design and development of the database needed to store data from the pilot hospitals and to the creation of the GUIs (Graphical User Interfaces) needed to present this data to different kinds of stakeholders.

Database design and development was the result of the strong cooperation between WP3 and WP2. For this reason the database structure has been described in Deliverable 2.3 Data collection active from all pilot hospitals.

This document describes the development of the Graphical User Interfaces carried on in the framework of task 3.2.

Chapter 2 recalls the steps leading to the actual version of the Web-EMCS with a particular focus on the feed forward feedback mechanism put in place by the project partners to improve the platform design from the first demo to the actual release.

Chapter 3 resumes the platform technical features concerning programming environment, software location and setup.

2. GUI development

GUIs design and development process can be divided in three different phases leading to the delivery of three different outputs:

- **Phase 1** Objectives definition, preliminary structure design, reserved area creation.
 - o Period: November 2012 – May 2013;
 - o Output: Demo version of the platform presented during the first review meeting;
 - o Feedbacks: Project partners and project reviewers.
- **Phase 2:** Navigation structure definition and implementation, first graphical user interfaces development.
 - o Period: June 2013 – October 2013;
 - o Output: Prototype presented to the consortium during the third plenary meeting and the workshop held in Granada and during ICT 2013;
 - o Feedbacks: Project partners and ICT 2013 visitors.
- **Phase 3:** Actual release.
 - o Period: November 2013 – December 2013;
 - o Output: Actual platform release described in Deliverable 3.2 Web-EMCS User manuals and GUIs;
 - o Feedbacks: Technical users.

Below for each of the three phases outputs delivered and feedbacks collected are presented.

2.1. Phase 1

The work done in the framework of Task 3.2 during the first months has been mainly devoted to define the objectives of the portal and to design a preliminary structure for the Web platform. In the meantime the website area dedicated to technical stakeholders has been designed and implemented including measurement from just one of the solution set available. The platform architecture shown in Figure 1 has been implemented and presented as Web-EMCS demo version to the project partners during the second plenary meeting and to the project reviewers during the first review meeting.

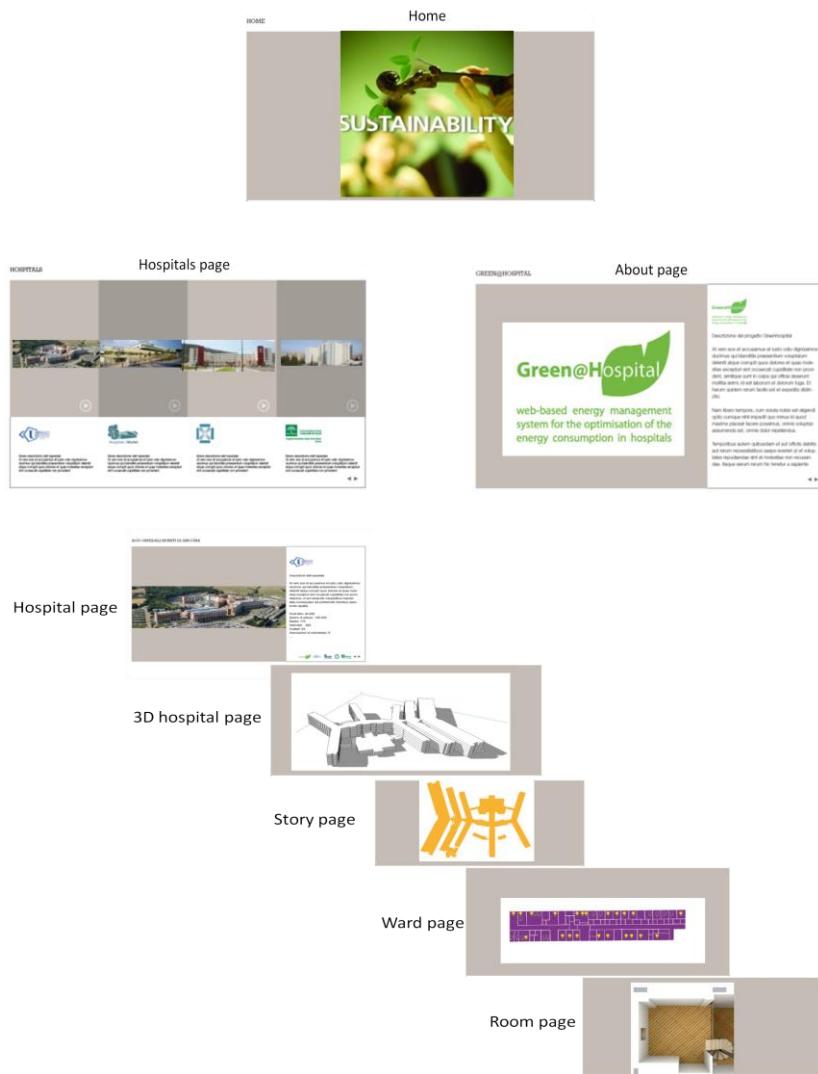


Figure 1: Web-EMCS platform – first design

The demo included also examples of Infographics that were proposed to communicate data concerning comfort conditions and energy savings to the non technical stakeholders in order to increase their awareness about the results reached by the project.

The work done was positively judged by both project partners and project reviewers. However some issues were raised:

- The proposed infographics were not always easy to be understood.
- The navigation structure could be simplified.
- The platform structure should be ready to be expanded easily to other hospitals, other areas and other solution sets.

2.2. Phase2

The first months after the review meeting were dedicated primarily to address this third issue. Several Content Management Systems (CMS) have been analyzed and tested in order to use them to setup the platform. A CMS would have assured a rapid expandability of the system providing page templates easy to be used and filled in with information and data coming from different hospitals, areas and solution sets. The choice laid on Orchard a free, open source, community focused CMS built on the ASP.NET MVC platform.

This CMS has been tested and some pages have been built. Unfortunately this system was proved good to produce the main platform navigation pages but not flexible enough to include the graphical elements needed to develop infographics.

For this reason it was decided to abandon the idea of using a CMS and to go back to a traditional webpage creation technique.

Then the most effort was put on the integration of the Pilot hospitals into the Web-EMCS in terms of data collection activation and in terms of navigation architecture. This effort has led to the creation of the prototype version of the Web-EMCS that has been presented during the third plenary meeting and during the Workshop held in Granada in October 2013. The same platform release has been presented during ICT 2013, the event organized by the

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European commission in Vilnius during the first week of November 2013. Some screenshots from this release of the platform are presented in Figure 2.



Figure 2: Web-EMCS platform – second design

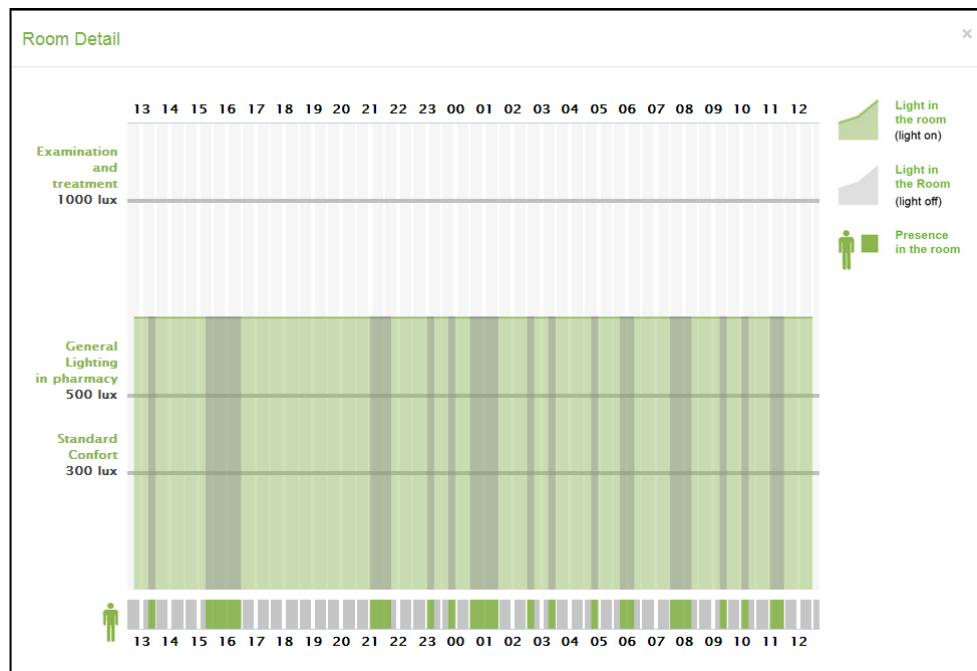


Figure 3: Web-EMCS – lighting infographics

Numerous feedbacks were received from different categories of stakeholders. Particularly hospital managers and energy managers appreciated the possibility to have a tool capable of investigating the performance of energy systems and to improve the system tuning.

Moreover it was asked to develop a solution set based navigation architecture to be added to the area based navigation architecture already available.

The infographic developed to show the performance of the artificial lighting systems (Figure 3) received positive feedbacks from non technical users interviewed during the platform development phase.

2.3. Phase 3

The last months have been dedicated to the development of the actual release of the Web-EMCS. A lot of work has been done to simplify the platform structure reducing the number of levels and introducing a new menu to surf the different solution sets. This has decreased the number of clicks needed to reach the platform pages containing project results.

Furthermore specific infographics have been designed in order to present to the final users project results and some key parameters concerning the solution sets.

Solution sets have been classified in four main categories:

- Lighting
- Heating Cooling And Ventilation
- Data centre
- Heating and cooling generation

For each of them a team of designers has tried to understand which kind of information should be pointed out to the final users and in which way they could be presented.

Considering the non technical background of the general users it was decided to emphasize the concept of comfort. This could be done for three of the four solution set categories:

- Lighting: compliance with required luminance levels;
- Heating Cooling And Ventilation: compliance with ranges of temperatures, relative humidity, CO₂ and biological particle concentration;
- Data centre: server comfort. Compliance with temperature and relative humidity required levels.

Concerning the data centre category the PUE (Power Usage Effectiveness) has been identified as the KPI capable to represent its efficiency.

The forth solution set category does not really address the concept of comfort and represents a group of systems which never comes in direct contact with the final user. In this case the concept of efficiency has been stressed more.

For each data set to be represented different possibilities to represent data have been analyzed considering different requirements:

- Friendly perception from users;
- Ease of code programmability;
- High replicability.

The final results are highlighted in Figure 4. Some developed infographics have not been implemented like the one shown in Figure 5 since the limited number of comfort parameters available in the different areas does not allow building up a four sided shape.



Figure 4: Web-EMCS –infographics



Figure 5: Not used infographics

3. Platform technical features

The Web-EMCS architecture has been already presented in Deliverable 3.1 Web-EMCS drivers which presents also the steps needed to enable the communication towards the Pilot hospitals. Furthermore the functionalities available in the technical user reserved area have been described in Deliverable 3.2 Web-EMCS User manuals and GUIs.



Figure 6: Web-EMCS – Reserved area

This paragraph resumes some of the Web-EMCS main technical specifications.

The Web-EMCS is based on MS Asp .net MVC 3 web technology. This technology uses the MVC (Model-View-Controller) design pattern by which includes the following components:

- **Model (M):** Model objects are the parts of the application that implement the logic for the applications data domain. In this way data are passed between Controller and View;
- **View (V):** Views are the components that display the application s user interface. This user interface is created from the model data. Graphs, charts and so on are part of the View;

- Controller (C): Controllers are the components that handle user interaction, work with the model, and ultimately select a view to render that displays GUI. In an MVC application, the view only displays information; the controller handles and responds to user input and interaction.

This approach has been very helpful to decouple the representational layer from the logic layer. In this way it was possible to change a single part of the project without regenerating each time the platform from the beginning. This potential has been exploited particularly while developing and upgrading infographics and business logics.

The View layer has been developed using the most modern web technologies:

- Server side
 - C# (Razor syntax)
- Client side
 - HTML5
 - Javascript
 - CSS3
 - jQuery library
 - Highcharts library
 - Twitter Bootstrap (a tool for layouts management)

The platform is installed on a Windows machine using IIS (Internet Information Server) to publish the site in the web.

The chosen URL is <http://greenhospital-emcs.eu/>

The connection between the Web-EMCS and the pilot hospitals is granted by a VPN connection which creates an encrypted point to point tunnel ensuring data security. More details are available in Deliverable 3.1 Web-EMCS drivers.

4. Conclusion

The Web-EMCS development has been a complex task involving people with different skills: the platform design and implementation has involved IT experts, communication experts, and web designers. Furthermore personnel from pilot hospitals have had a key role in requirements definition and system integration.

The actual release of the Web-EMCS is fully operational and reaches the project objectives addressing both technical and non technical stakeholders. However the Web-EMCS development is an ongoing task: new inputs are expected from technical and non technical users and the platform will be improved following the stakeholders indications. This activity will be done in the framework of WP5 and will be part of the optimization process involving also models validation, algorithms fine tuning and data presentation.

Finally the exploitation potential of the Web-EMCS, one of the main project outputs, will be deeply investigated in the framework of Task 6.3 Exploitation with the aim of proposing this platform as a commercially available product.